¼ Scale Lunkenheimer Mixer from Morrison & Marvin Casting

Introduction

When I saw my friend's 1/4 Scale Gade for the first time many years ago he showed me the Lunkenheimer Mixer. He asked if I noticed anything unique about it. It was working. That was the smallest Lunkenheimer I had seen. He had purchased the engine complete from a builder in Iowa. A number of years later I decided I was going to build a Gade and order a set of castings from Morrision and Marvin along with all the extra goodies. When I got it, the drawings only showed using the Mixer as a venturi type. I could not locate who built the working ones although I had a good guess. Before building the Gade I got caught up in building a 1/8 scale 5HP Galloway. As part of that build I decided the Mixer casting was just not good looking. The 1/4 scale Gade casting was actually smaller than the casting supplied with the 1/ 8 scale Galloway. I undertook the task of figuring out how to build a working Lunkenheimer. The following is a timeline of how these drawings were produced.

2012

I am not the first to build this so I lay no claim to originality. I took my friends Mixer apart and saw how it was built. Basically just like a full size one with no real differences other than size. I took some measurements to get an idea of where to start. Since this was for my 1/8 Galloway, I decided on several changes from the one that was working on his Gade. As I had re-done all the Galloway drawings in Alibre I did some rough parts and produced a usable set of drawings for the first one I built. I used the valve from the Galloway, a finer thread for the cap, and instead of a 2 -56 needle made a finer thread. I sighted the fuel port by eye rather than figuring it on the Alibre model. I finished it and it worked very well on the Galloway. It is still going strong after 7 years of shows.

2013

I was building my 1/4 scale Gade and decided to make a better set of 3D models of the Lunkenheimer Mixer. I modeled it after the one I built making a set of much more usable models and drawings. I made up fixtures to hold the mixer while drilling the fuel ports, and the rest of the casting. This one also worked very well and I cleaned up the prints a bit and set them aside with every intention of making them usable by anyone wanting to try.

2017

So much for getting them together and as you can see it took 4 years before I picked them up again at the request of a modeler who was also building a 1/8 scale Galloway. I went through the drawings, put in lots of notes, completed remaining parts, and a set of machining steps. This fellow modeler who wishes to be unnamed built two of these Lunkenheimer mixers from preliminary prints. He took a different approach to several of the building sequences. He used a different needle design, fuel port connection, cap/valve spacer, and drilled the fuel port in a different fashion. I adopted several of his design alternatives. My original Needle Holder is now more flexible to accommodate different needle threads, both Cap designs are shown. The fuel ports he used followed the traditional approach used on larger Lunkenheimer Mixers ie 1/8" and 1/4". I think all of us can thank him for taking the time to show me what he did so I could improve on these drawings. The two Mixers he built worked on a small Hit & Miss as well as his 1/8 Scale Galloway.

2018

A third person was interested in building the Lunkenheimer for his 1/8 Galloway. I made up a set of models for the changes set forth by the above modeler. I now had a huge set of models for multiple versions of the Mixer along with drawings and separate sets of build instructions. It was 17 pages of 11 x 17 drawings. I sent all of that to the new modeler and asked him to pick and choose what he would use. He finished his working version and shared with me his thoughts on the various approaches. Based on his input and my own thoughts I decided once again to create a set of working drawings.

2019

I set a goal to have these done by November 2018 but did not make it. I kept at it and the drawings that follow contain a set of machining steps, and as many views as I thought necessary to make the Mixer. There is basically one version. It has one method for the fuel port for connection the fuel intake to the Needle port. The Fuel intake port can use whatever connector you want from the Fuel Tank. The Needle Holder is more universal and can handle multiple Needle types. There are two versions of the Cap. The fixtures for making the mixer are included. The included 3D PDF file contains the parts and shaded views of the mixer so you can see the inside. It also shows the many setups on a mill.

Note: These specific prints have not been used to build a Lunkenheimer Mixer as they are a reduction and compilation of the methods used to build 5 Mixers. I do not anticipate any issues.

I would recommend reading through the entire document. Based on your equipment you will likely make up a hybrid approach plus your own ideas in order to build yours. As we all know there is always more than one way to do something. The main goal of all this information is that fellow modelers can have some fun building the little Lunkenheimer. It matters not how you do it just go ahead and give it a try!

There are two other PDF documents to assist in machining the Mixer. *Lunkenheimer Mixer Components 3D* and *Lunkenheimer Mixer Workholding Fixtures 3D*

A special thank you to all the modelers who have provided input by reviewing and or building the mixer.

Revisions:

1. Original drawings done 5-6 / 2013
2. Drawings updated for first user to try a build. Updates, drawing notes and clarifications, remaining parts added, fixtures confirmed, Introduction added, Machining sequence updated. Done 4 / 2017.
3. Alternative machining approach drawings added. Tap alternatives specified. General drawing cleanup. Done 7 / 2018.
4. All alternatives and drawings reduced to one set Done 3 / 2019
5. Final review edits included before public release 11 / 11 / 2019

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Introduction	
PART		DWG NO. 1	REV 5
SCALE 1	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	

Machining The 1/4 Scale Gade Lunkenheimer Casting to Produce a Working Version

Intro to Machining Process

This description explains the sequence and why the machining steps are needed in this sequence. The primary goal is to keep surfaces that need to be concentric machined in a concentric manner. In addition the steps keep the ports and hole depths sequenced. We are dealing with very small small distances ie the valve seat and jet hole. .005 will make a big difference. Some of the machining requires finesse not just working to the drawings. Study all the interactions of surfaces carefully. Study the *Lunkenheimer Mixer Components 3D PDF* part renderings to see how the ports are laid out and relationship of sub parts. The dimensions do work but given you do not have a real starting surface on the casting creating a working valve operated mixer is not for the faint of heart!

It should be noted the Lunkenheimer Mixer for the Gade is a left handed Mixer. That means the fuel line comes in from the left. If you are using this on an engine such as a Galloway that needs a right hand Mixer you must make accommdations. In the case of the Galloway the muffler must take a left bend sooner so as to not block the fuel intake. An alternative would be to modify the casting so it was a right hand. A bit of fiddling, silver brazing, and some JB weld. I have not tried making a right hand one. See photo of my Galloway using the left hand mixer (Dwg 9).

Casting Preparation

The first step is to use JB Weld to partially fill the air intake core and the needle core. The air intake cored hole is filled about half - make sure there are no air gaps. The air intake is filled so that the machining of the valve stem hole will be straight and not tend to wander as it might if going through an open space and onto a curved surface. The needle cored hole is partially filled to insure enough material for machining that hole for the needle holder and fuel port. The stub to hold the casting needs a little cleanup so it will fit in the collet holder, see later description.

Machining Key parts to assist in machining the Mixer Body

(Cap, Needle Holder, Needle)

The use of the fixtures shown on the Workholding sheet (dwg 8) as well as a collet set up on the lathe is recommended. Also it is recommended to have made the Cap (dwg 6), the Needle Holder and Needle (dwg 5) so they can be used to check machining operations on the Mixer Casting. The author is sure there are other ways to build this mixer but this is a proven method that has produced several working Lunkenheimer Mixers.

1. The Cap is partially machined (Mixer Holder Dwg 8), the choice of the actual Cap style (Dwg 6) will be done later when all machining operations requiring this fixture are completed. Use ½ dia brass about 1 3/8 inch long, and thread 5/16-40 (preferred) per Dwg. 8.

2. Decide which Needle you are going to use ie its thread and size ie 0, or 2 (your own favorite as long as it fits in the Holder). Make the Needle as it will be used to determine the fit in the Jet as well as Jet size. see Dwg 5.

3. Next make the Needle Holder to match the Needle you just made. The Holder will be used as gauge to check the fit of the Needle Holder Hole in the Mixer Casting. See Dwg 5.

4. This would also be a good time to make the valve, valve spring keeper, and valve spring see Dwg 7.

Please check drawing to verify any dimensions given in the following steps. The drawing is always correct this is just a narrative of steps.

1. Place the cast body's hex end in a suitable chuck / collet, tap the small end around to reduce run out, and turn stem to .1875 (3/16). This trues up the stem for mounting the body in a collet and subsequent machining operations. The final sizing of the stem per Dwg 3 section D-D will be done later.

2. Mount the casting by the stem in a collet. For consistency mark the collet, lathe spindle, and casting so it can be returned as close as possible later after it is removed. The casting will have two machining operations when mounted by the stem. First the threading for the cap, second the valve stem hole and valve seat which must be done after the Jet port is drilled.

3. Machine off the hex and machine top back to dimension on drawing. The bottom of the large "hub" to the finished top is .195 as per Dwg. 3 lower left view on sheet. This is a reference surface.

4. Bore per the Dwg 3 section D-D ie ∅.282 to a depth of .165 which is to the top of the valve seat. This produces the surface for the 5/16 - 40 threads. For 75% engagement bore would be ∅.288. The ∅.282 gives about 73%.

5. Bore a thread tool relief groove at the bottom of the hole at ∅.312 and .030 wide, which is 1.2 threads. This is optional as it just makes threading a bit easier. Dwg 3 section D-D

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Build Notes	
PART		DWG NO. 2A	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	

Machining The 1/4 Scale Gade Lunkenheimer Casting to Produce a Working Version

5. Tap or single point (recommended) the 5/16 - 40 threads. There will be 5.4 usable threads. The reason for single pointing is that the stub holding the casting in the lathe is likely to slip or break if using a tap. By single pointing and turning the lathe by hand you get exactly what is needed. Use the Cap fixture as a thread gage. Be sure the faces meet, the thread doesn't bottom out, and the parts close tight. Dwg 3.

The next series of steps uses a square 5C collet holder, 1/2" and 3/16" 5C Collets, and a vise all mounted on a milling machine table. By using this approach the location of the Mixer center line is found first while setting up to machine the Needle Holder hole and the Jet. Once you have the Y axis Zeroed for that operation all you will be doing is rotating the Collet Holder and changing Collets. Everything will remain relative to the initial Y axis Zero. If you step through the sequence in the *Lunkenheimer Mixer Workholding Fixtures 3D PDF* and look at Dwg 8 it should become apparent how this approach works. Even if you take a different approach by reviewing this method it should assist in aligning the steps for your equipment. My first one was returned to the lathe for the valve stem and seat machining. As I said in the beginning this is just one approach.

6. Screw the ½ dia. brass 5/16 thd. fixture into the mixer body, and place it in a square 5C holder with the needle boss up, centered, and place the 5C holder at a 45 deg. angle in a vice (Dwg 8). Zero the Y- Axis over the center of the Needle Boss on the Mixer casting. Take care in doing this because once the Mixer is centered relative to the Y-Axis the 5C Holder can be rotated and the Mixer Casting is always on center relative to the Y Axis.
7. Drill, Bore, mill the Needle Holder and Jet hole. The Jet hole will depend on which Needle design you used. I recommend making a test Jet hole in some scrap and see how far in the Needle goes. Make sure you drill the Jet hole deep enough to be well into the seat area. See Dwgs 3, 5 and 8.

8. A choice must be made which setup to use for machining the valve stem hole and seat. You can return the casting to the lathe and match up the original setup marks or put stem in 3/16 5C collet and use the setup shown in Dwg 8, upper left. After setting up the casting proceed with next steps.

9. Now drill or bore the valve stem hole at least .750 deep to insure it clears the bottom of Mixer. Dwg 3 bottom left. Later the stem will be shortened to .714 per the drawing.

10. Use a 82 degree countersink (sharp) to create the valve seat or whatever method you wish, it just needs to match the valve you made. Cut until the jet hole is in the center (or close to it) of the valve surface. This is a tricky depth. If the top of the valve seat appears to be too high above the jet hole the valve seat top will need to be machined down a bit. This was the reason for setting the casting back as close as possible to concentric. Getting this right is critical. The valve must cover the jet hole to seal the flow of fuel. See Dwg. 8 upper left, and Dwg. 9 photo lower right.

11a Refer to Dwgs 4 and 8 as well as PDF Workolding setups. Place 5C collet block with the mixer attached to the fixture, and install a stop for the block in the vise so block can be returned to same spot. The point of the next sequence of steps is to combine routing the fuel ports through the highest pont of the casting and making sure it hits the upper corner of the Needle Holder hole as seen in Dwg. 4 hole marked A. The aligning of these ports is somewhat based on the casting, your machining, depth of the needle holder hole, needle port depth etc. The position of hole A in the needle hole is the most important. The hole through the intake fuel port just needs to pass through it and hit the needle side port.

11b With the mixer to the left, fuel intake up, and the needle boss toward you, pick up the highest point of the fuel transfer section approx .240 from the top. Once you are satisfied that will also hit hole A, zero the X axis.

11c Now rotate the block 180 deg., and place it in the vise against the stop. With the air intake boss toward you and the needle boss away from you, move the Y axis .190 towards the needle boss, and drill a .031 hole as far as you can (Dwg. 4 Fuel Port A) without the drill breaking out. Rotate 5C block CCW 90 degrees so air intake up and fuel intake toward you. Move the Y axis towards the fuel intake boss .140 and drill a .031 hole (Dwg 4 Fuel Port D) to intersect hole A. If you break out of the casting fix later with J-B weld not now as you may be silver brazing later on the Mixer Casting.

12. Position the 5C holder with the mixer body on the fixture with the with the air intake boss up and Y axis dialed to 0 in the vise shown in Dwg 8 lower right and 3D PDF air intake setup. Adjust X axis to center over the air intake boss. To clean out the J-B Weld plunge a .187 (ball) end mill in the center no further than the .113 drilled hole Dwg 3 section D-D.

13. Position the 5C Collet with the Fuel intake port up. See Dwg 8 upper right for workholding. Locate the center of the boss and drill the supply fuel port .047 per Dwg. 3 top right. Then prepare the rest of the opening for the fitting of your choice (Dwgs 3 and 7 show dimensions for fitting I used). It of course must fit the space available see Dwg 3 top right. You choose the type of fuel line to fuel tank and make corresponding fittings.

14. Remove the Mixer and its holder from the 5C collet. Place it in a lathe collet for maximum concentricity. The .1875 original stem diameter is now machined to the correct size Dwg 3.

15. Remove the Mixer from the workholder and install the needle holder permanently - Silver Braze, Stay-Brite, or retaining Loctite. Make sure it is seated at the bottom and that the Jet port is clear ie no solder or Loctite is in it.

16. See Dwg 6. At this point either make a new cap or use the threaded end of the fixture to make the cap. If you anticipate making more mixers, make a new cap and keep the fixture for future use. There are two cap choices either will work. Make the Gasket as it is needed to fit the Cap properly. The one with the bar gives a bit more control over amount of air flow if valve sucked all the way to the cap. If the bar Cap was made file the bar so the valve can lift about .020 (have the Gasket on when making this fit). The cap is tapped to suit connection to the engine.

17. Use some J-B Weld to seal the two ends of the Fuel ports and if you broke out fix that now.

18. Now assemble Mixer with valve, spring, and keeper.

19. Place needle holder cap on needle hole use some packing. Thread needle into holder.

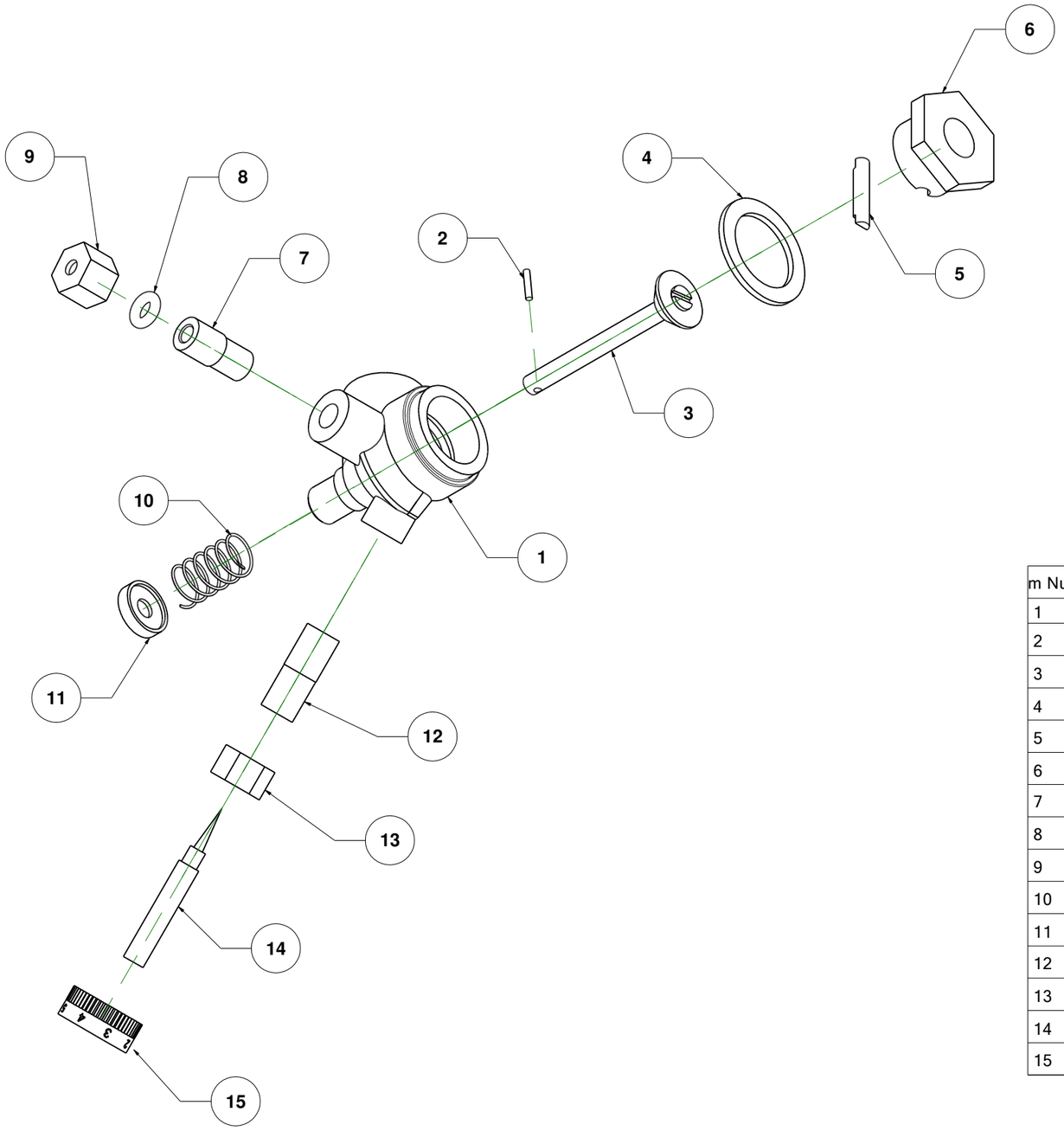
20. All done!

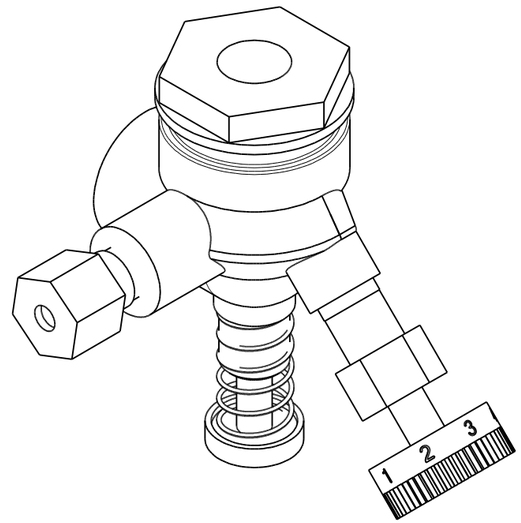
Tap Alternatives:

I discovered a source for some fine thread taps and dies, Victor Machinery Exchange - victornet.com. They have a 6-80 and a 2-80. I think the 2-80 would give a nice fine adjustment. They give a formula for calculating tap drill sizes. The formula produces 75% thread.

Tap Drill Diameter = Major Diameter minus (.975 divided by the number of threads per inch)

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Build Notes	
PART		DWG NO. 2B	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	





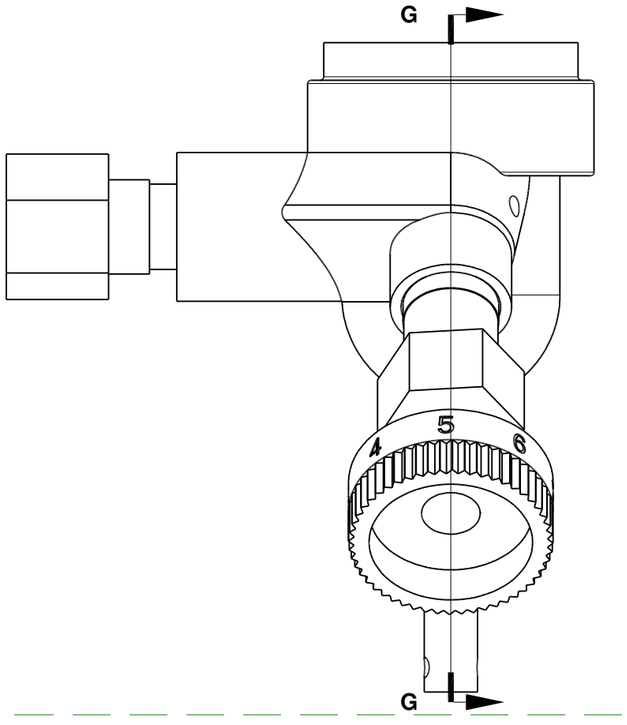
m Numb	Quantity	Part Name	Drawing #	Revision	Comment
1	1	Mixer Body	3,4	5	
2	1	Spring Keeper Pin	7	5	
3	1	Mixer Valve	7	5	
4	1	Cap Gasket	6	5	
5	1	Valve Stop Bar	6	5	Option 1 Cap
6	1	Mixer Cap	6	5	Option 1 Cap
7	1	Fuel Line Fitting	7	5	7,8,9 Optional Fitting
8	1	O ring	7	5	7,8,9 Optional Fitting
9	1	Fuel Line Cap	7	5	7,8,9 Optional Fitting
10	1	Valve Spring	7	5	
11	1	Spring Keeper	7	5	
12	1	Needle Holder	5	5	
13	1	Needle Holder Cap	5	5	
14	1	Needle	5	5	#4 Needle Assembly Option
15	1	Common Needle Head	5	5	

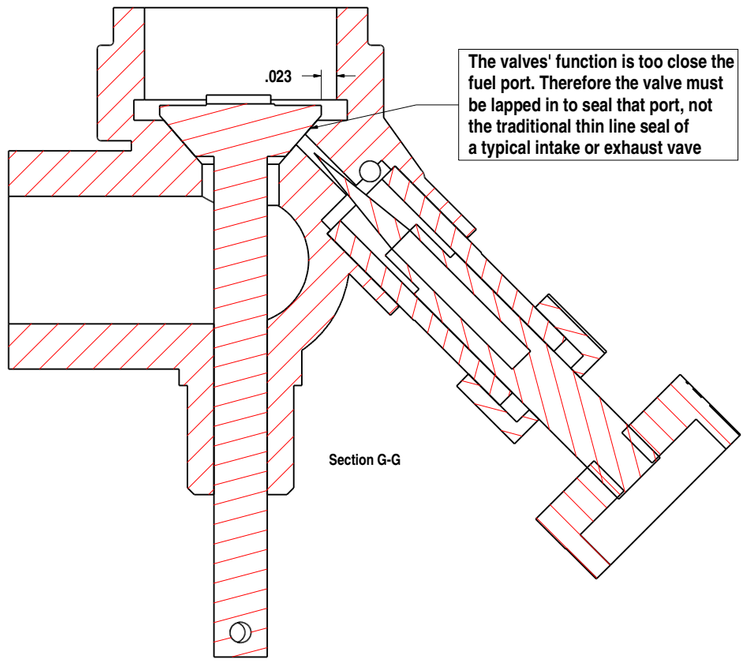
1/4 Scale Lunkenheimer Mixer
using Morrison & Marvin Gade Casting

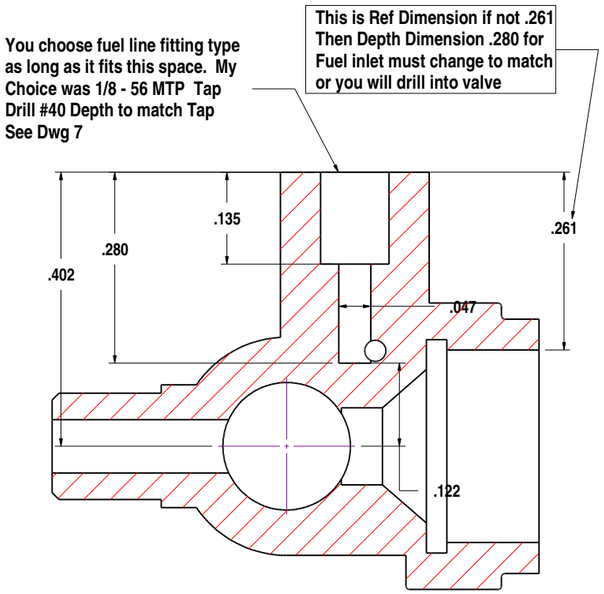
SUBASSEMBLY
Exploded View

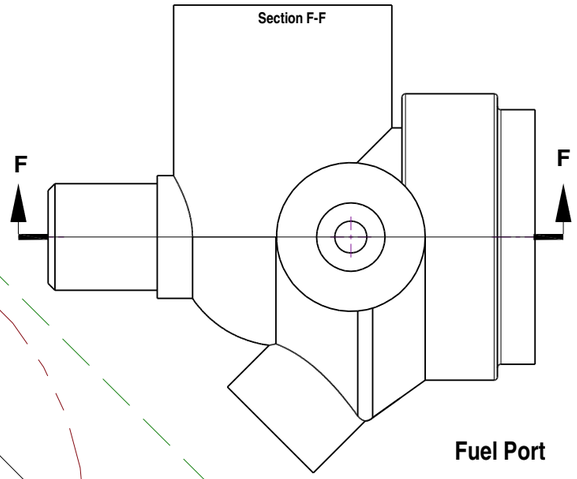
PART	DWG NO.	REV
Mixer	2C	5

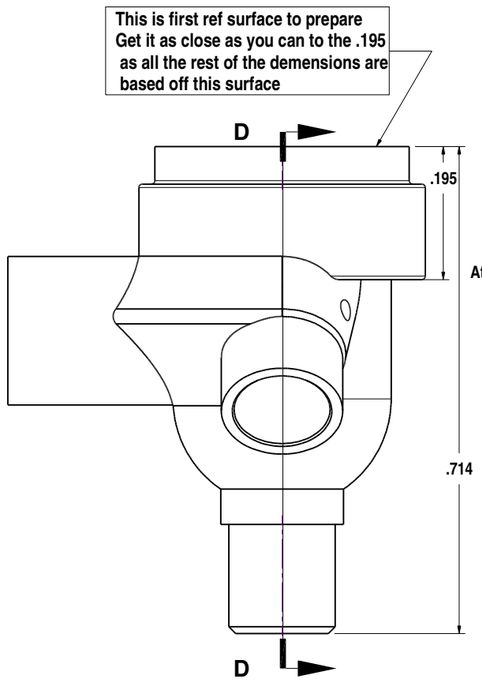
SCALE	DATE	DRAWN BY:
None	11 / 21 / 2019	Bob Nawa

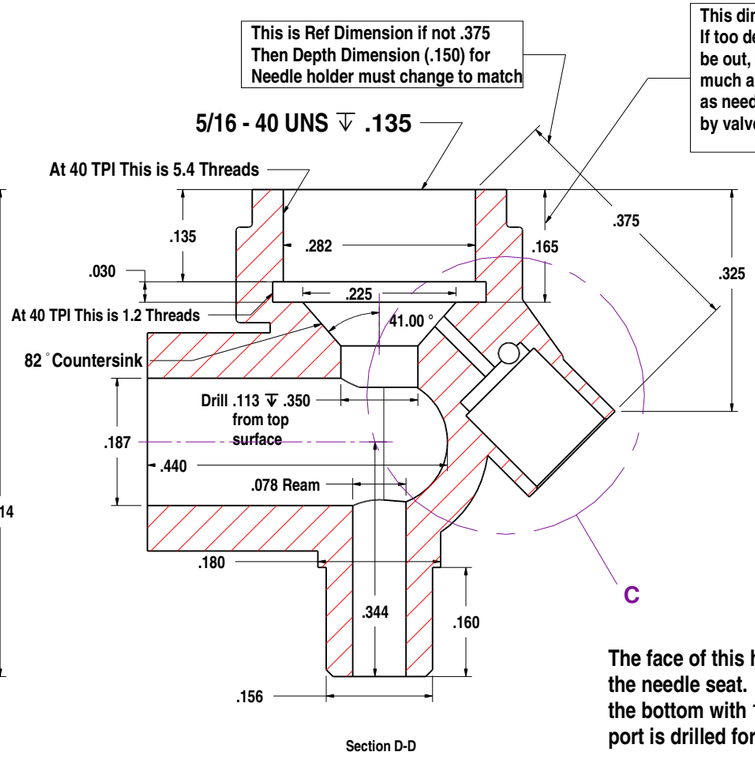


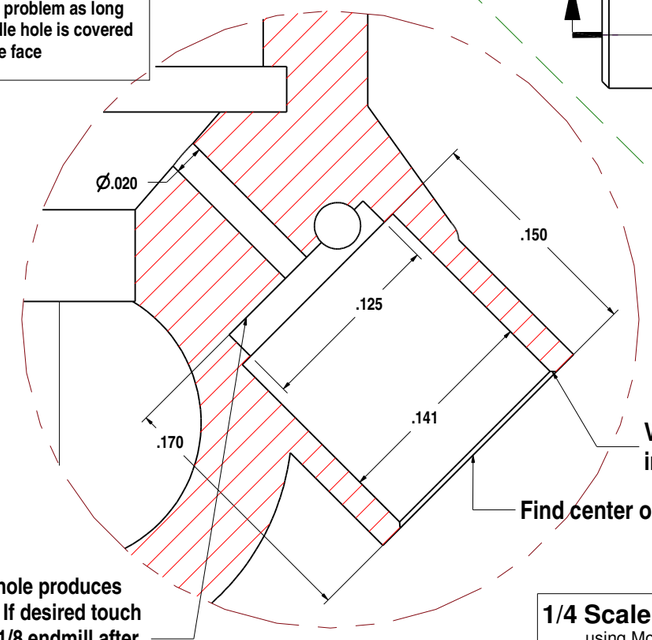




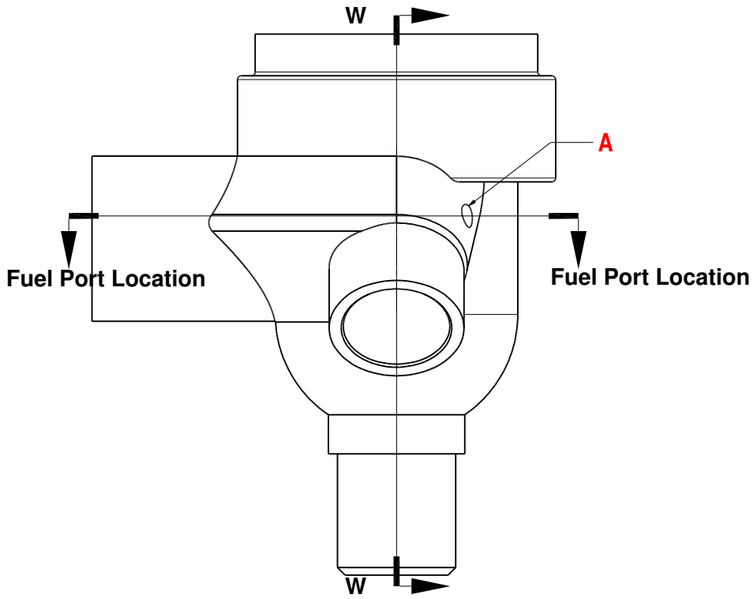


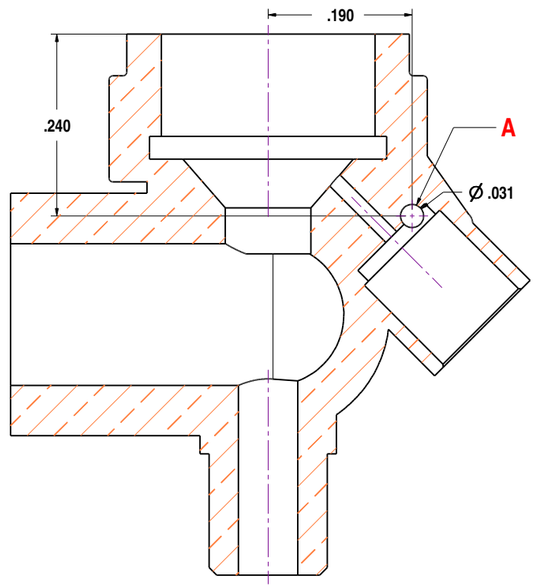




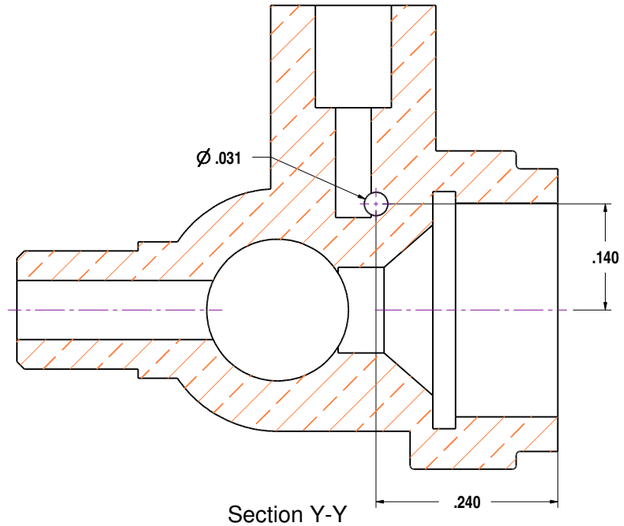


1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting	SUBASSEMBLY Cored Casting	
PART Mixer	DWG NO. 3	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa

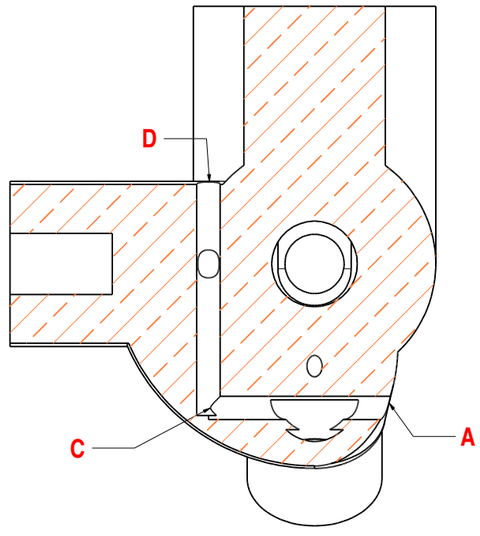




Section W-W



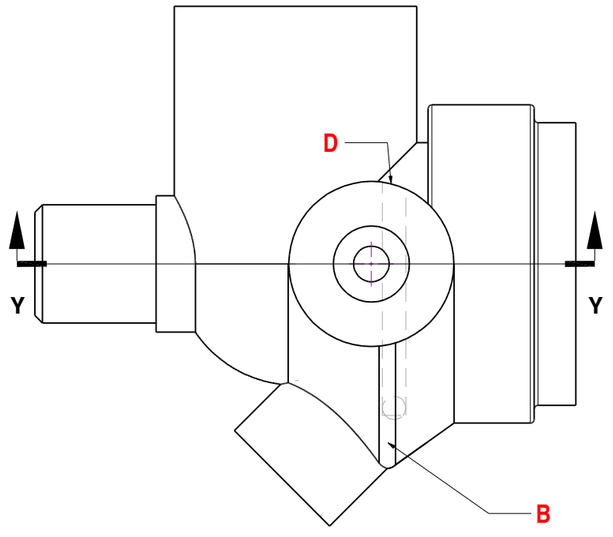
Section Y-Y



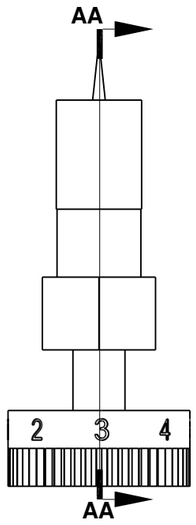
Fuel Port Location

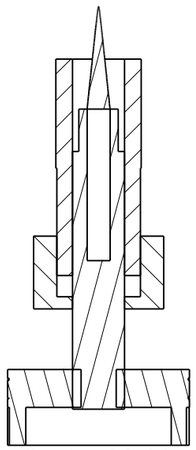
Notes: (for setups see Dwg 8 and *Lunkenheimer Mixer Workholding Fixtures 3D* PDF)

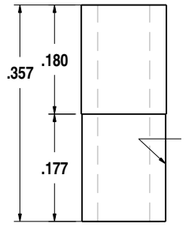
1. **The dimensions shown for positioning the fuel port are estimates. They depend on how the top was machined, the actual center etc. The key is to drill the ports last.**
2. **The .240 dimension needs to align with the upper corner of the needle hole at location A. The hole also needs to be close to the center of the fuel boss B to have most material available for drilling the .031 hole starting at point A.**
3. **The .190 dimension needs to also align with location A.**
4. **The .140 dimension needs to align so it will break into the hole through the needle port at point C. Start drilling this hole at point D.**



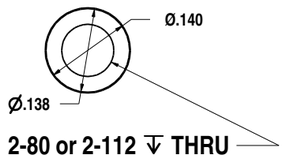
1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY **Fuel Porting**	
PART		DWG NO. 4	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	

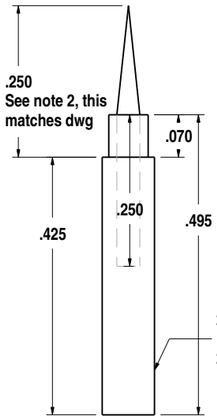




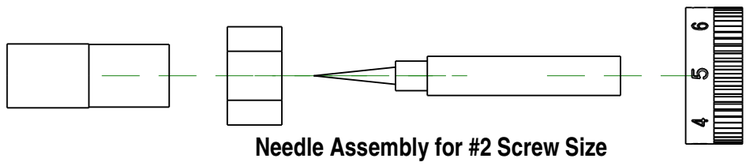


Needle Holder
Brass

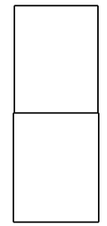




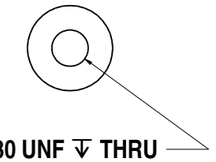
Needle
Stainless

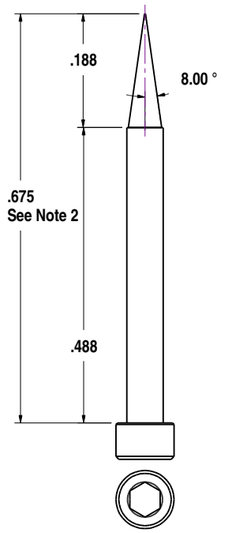


Needle Assembly for #2 Screw Size

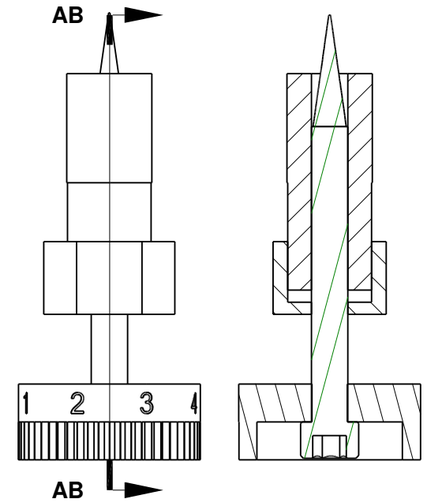


Needle Holder
dim same except
threaded hole

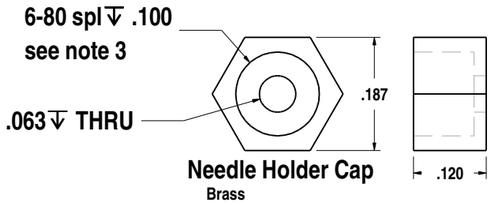




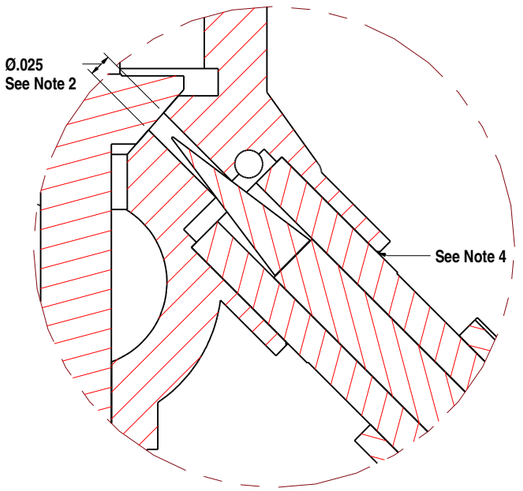
Needle
0-80 Stainless socket screw



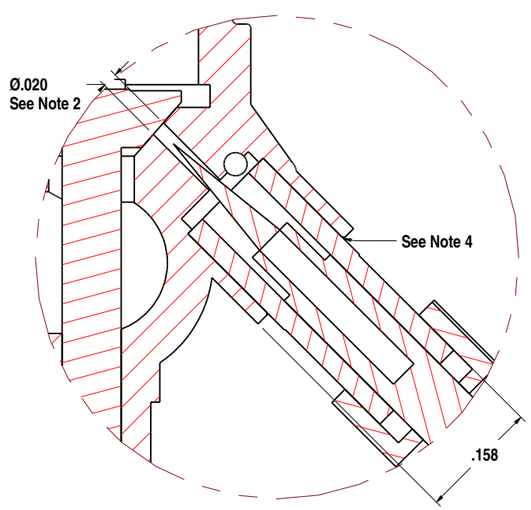
Section AB-AB



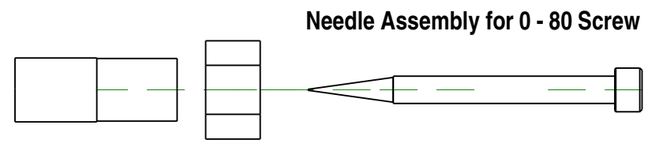
Needle Holder Cap
Brass

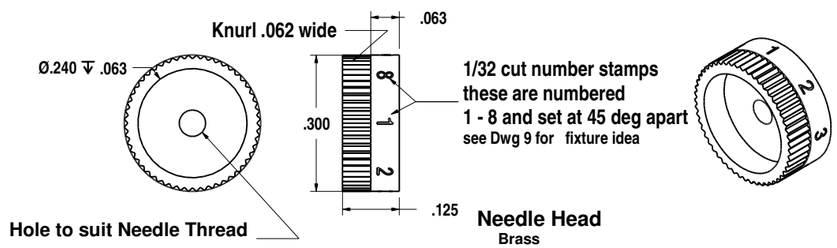


Holder using 0-80



Holder Using Needle





Common Needle Head

Locktite, Silver Braze, or your choice to the needle.

Note 1:

A method of insuring that the #4 needle is Loctited straight is needed. One approach is to use a slow setting Loctite like 640. Place needle in end of Needle body and clean off ALL the Loctite. Then thread the assembly into the Needle Holder and temporarily insert it into Mixer such that the Needle enters the Jet. Do this lightly. Let set for a day. If the Loctite was not cleaned off thoroughly there will be a lot of new machining!

Note 2.

Depending on Jet diameter you choose (.0156 - .025) the length of the needle may need to be modified. On the ones I built I used .020 and I used the #4 needle approach. You need to take your needle and see how far it goes into a test hole. From that you can determine the length you need. You want the needle to go into the port about .050. Two other modelers used the 0-80 approach and used a port size of .025 - .031. I think the .031 is a bit large. Your choice and a bit of an experiment.

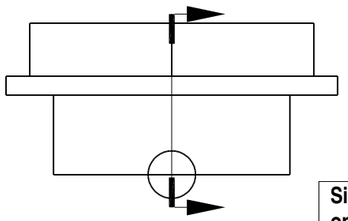
Note 3

The thread used for the Holder and the Needle Cap just need to clear the inside thread. For the version 0-80 a 6-48 or 6-32 would give of clearance. When using the #2 size there is enough wall thickness for use of 6-48 or 6-32 also. Your choice just make sure there is clearance.

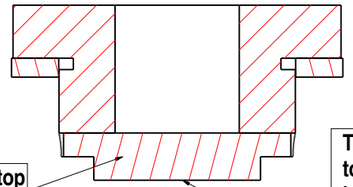
Note 4

A slight countersink is machined on the mixer body to aid installing the Needle Holder. You can either silver braze, Stay-Brite, or use retaining Loctite to attach the Needle Holder. Either way make sure surfaces are clean. I used silver braze.

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Needle Holder	
PART		DWG NO. 5	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	

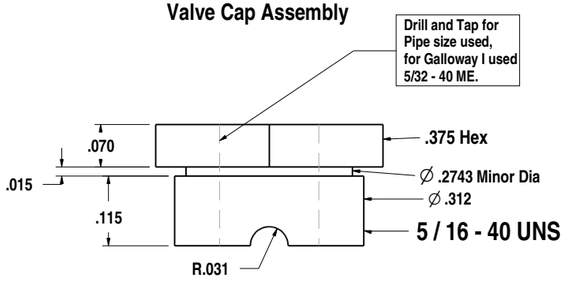


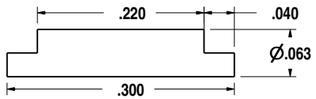
Valve Cap Assembly



Silver Braze Valve Stop on the cap

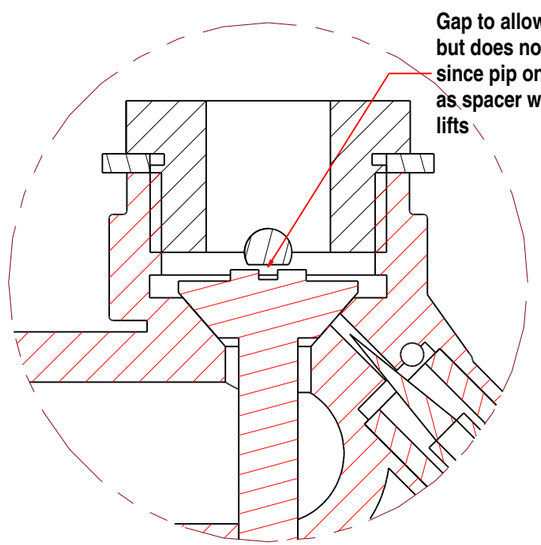
This surface will be filed to allow valve to open just enough (~.020) to allow fuel and air to enter intake chamber. See Note.





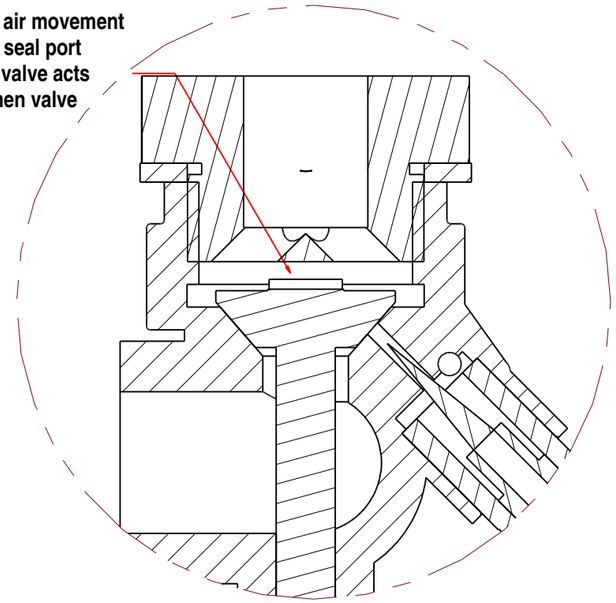
Valve Stop Bar

Mixer Cap Option 1



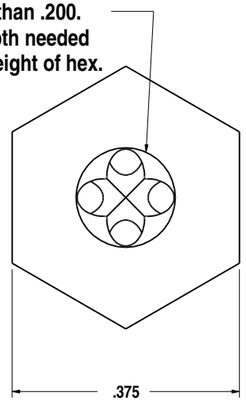
Gap to allow air movement but does not seal port since pip on valve acts as spacer when valve lifts

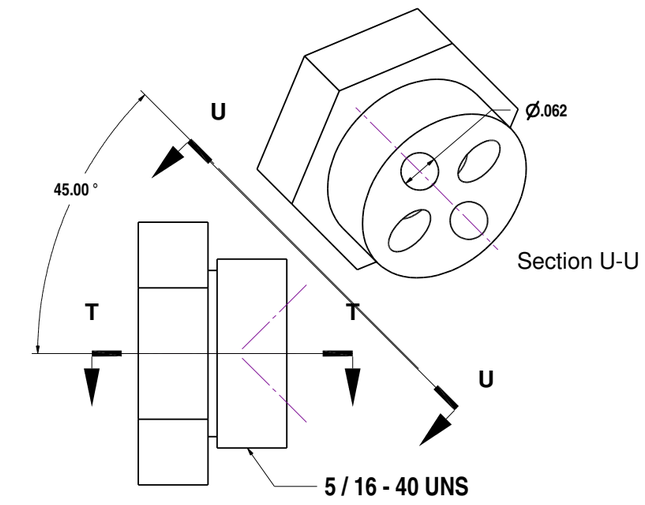
Valve Cap 1 Stop Bar

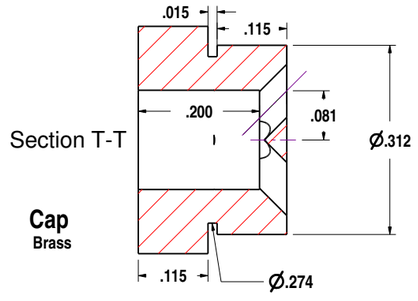


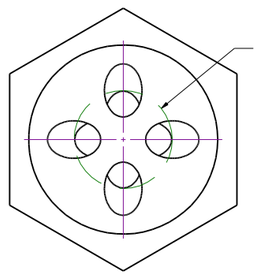
Valve Cap 2 Ports

Hole tapped to suit engine connection. no deeper than .200. If more depth needed increase height of hex.

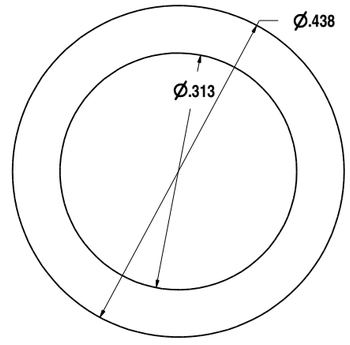








Mixer Cap Option 2

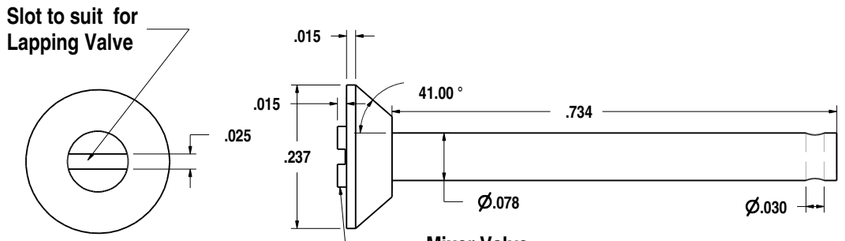


Cap Gasket
~ .025 thick

Note:

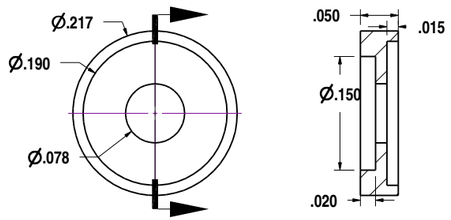
Two different Cap types are shown and both provide a stop so the valve does not get sucked up flat against the Cap and thus sealing off air / fuel mixture.

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Cap	
PART		DWG NO. 6	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	

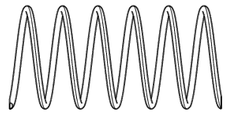


Mixer Valve
Stainless or Brass
length may vary depending casting

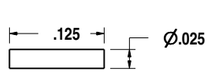
Raised section for slot is required even if no slot is made. It is used to insure air flow space see Dwg 6



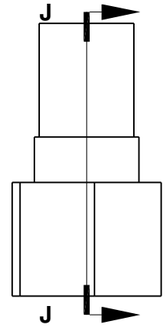
Spring Keeper
Material: Aluminum to keep weight down

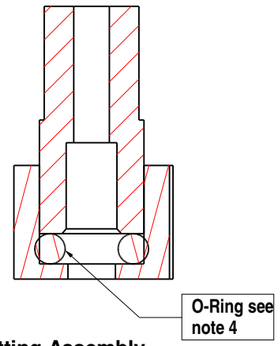


Valve Spring
.010 Music Wire about 5-6 turns .187 OD .350 long
The spring needs to just hold the valve tight so it seals so some experimenting may be needed based on your engines intake vacuum. May need lighter music wire.



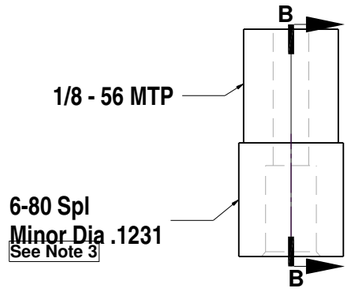
Spring Keeper Pin
Brass, Copper, Lead Wire

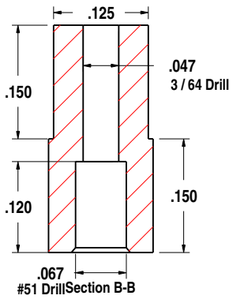


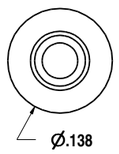


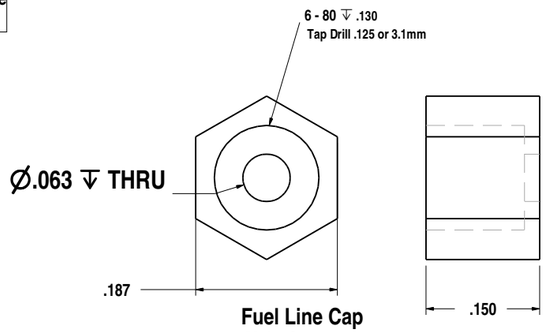
Fuel Line Fitting Assembly

This is the fitting I made you can make any type you want ie different threads, just a tube for flexble line whatever you want as long as it fits the space available on the fuel line port shown on dwg 3 upper right





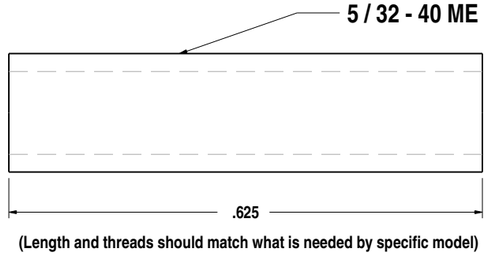




Fuel Line Cap
Make 2

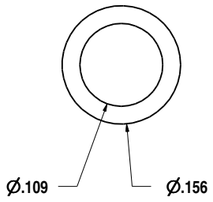
Optional Fuel Line Fitting
Make 2 one for each end
of fuel line

See Notes 1 and 2 for Parts Below



(Length and threads should match what is needed by specific model)

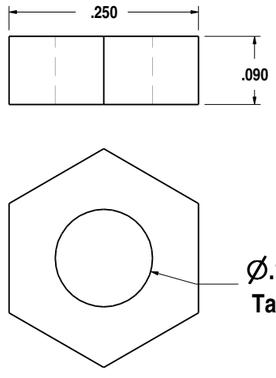
Intake Pipe



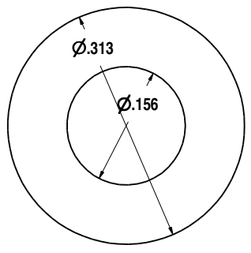
5 / 16 - 40 UNS Thread specifications:

External Major Dia .3116 - .3065, Minor Dia .2818 Thread depth .0298 - .02470

Internal Major Dia .3125 Minor Dia .285 - .291



Mixer Intake Pipe Lock Nut
Make 2

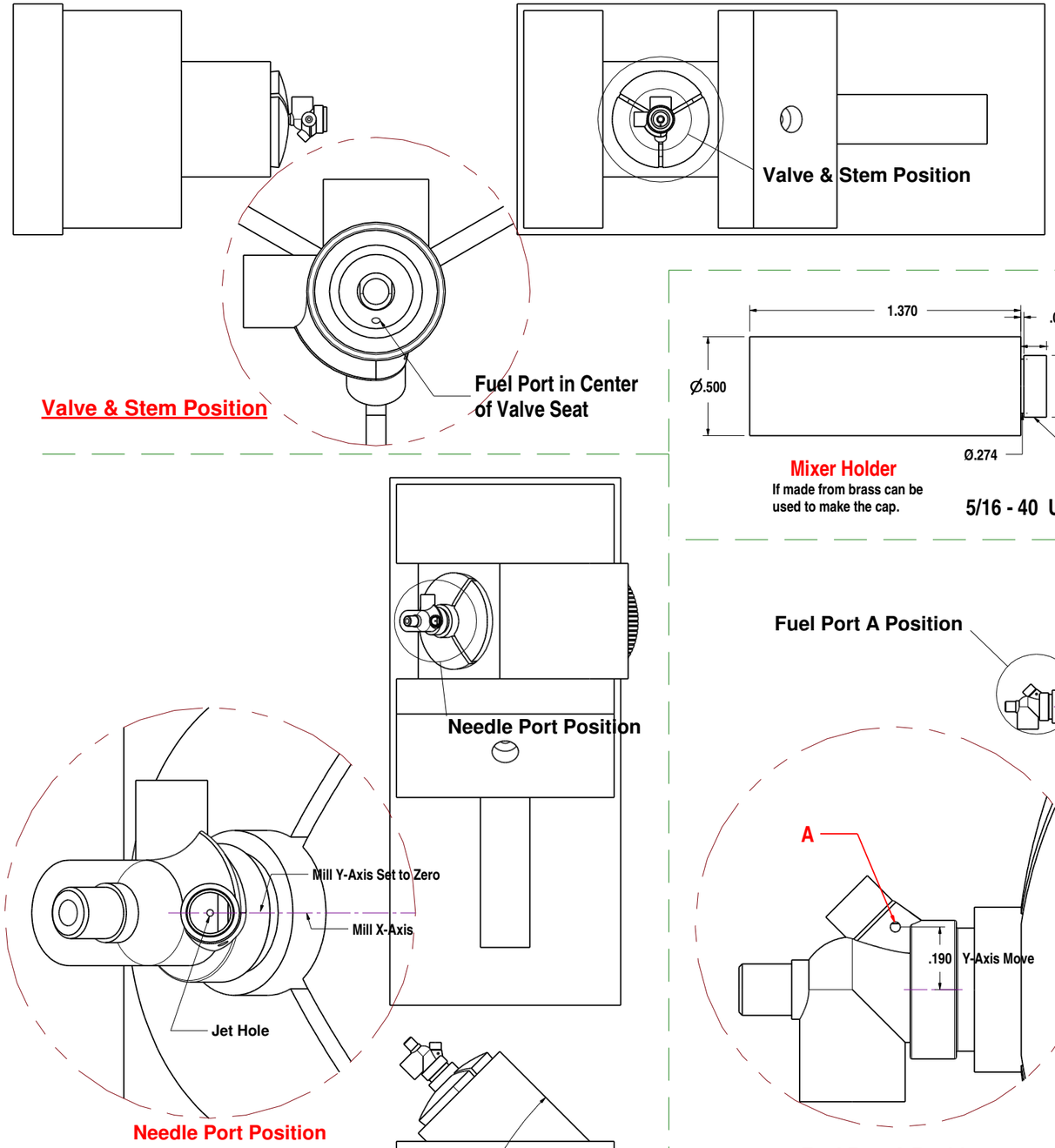


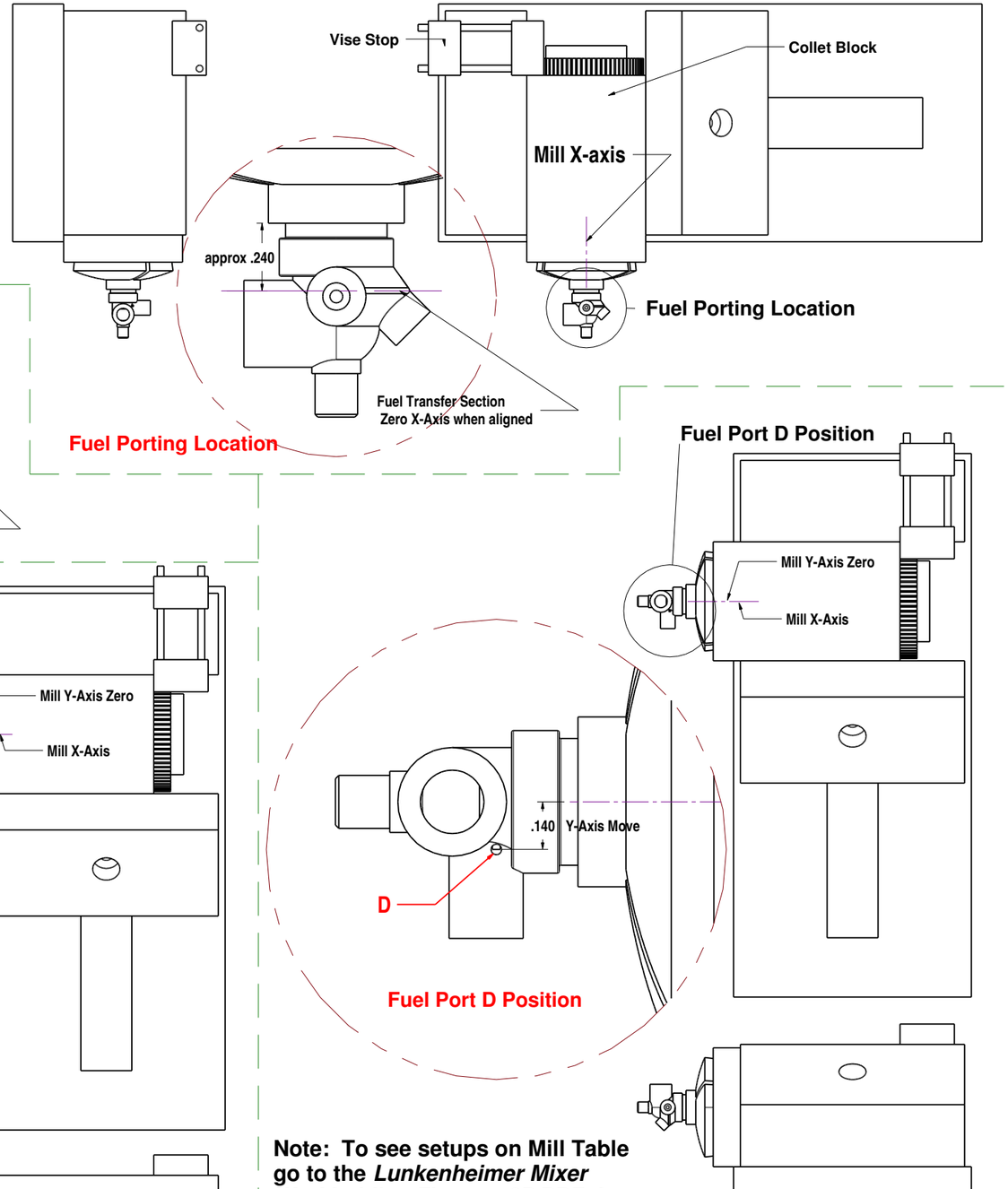
Materials:
Metal parts - Brass
Gasket - .025

Notes:

1. These are sizes and quantities I used for my Galloway.
2. The mounting methods used by your model will dictate mounting threads and parts needed.
3. As mentioned the 6-80 can substitute a 6-48 as long as use a 1/16 fuel line. With 6-80 you can go up to 3/32 line.
4. I used a O-ring to seal the fuel line size 001-1/2 which is 1/16 ID x 1/8 OD actual 0.070 ID x 0.150 OD.

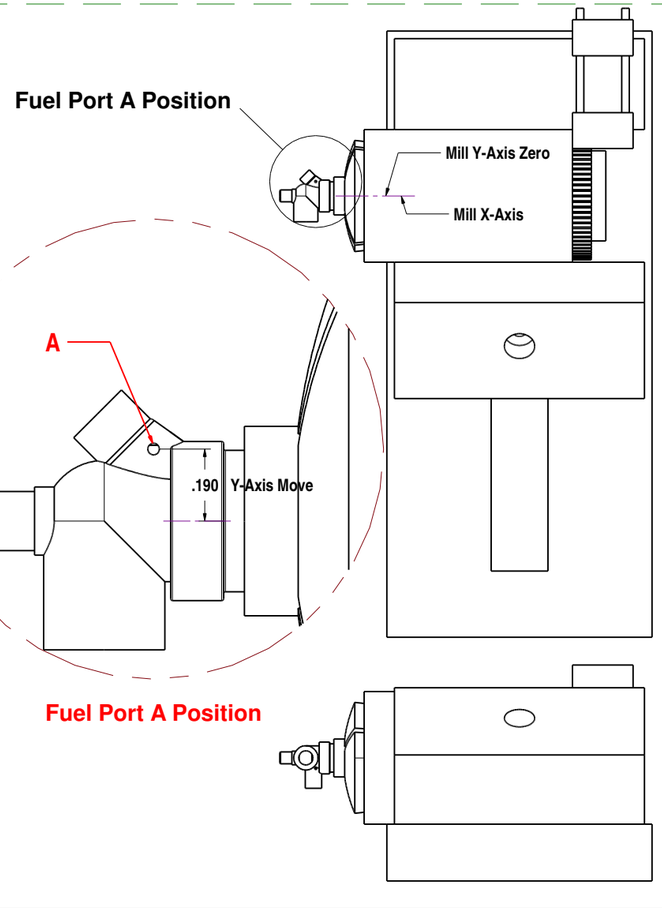
1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Valve and fittings Fittings	
PART		DWG NO. 7	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	





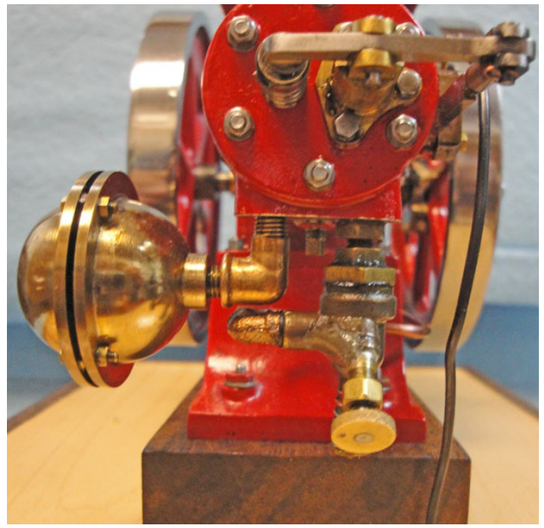
Mixer Holder

If made from brass can be used to make the cap.

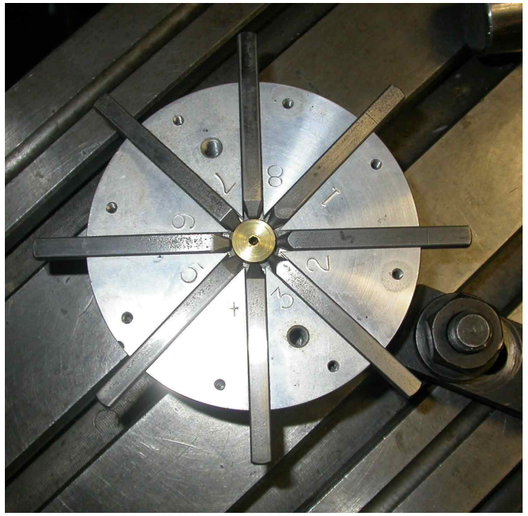


Note: To see setups on Mill Table go to the *Lunkenheimer Mixer Workholding Fixtures 3D* PDF document

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting	SUBASSEMBLY **Vise Holder**	
PART **Needle Hole operations**	DWG NO. **8**	REV **5**
SCALE **None**	DATE **11 / 21 / 2019**	DRAWN BY: **Bob Nawa**



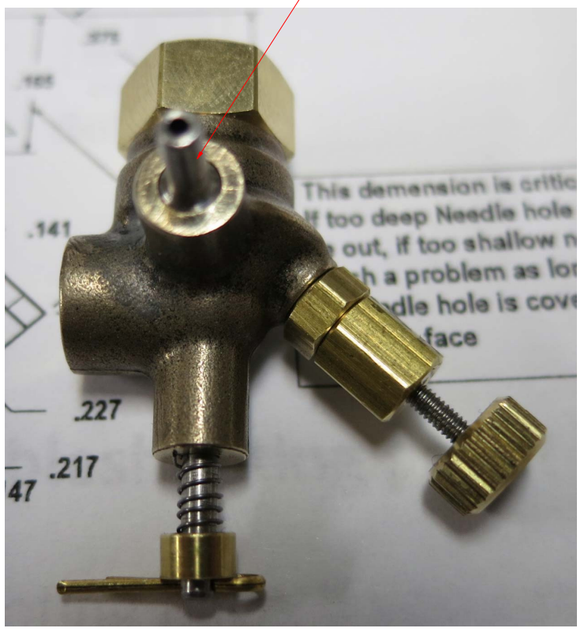
Left Hand Lunkenheimer
on 1/8 Scale Galloway



Fixture for Stamping Numbers on Needle Head

Needle Head in the middle held down by steel pin in Chuck, just give each stamp a hit and all done.

Option 2 Cap



Lunkenheimer Built by 2nd Modeler who provided Alternate Design Approaches

1/4 Scale Lunkenheimer Mixer using Morrison & Marvin Gade Casting		SUBASSEMBLY Alt Design Photos	
PART		DWG NO. 9	REV 5
SCALE None	DATE 11 / 21 / 2019	DRAWN BY: Bob Nawa	