SkillsUSA
2010 Contest Projects

Technical Drafting

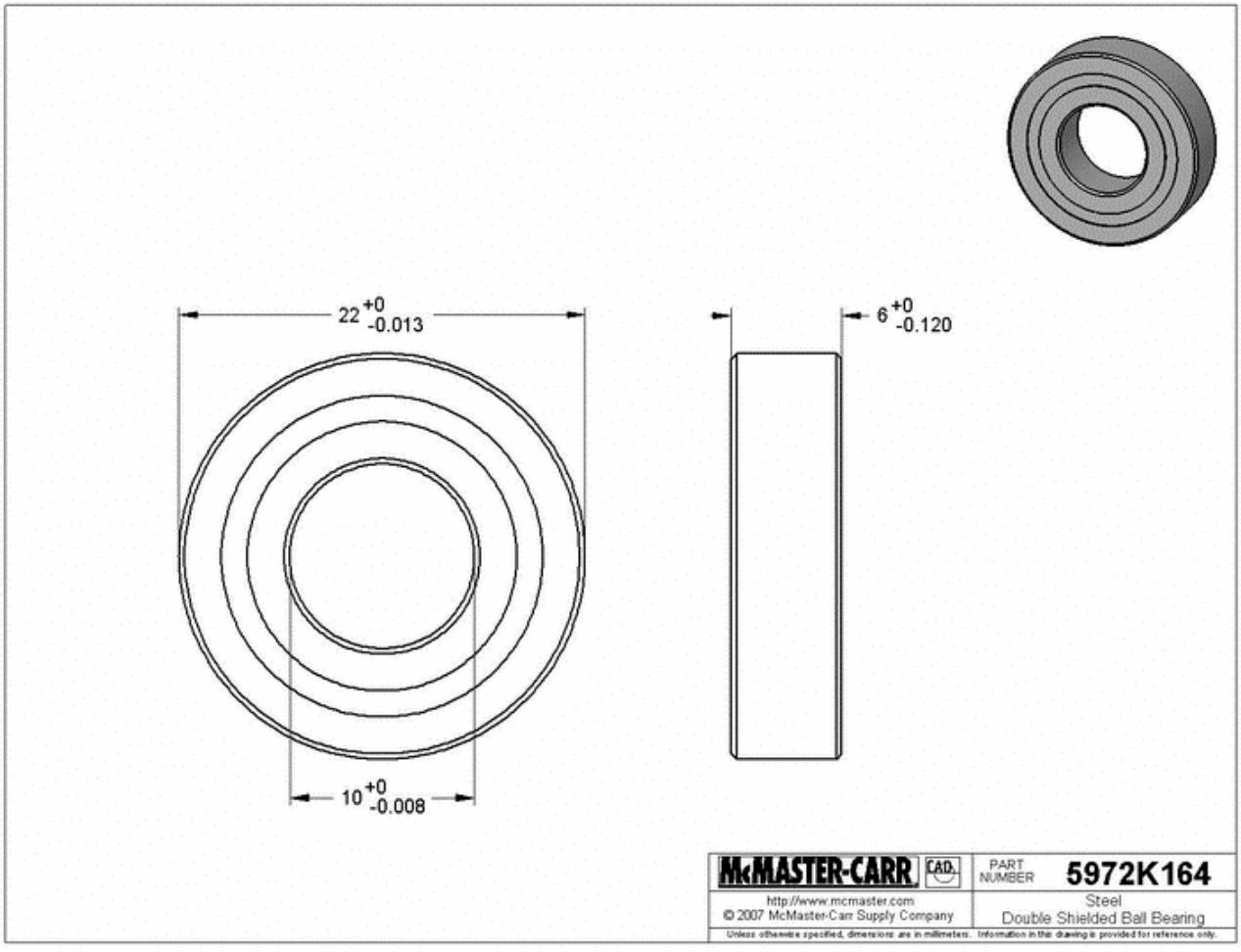
Click the “Print this Section” button above to automatically print the specifications for this contest. Make sure your printer is turned on before pressing the button.

UPDATE:

As is often the case in the design world, things may change before you even get done with the design. We have just received an update from the customer. They found a metric bearing with tighter tolerances that will fit into this design without too much modification or lost time, and want us to use it instead of the previously called out inch series bearing. The specs of this new bearing are shown in the view below.

Your task is to modify your design in order to use this new bearing. Since you haven't released control of any drawings that will be affected, you don't need to show any revisions on your drawings.

While you are making your changes, make sure that specifications called out in your instructions are still followed. For example, look at the definition of length of the lower bearing journal, etc. You need to maintain the existing positions of the outer faces of the bearings since those faces contact the Coupling Hub and the Lower Blade Holder, and those parts must remain where they were. Remember to watch your fits, tolerances and clearances as the bearing has changed size.



Orientation comments - general:

1. (Make sure the PA is proper for this area only.)
2. (Students meet in lobby and someone bring them up?? What time?? What time will we start talking to them? When can they start on the problem? What is the official stopping time? 4:30?)
3. Welcome and philosophy.
4. Roll call
5. State prizes will be distributed after the awards ceremony.
6. Debriefing will be on Friday at 11:00 am, but not in this room – see the program. Your drawings will be returned to you then as this is the point.
7. Rules:
    A. No electronics other than your computer. That means no cell phones, head phones, mp3 players, iPods, GPS, modems, radios, etc. – nothing wireless – this is monitored. We have had disqualifications in the past.
    B. If your equipment goes down, we will mark time on paper by your station, and you get the time back during make-up time between 4:30 & 5:00 pm
    C. Dress code
    D. Courtesy Corp for bathroom escorts
    E. Lunch will be at 11:30 am (30 minutes) and will be a provided sack lunch
    F. No one removes equipment until 5:00 pm.
    G. Return at 5:00 for teardown. Pack up the equipment, remove the paper from the tables, stack tables & chairs.

Orientation comments - problem:

8. Anyone here that was here last year?
9. You created the Title Block yesterday – make sure you use that.
10. File names are your contestant number- part number, not the other way around. This puts your stuff together on the server.
11. Here is the problem along with the associated references you need. (Do a quick walk-through. 14 pages? Everything readable?)
12. No complaints – this is what it is.
13. Pay attention to the details. "I didn't understand that." Isn't acceptable.
14. Save often – power could die any time.
15. Drawing M9456A01 Mounting Frame is due by 10:30.
16. Drawings M9456A04 Lower Blade Holder and M9456A05 Upper Blade Holder are due by 11:30.
17. Do not submit the other four drawings before 12:15.
18. Contest questions end at 1:00 pm – the customer is gone by then.
19. Drawings that you submit to the printers will be brought to you to initial. Only one initialed plot per drawing will be accepted – more than one per results in disqualification for that plot. Final plots will be delivered to the judges by the Courtesy Corp. Make sure you keep track of what you send – it is your responsibility. (Make sure we don't clear printer cache.)
20. Read through the entire problem first so you know what is expected and then decide how to best use your time. Remember the time deadlines for the first three drawings. Hint – only do the calculations necessary up front in order to get the first drawings done on time.
21. If you have a question about the problem, hold up a copy of it. If you have some other question, hold up a hand without the problem.
22. Questions about the problem will be answered by WT. (And maybe someone else if I can get someone up to speed on the problem.)
23. Don't break the rules – it's not worth it.
24. Hint – submit a required drawing anyway.
25. Have fun!

P.O. Box 3000
Leesburg, VA 20177-0300
Voice: (703) 777-8810
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Memo:

Date: June 23, 2010
To: Technical Drafting Contestants
From: Technical Drafting Committee
Re: Title Block Layout

Overview:
Create a title block such that it will fit on an 11" x 17" (B size) sheet of paper in a landscape orientation.

Text Information:
Unless otherwise specified, all text labels and notes are to be 0.104" tall. All text entered in the title block area for each specific drawing must be 0.146" tall, bold, and fit within the allotted space provided. Remember to always use a font that is readable & appropriate for mechanical drawings, such as Arial, Roman something, etc.

Instructions:

1. Create a 10" x 16" border so that it will fit evenly on the sheet. (The lower right hand corner will be referred to as the reference corner.)
2. Make a horizontal line 8" long and 1.5" up from the bottom border line, with one end of the line coincident with the right edge of the border line.
3. Draw a vertical line that is 1.5" long and 3" to the left of the reference corner, with one end of the line coincident with the bottom edge of the border line.
4. Create two more duplicate vertical lines such that they are spaced 6" & 8" respectively from the reference corner. *You should now have a rectangular shape that measures 1.5" tall and 8" wide and that is divided into 3 major vertical portions.*
5. In the reference corner, create a 3" long horizontal line spaced 0.375" up from the bottom border line, with one end of the line coincident with the right edge of the border line.
6. Create a duplicate parallel line 0.375" up from the before mentioned line, with one end of the line coincident with the right edge of the border line.
7. Equally divide the middle portion of the title block rectangle into 4 horizontal sections.
8. Equally divide the last portion of the title block rectangle into 2 horizontal sections.
9. The vertical portion that is closest to the reference corner will be called portion #1. Portion #2 is located immediately to the left of portion #1, and portion #3 is located to the left of portion #2. In portion #1, label the three boxes (starting with the top one) with DRAWING NAME:, CONTESTANT #:, and CONTESTANT INITIALS:.
10. **Also place your contestant number inside the lower left corner of the drawing border.**
11. In portion #2, label the four boxes (starting with the top one) with WEIGHT:, MATERIAL:, SCALE:, and DWG NO.:.
12. In the SCALE: box, further divide it by putting in a vertical line that is 1.32" to the left of its RH end. Label this new box as SHT NO.:.
13. In portion #3, label the two boxes as shown to the right. Tolerance notes are to be 0.06" tall, the SkillsUSA is to be 0.25" tall and bold, and the city and state are to be .125" tall. Everyone's drawings shall list "LEESBURG, VA", not your home town and state.

Additional Information:

- **Every document that is submitted for judging must have this title block format for points to be awarded.**

JUDGE
REFERENCE
ONLY

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ±1/16 DECIMAL .XX ± .03 .XXX ± .004 ANGLES ± 1°	WEIGHT:		DRAWING NAME:
	MATERIAL:		
SkillsUSA Leesburg, VA	SCALE: 2:1	SHT NO: 1/1	CONTESTANT#: 000
	DWG NO:		CONTESTANT INITIALS: XYZ

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Memo:

Date: June 24, 2010
To: Technical Drafting Contestants
From: Technical Drafting Committee
Re: Seam Saw Assembly

Overview:

A major medical equipment manufacturer has requested that our company design a Seam Saw Assembly that will be used to cut open implantable electronic devices that have been LASER welded together. This company has provided pertinent details regarding the Mounting Frame (which will interface with an existing gearbox), the Housing, the Shaft, the Upper and Lower Blade Guards, and the Upper and Lower Blade Holders, as well as the necessary saw blade data and required hardware. This assembly requires that the Mounting Frame be attached to the gearbox using 1/4-20 hardware and a purchased High-Offset Slotted-Disc Shaft Coupler (Coupler Hub Assembly) to attach the gearbox shaft to the Seam Saw Shaft. The Coupler Hub Assembly will need to be altered to provide a relief such that the base of the upper hub half can be installed next to the inner race of the lower bearing. A drawing of the gearbox has been provided to aid in your design.

Drawing Requirements Summary:

For this event you are the assigned Designer and will be drawing/modeling and detailing the first five major items along with the assembly drawing. You have six drawings to submit as listed below.

M9456A00 - Seam Saw Assembly
M9456A01 - Mounting Frame
M9456A02 - Housing
M9456A03 - Shaft
M9456A04 - Lower Blade Guard
M9456A05 - Upper Blade Guard

The remaining manufactured items, M9456A06 - Lower Blade Holder and M9456A07 - Upper Blade Holder, will need to be designed but not detailed on a drawing.

The altered Coupler Hub Assembly will also need to be designed (simplified representation) and properly noted in the BOM, but not detailed on a drawing. Assign a part number of M9456A08 to the altered hub half.

The customer has specified how they want the Bill of Materials (BOM) shown on the assembly drawing. It shall be listed in ascending order (bottom-to-top) and shall be directly above the Title Block. Show “Make” items followed by “Purchased” items.

General Considerations:

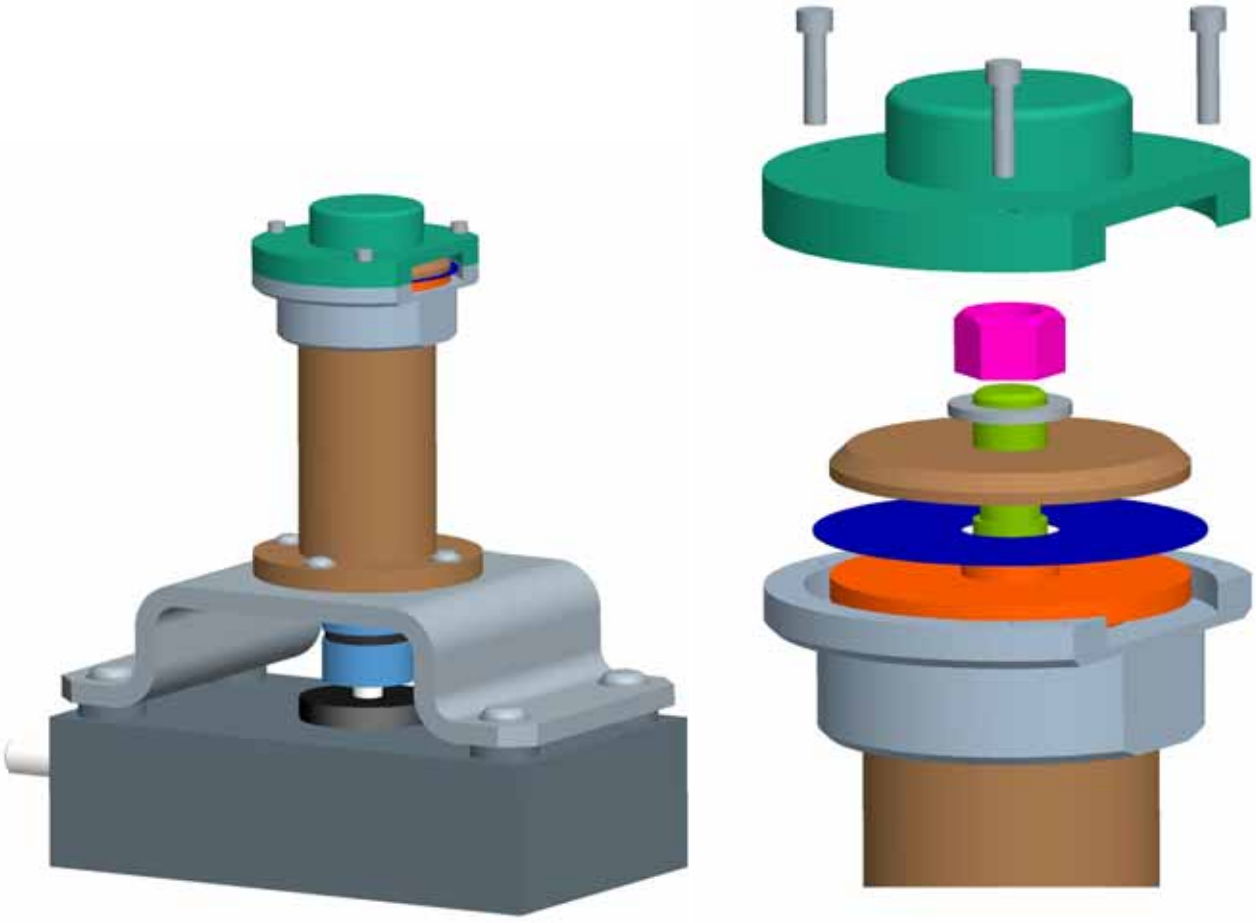
- All dimensions in this documentation are given in inches unless otherwise noted.
- Use nominal dimensions for all parts unless special fits are called for in this document.
- Dimensions are shown in this document as 3 place decimals for clarity.
- Use 2 place decimals when tolerancing non-critical features.
- Use ASME Y14.5M – 1994 symbols where necessary.

- A surface finish of 32 microinches shall be applied to all close tolerance diameter surfaces, which includes the bearing surfaces of the Housing and Shaft, the pilot surfaces of the Housing and the Mounting Frame, and the interface surfaces between the Housing and the Lower Blade Guard. All other surfaces shall have a finish of 63 microinches.
- Unless otherwise specified, all fabricated parts are to be made of Aluminum 6061 T6 and hard Black anodized .0010 thick per MIL-A-8625, TYPE III, Class 2.
- Show all threads as a simplified illustration – hardware excluded, see next bullet.
- Show all related assembly hardware as a simplified representation – exclude threads, lead-in chamfers, and socket head configurations. (Unless you find yourself with extra time at the very end, then go for it.)
- Clearance holes for all fasteners shall be the nominal fastener diameter plus 10%, and then round up to the nearest 1/64th inch standard fractional drill bit size.
- The box labeled "SHT NO.:" in the Title Block of each drawing is to be an indicator of the sheets for that drawing only, not the whole drawing set. So do not enter "3/6", etc.

PART: M9456A00 SEAM SAW ASSEMBLY:

This is the finished Seam Saw Assembly. It shows the proper orientation of the components and how they are to be assembled.

YOUR TASK: *Produce a drawing that shows how to properly put this assembly together, including the mounting hardware. If you have time at the end, show the gearbox as a reference. At a minimum you need to provide a full section view and an exploded isometric view along with the Item Detail Balloons that correspond to the BOM. Include a reference dimension that shows the overall height of the assembly, not counting the fasteners.*



PART: M9456A01 Mounting Frame (Formed or Weldment):

This Mounting Frame is the device that will allow the existing gearbox to be mated to the Housing assembly. It will support the Housing at the correct height and provide the proper alignment between the gearbox shaft and the Seam Saw Shaft. The Mounting Frame can be constructed as either formed sheet metal or as a multi-piece weldment – your choice. Both versions shall be made from 1/4 inch thick Aluminum 5052 H32 and shall be hard Black anodized .0010 thick per MIL-A-8625, TYPE III, Class 2 after all features and operations have been done. The overall length and width shall be such that there is .500 material past the centers of each of the mounting holes, not counting the corner chamfers. The overall height shall be 1.500 and the mounting tab lengths (inside to outside) shall be 1.350. See the Gearbox detail drawing for the mounting hole pattern. The corners are to be chamfered 45 degrees by .310. See the Housing detail to determine the tapped hole arrangement in this part, and match the threads to the selected hardware. Also use the Housing detail to determine the proper pilot hole diameter in order to have a .005 clearance when both parts are at their MMC. The pilot hole shall have a .160 deep counterbored feature and a through ID of 1.094. Use the pilot hole as the origin for dimensioning. Write a statement on your drawing (typed or legibly written) indicating the purpose of the counterbore, and if the feature could be omitted, then how and why. (~50 words or less)

The formed version shall have an inside bend radius of .280 and a K-factor of .47. This part will be LASER cut in the flat pattern shape. Provide a dimensioned flat pattern drawing view with geometry that is appropriate for sending directly to the LASER.

The welded version shall be a multi-piece weldment. You do not have to individually detail each member on a separate sheet – you may either show the dimensions of each piece in the weldment or show details of each on the same sheet. If you choose the welded version, you need to include a proper BOM and balloons. Use best design practices in determining weld joint design, bead type, and placement. Use weld symbols that are appropriate for your design.

Define the following geometric tolerances on the part as follows:
1) Specify a profile tolerance of .005 for the coplanar surfaces as Datum A (the bottoms of the mounting tabs).
2) Specify a parallel tolerance of .010 for the top surface, in the Free State, with respect to Datum A.

YOUR TASK*: Produce a drawing with the necessary views of this part in its final form (and flat pattern if elected) that include the correct features for the chosen version. Also include an isometric view.*

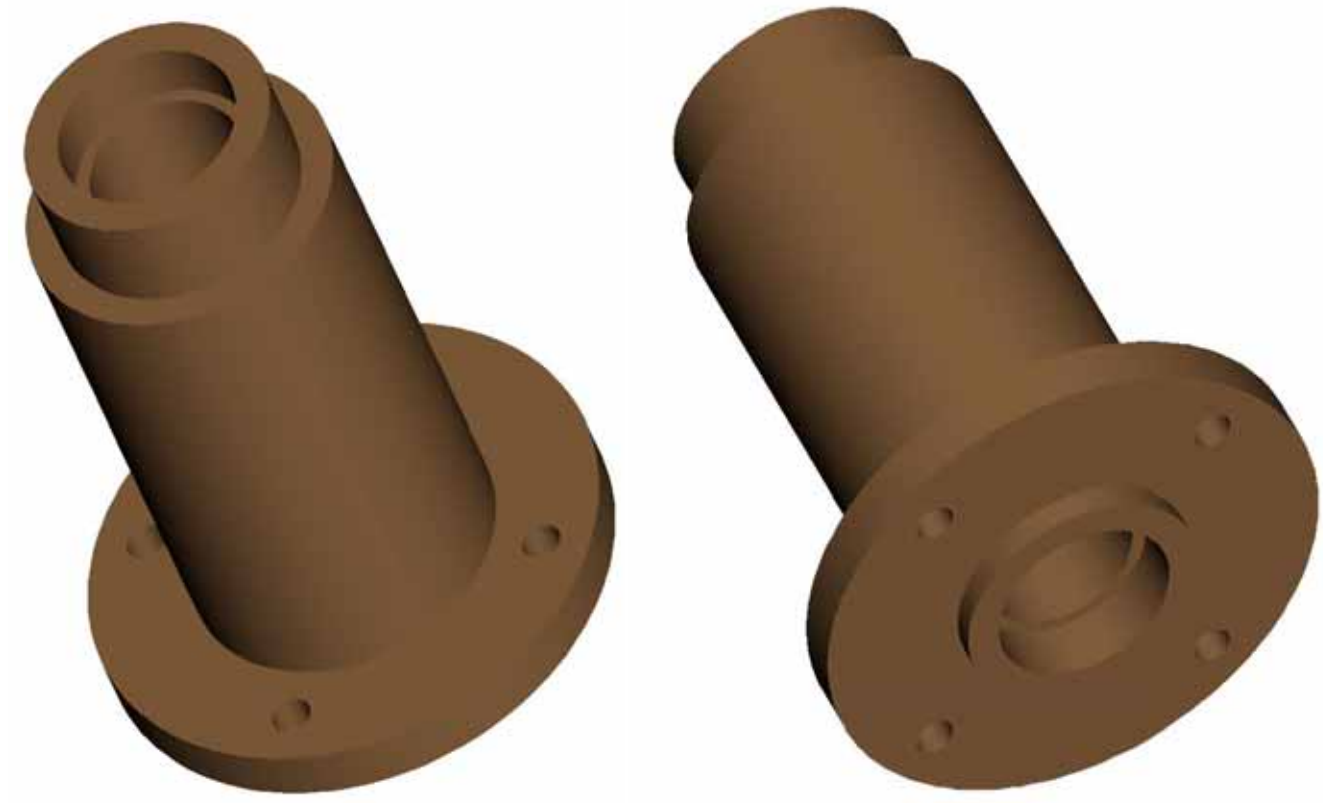
PART: M9456A02 Housing:

This is the main component of this engineering project. This component has two surfaces for ball bearings that have an LT1 fit and a "pilot" for interfacing with the Mounting Frame. Additionally, there is a cylindrical feature with an RC5 fit that holds the Lower Blade Guard, allowing it to rotate freely in the assembly.

Define the following geometric tolerances on the part as follows:
1) Identify Datum A as the bottom surface that mounts against the Mounting Frame.
2) Designate the ⌀.750 shaft hole as Datum B and apply a perpendicularity tolerance of .002, with a cylindrical tolerance zone shape, with respect to Datum A. Although this is a feature-of-size, do not use a material condition modifier.
3) Add a parallelism of .005, relative to Datum A, to the shoulder feature that the Lower Blade Guard sits on.
4) The ⌀1.180 ±.003 "pilot" feature needs a positional tolerance of .002 at MMC, with a cylindrical tolerance zone shape, with respect to Datum B at RFS.
5) The four mounting holes shall be specified with a positional tolerance of .010 at maximum material condition with respect to Datum A and Datum B. Remember, feature-of-size datum features need a material condition modifier.
6) Add a positional tolerance, with a cylindrical tolerance zone shape, of .0004 with respect to Datum B on the two bearing OD's.

The Housing is: 2.805 ±.002 between the bearing shoulders, has a major OD of 2.500 at the flange, the main body has an OD of 1.500, and the through hole for the Shaft (Datum B) is .750. Radially center (on the top face) the four mounting through holes on the flange. Counterbore the two ends to allow the bearings to be .004 below the surface at nominal and up to flush at MMC. The shoulder depth for the Lower Blade Guard is .495 ±.005 with a nominal diameter of 1.200. The height of the "pilot" shall be such as to leave .035 nominal clearance to the bottom of the pilot hole in the Mounting Frame. Break the outer edge of the "pilot." The thickness of the flange is .250. Show the overall height of the part as a reference dimension.

YOUR TASK: *Produce a drawing for this part that properly defines all the features. At a minimum include a full section front view, and an isometric view.*



PART: M9456A03 Shaft:

This component represents a threaded shaft onto which two ball bearings will be lightly pressed. The bearings have a measured ID of .378. Select a proper fit, and dimension the bearing journals accordingly per the nominal measured size of the bearings. The shaft will have provisions to locate the Lower and Upper Blade Holders along with a SST Washer and 3/8-24 SST Hex Nut. The threaded portion of the shaft shall be such as to prevent the Hex Nut from loosening when the shaft is turning in a clockwise direction as viewed from the top. The material for the shaft is 316L Stainless Steel and shall be passivated after machining.

Write a statement on your drawing (typed or legibly written) indicating the purpose of the passivation. (~25 words or less)

Define the following geometric tolerances on the part as follows:
1) Identify Datum A as the .500 OD.
2) Show a total runout of .001, relative to Datum A, on the 5/16 diameter on the coupler end.
3) Show a total runout of .0005, relative to Datum A, on the two bearing journals.

The Shaft has a major OD of .500. The distance and tolerances between the bearing shoulders are the same as the Housing. The threaded end of the shaft is 1.175 from tip to bearing shoulder with .590 of threaded area (including chamfers). The coupler end of the shaft is .636 long from tip to bearing shoulder and includes a 5/16 diameter with a .040 by .280 flat. Place a .010 maximum fillet between the bearing journals and related shoulder. Place a .100 wide relief between the threaded area and bearing journal, and make the diameter of it .020 less than the standard tap drill size for this thread. The length of the lower bearing journal shall be defined as a 3 place decimal. Determine that length such that the journal will never extend past the face of the bearing, and in that extreme condition, make the face of the journal and the end of the bearing flush with each other. Add chamfers where appropriate. Show the overall length of the shaft as a reference dimension.

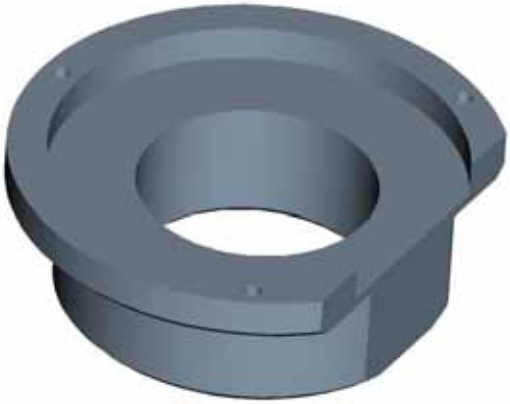
YOUR TASK: *Produce a fully dimensioned drawing for the Shaft as described. Use a minimum number of views to detail this component. Also include an isometric view.*

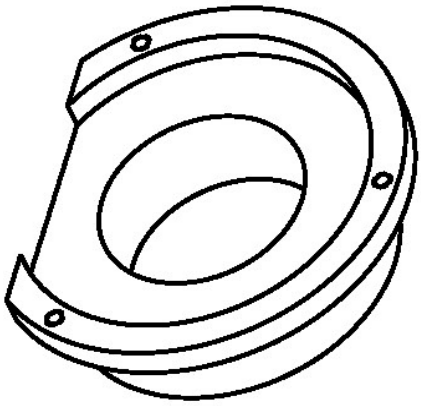
PART: M9456A04 Lower Blade Guard:

This item is the base component of the blade guard assembly and shall rotate freely (RC5 Fit) on the upper portion of the Housing. This Guard, when properly installed and assembled to the Upper Blade Guard, allows limited exposure to the rotating components when the Seam Saw is in operation. The two Blade Guards are held together by means of three #4-40 X 1/2" long SHCS.

The outer diameter is 2.500 (before flat feature) and the overall height is .800. The cavity for the Lower Blade Holder is .175 deep with a 1.050 radius, and the mounting flange is .250 thick. The minor OD is 1.960 before inclusion of the flat feature, which is created such that the blade is exposed by .100. There are three equally spaced tapped holes, radially centered on the top face of the flange, and centered relative to the flat side. Apply a 45 degree by .050 chamfer to the lower edge of the 2.500 diameter flange and to the lower inside and outside edges of the 1.960 feature, all before the flat feature is made.

YOUR TASK: *Produce a drawing of the Lower Blade Guard that includes a front sectional view and other appropriate views. Also include an isometric view.*



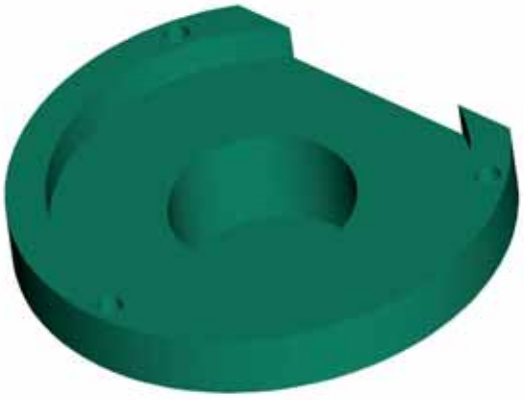


PART: M9456A05 Upper Blade Guard:

This item forms the top component of the blade guard assembly when assembled to the Lower Blade Guard and allows limited exposure to the rotating components when the Seam Saw is in operation.

Use the necessary features from the Lower Blade Guard to design this part including the following information: The overall height is .750, the flange thickness is .312, the recess for clearance of the Hex Nut is .940 in diameter by .660 deep as measured from the flange face, the outer diameter of the recessed feature is 1.250, and the cavity depth for clearance of the Upper Blade Holder is .180. There is a .060 radius on the outside edge of the 1.250 diameter.

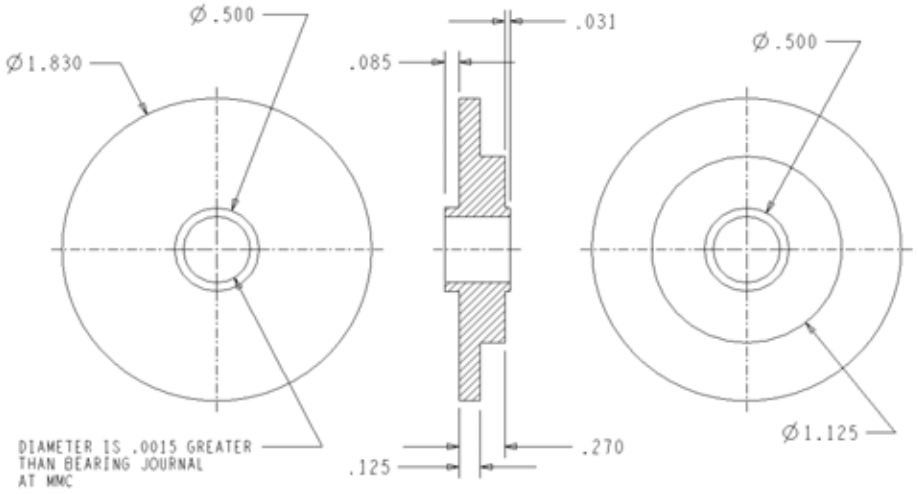
YOUR TASK: *Produce a drawing of the Lower Blade Guard that includes a front sectional view and other appropriate views. Also include an isometric view.*



PART: M9456A06 Lower Blade Holder:

This component, in combination with the Upper Blade Holder, provides support for the Thurston Jewelers Slotting Saw Blade and acts as a depth gauge to prevent the blade from penetrating the welded seam too deeply, which could cause unintentional damage to internal components of the medical device. For this contest you only need to show this simplified version – no detail drawing required.

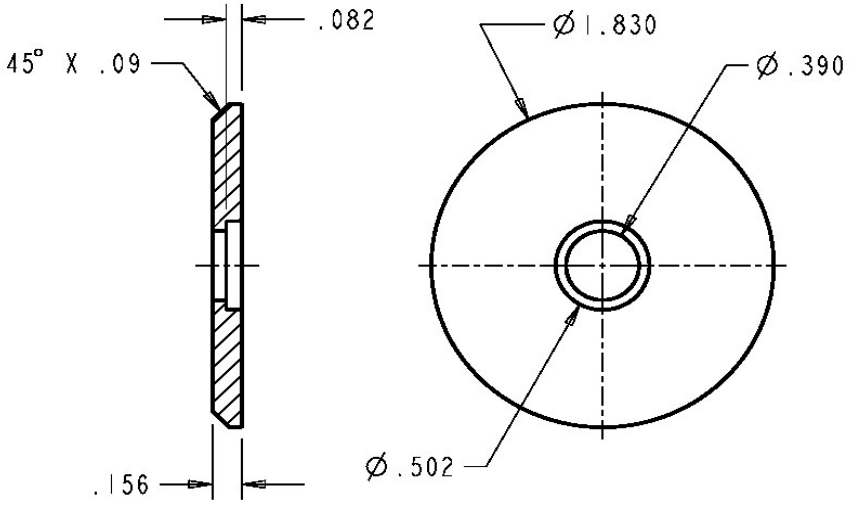
YOUR TASK: *Create this part per the provided dimensions and show this component in all related assembly views and in the BOM.*



PART: M9456A07 Upper Blade Holder:

This component, in combination with the Lower Blade Holder, provides support for the Thurston Jewelers Slotting Saw Blade. It has clearance for the location shoulder on the Lower Blade Holder as well as for the Shaft. It is held firmly in place by a Washer and Hex Nut. For this contest you only need to show this simplified version – no detail drawing required.

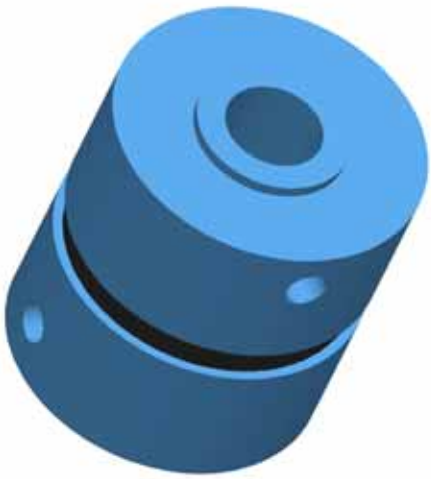
YOUR TASK: *Create this part per the provided dimensions and show this component in all related assembly views and in the BOM.*



PART: Coupler Hub Assembly - Alter:

This assembly is made up of purchased components from McMaster-Carr. The High-Offset Slotted-Disc Shaft Coupling is comprised of two coupling hubs and a coupling disc. For this application select the Set-Screw Coupling Hub and the correct Acetal Coupling Disc. Specify both the part number for the Coupling Hubs and the Coupling Disc in the BOM.

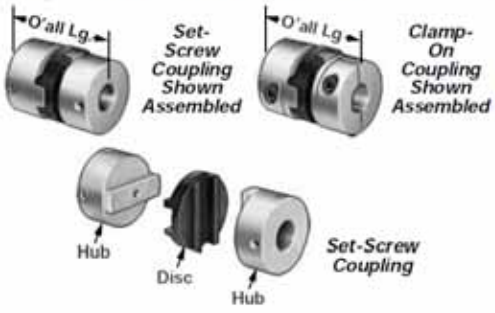
YOUR TASK: *Select the correct Coupling Hub from the available bore sizes that will fit the OD of both the Seam Saw assembly Shaft and Gearbox shaft, and fit within the available space. Alter one of the Coupling Hubs by adding a .040 step with a .490 OD to allow the hub to be installed against the inner race of the lower Ball Bearing. Properly indentify this hub, the other Hub, and the Coupling Disc in the BOM. No detail drawing required – show a simplified version of the altered Coupler Hub assembly (including the Coupling Disc) in all related assembly views and in the BOM.*



Flexible Shaft Couplings

For information about couplings and ANSI keyway dimensions, see page 1160.

High-Offset Slotted-Disc Shaft Couplings



Also known as Oldham couplings, these couplings have a slotted disc that allows hubs to slide independently to compensate for parallel misalignment. They allow zero backlash (no play) and never need lubrication. Maximum rpm is 4500. For a complete coupling, you need to order two hubs and one disc from the same line in the listing below (for example, 59985K1 hubs are designed to work with either 59985K61 or 59985K91 discs).

Set-screw couplings connect to shafts with two or four alloy steel set screws. ***Clamp-on couplings*** connect to shafts via integral shaft collars, which won't damage your shaft. Tighten the two alloy steel socket-head cap screws to secure.

Hubs—Made of lightweight, corrosion-resistant anodized aluminum, the hubs easily slide out of the disc for quick assembly and disassembly. **To Order:** Please specify bore size from those available below. *Note:* You can use two hubs with different bore sizes in one coupling as long as the hub ODs are the same.

Acetal Discs—Stand up to high twisting forces. Temp. range is –10° to +150° F.

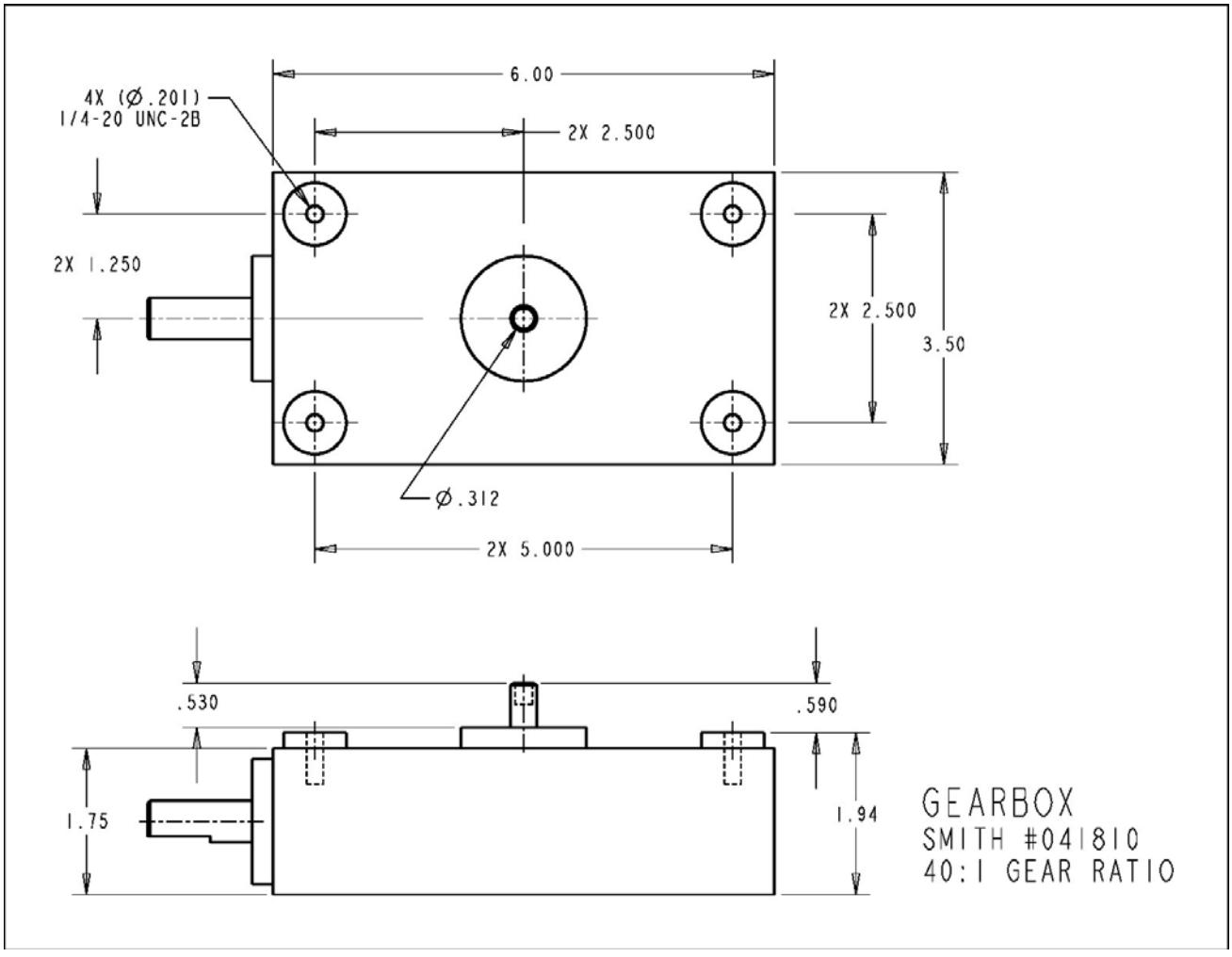
Nylon Discs—Have excellent vibration and shock absorption. Temp. range is –10° to +130° F.

COUPLING HUBS							COUPLING DISCS							
							Maximum Misalignment			Acetal Discs			Nylon Discs	
Available Bore Sizes	O'all Lg.	Hub OD	Bore Depth	Screw Size		Each	Parallel	Angular	Axial	Peak Torque, in.-lbs.		Each	Peak Torque, in.-lbs.	Each
Set-Screw Couplings														
1/8", 3/16", 1/4"	5/8"	1/2"	0.22"	M3	59985K1	$7.50	0.004"	0.5°	0.002"	34	59985K61	$1.81	25	59985K91 $2.42
3/16", 1/4", 5/16", 3/8"	7/8"	3/4"	0.30"	M3	59985K2	9.27	0.008"	0.5°	0.004"	93	59985K62	2.16	85	59985K92 3.35
1/4", 5/16", 3/8", 1/2"	1 1/8"	1"	0.39"	M4	59985K3	10.81	0.008"	0.5°	0.004"	168	59985K63	3.99	140	59985K93 4.85
5/16", 3/8", 1/2", 5/8"	1 7/8"	1 5/16"	0.59"	M4	59985K4	16.28	0.008"	0.5°	0.006"	350	59985K64	5.80	300	59985K94 7.13
3/8", 1/2", 5/8", 3/4"	2"	1 5/8"	0.71"	M5	59985K5	19.25	0.010"	0.5°	0.006"	480	59985K65	7.71	400	59985K95 10.55
Clamp-On Couplings														
3/16", 1/4", 5/16", 3/8"	1"	3/4"	0.38"	M2.5	9889T1	10.64	0.008"	0.5°	0.004"	93	59985K62	2.16	85	59985K92 3.35
1/4", 5/16", 3/8", 1/2"	1 1/4"	1"	0.467"	M3	9889T2	14.63	0.008"	0.5°	0.004"	168	59985K63	3.99	140	59985K93 4.85
5/16", 3/8", 1/2", 5/8"	1 7/8"	1 5/16"	0.59"	M3	9889T3	21.60	0.008"	0.5°	0.006"	350	59985K64	5.80	300	59985K94 7.13
3/8", 1/2", 5/8", 3/4"	2"	1 5/8"	0.71"	M4	9889T4	23.43	0.010"	0.5°	0.006"	480	59985K65	7.71	400	59985K95 10.55

GEARBOX:

This component is provided by the customer and it drives the Seam Saw assembly.

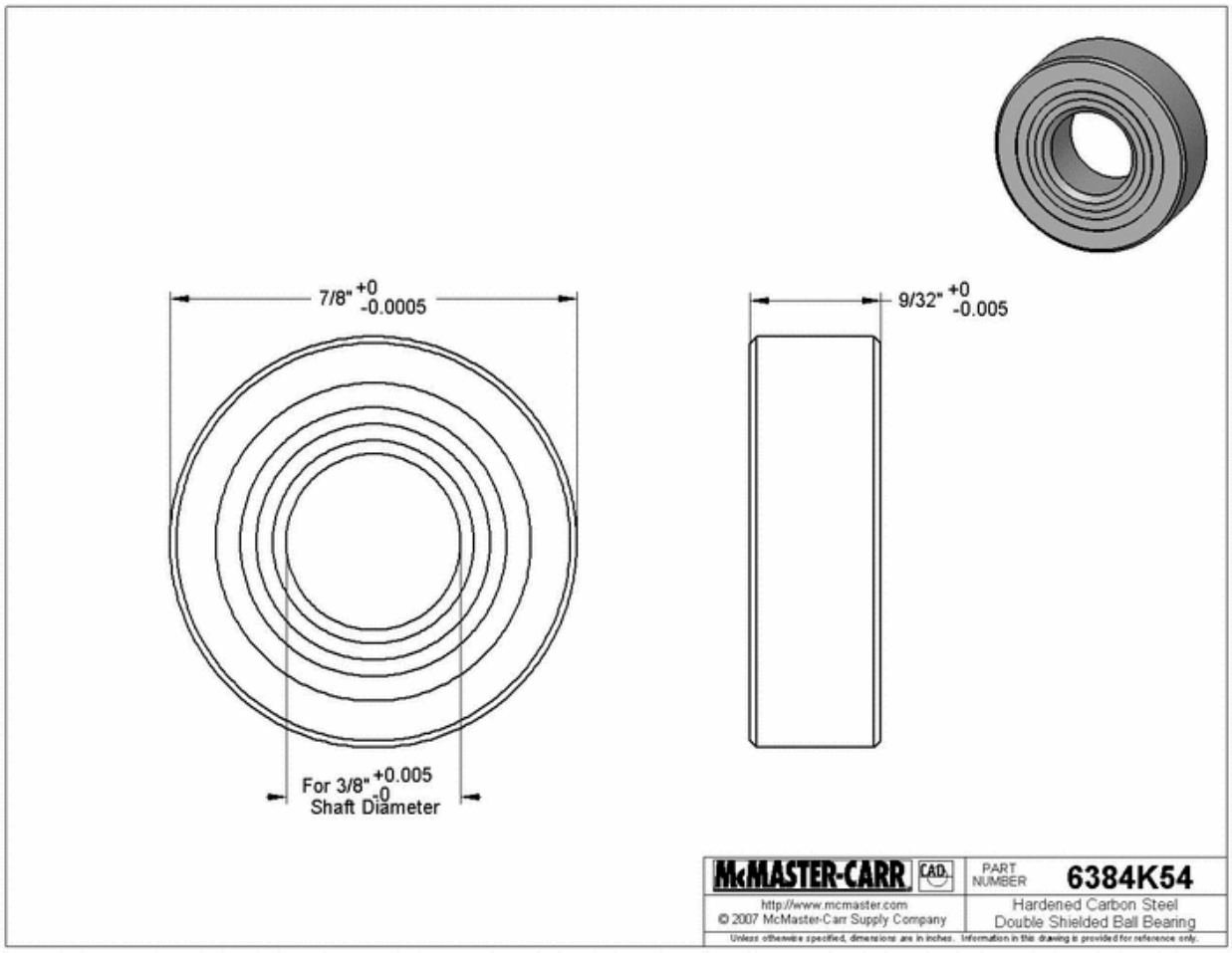
YOUR TASK: *Review the supplied Specification Control Drawing for the SMITH #041810 Gearbox and apply the necessary information to the Mounting Frame and the Coupler Hub selection.*

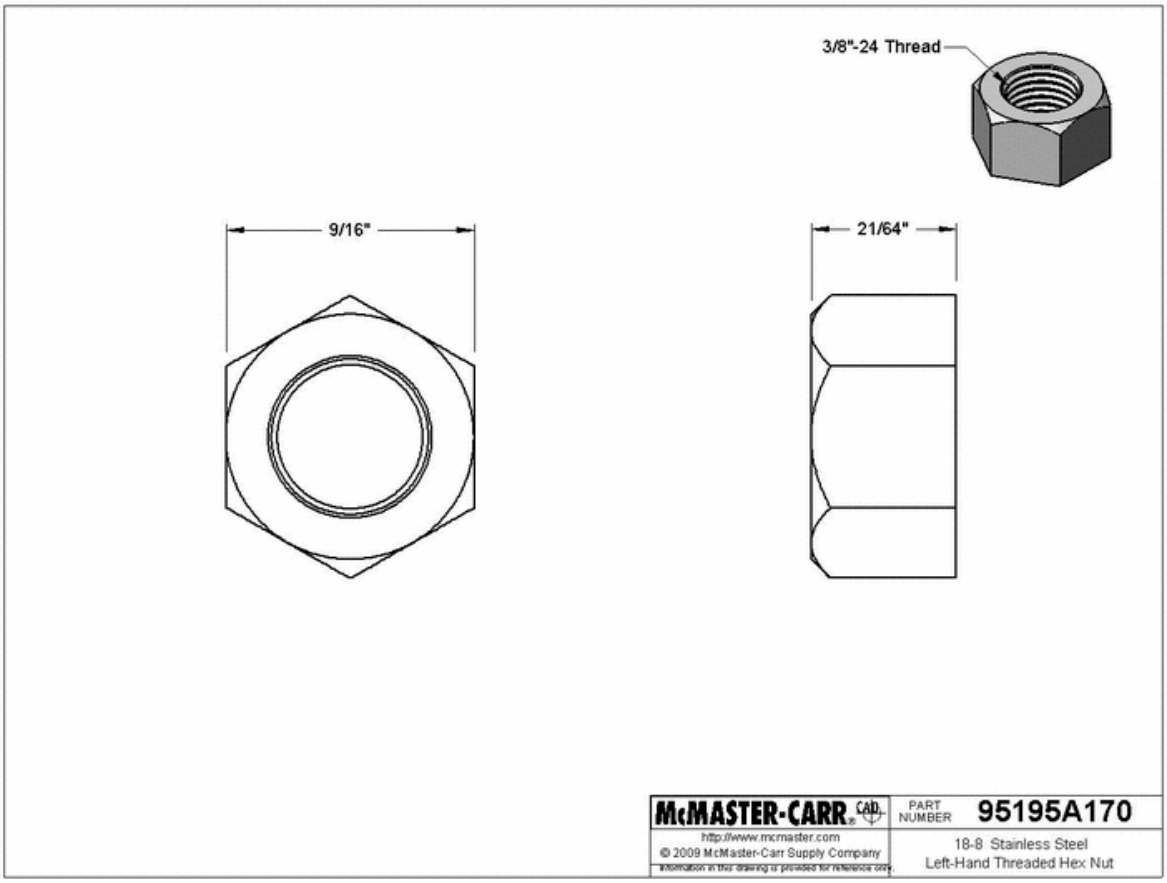


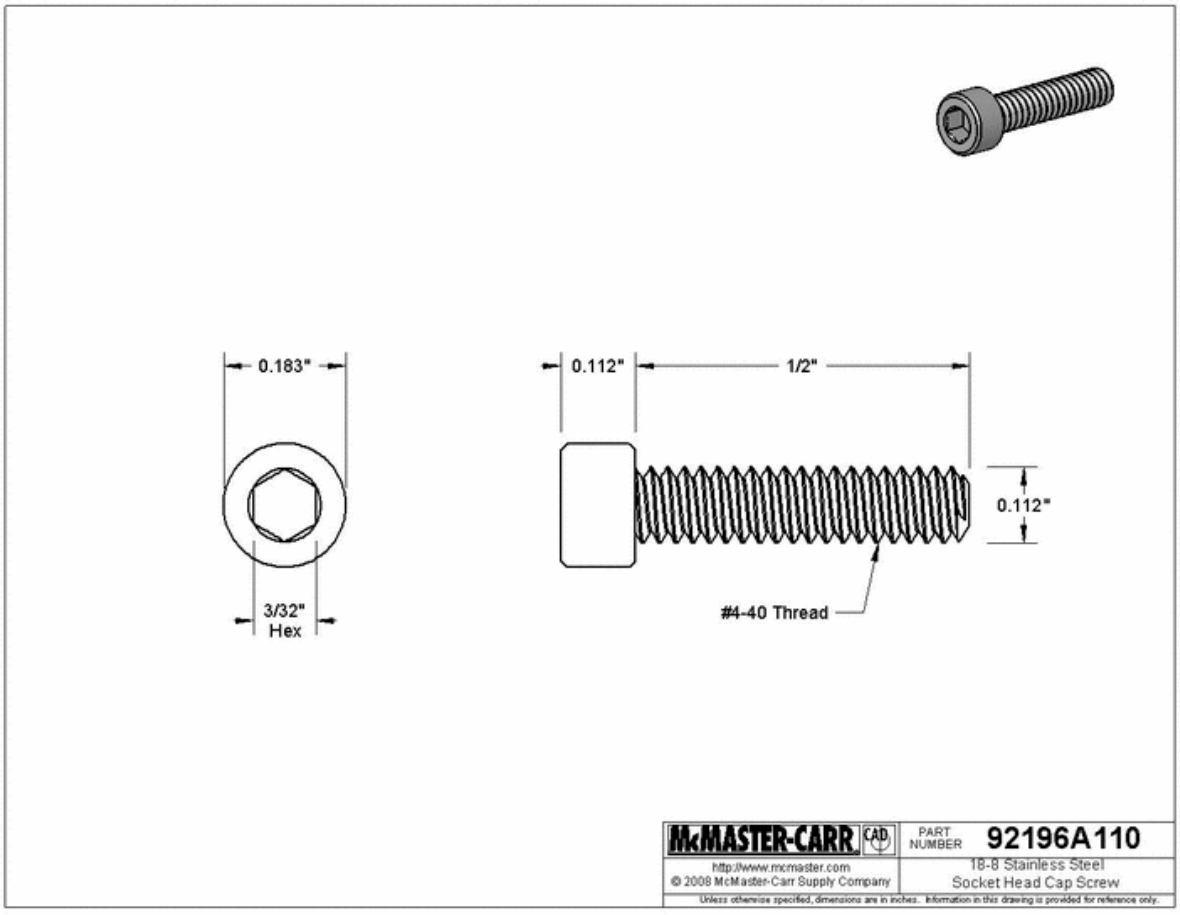
HARDWARE: Simplified Form:

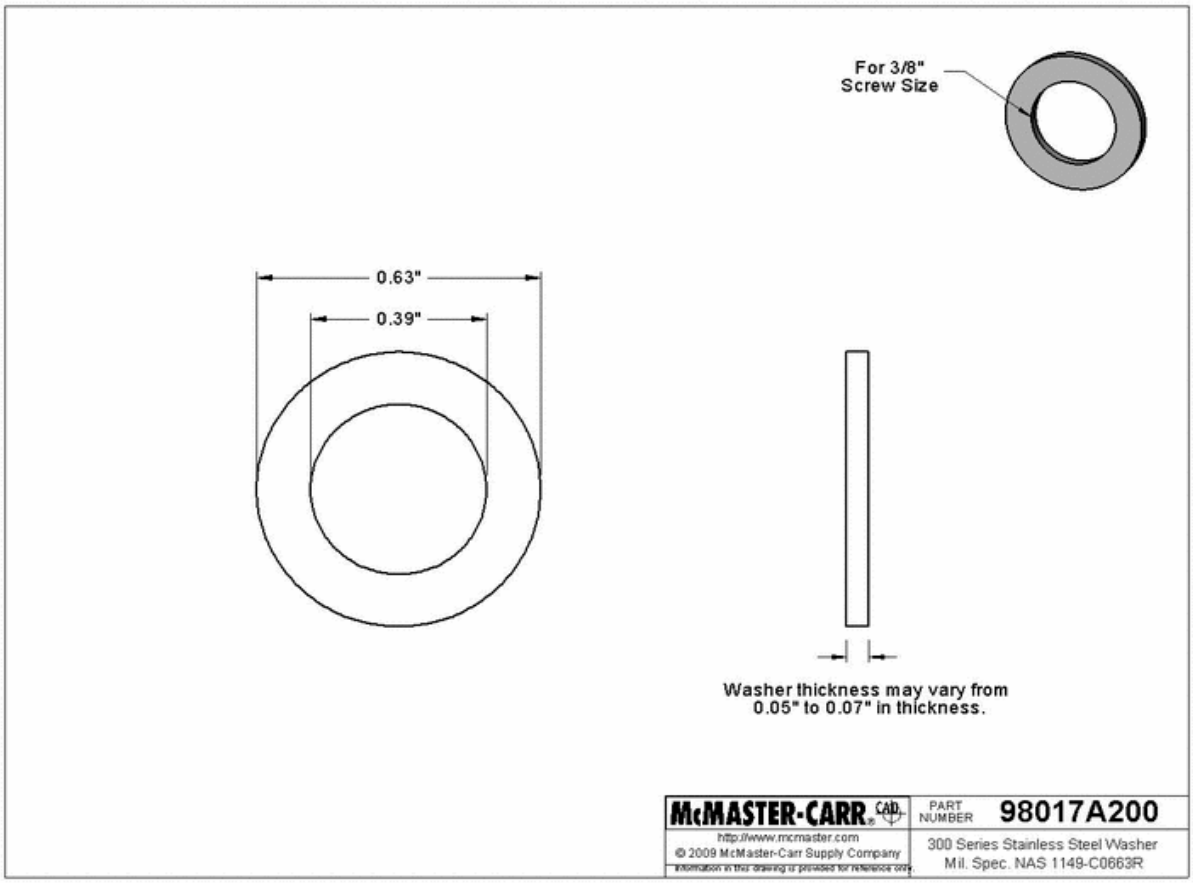
All assembly hardware is to be ordered from McMaster-Carr. See the provided Cut-Sheets for each item.

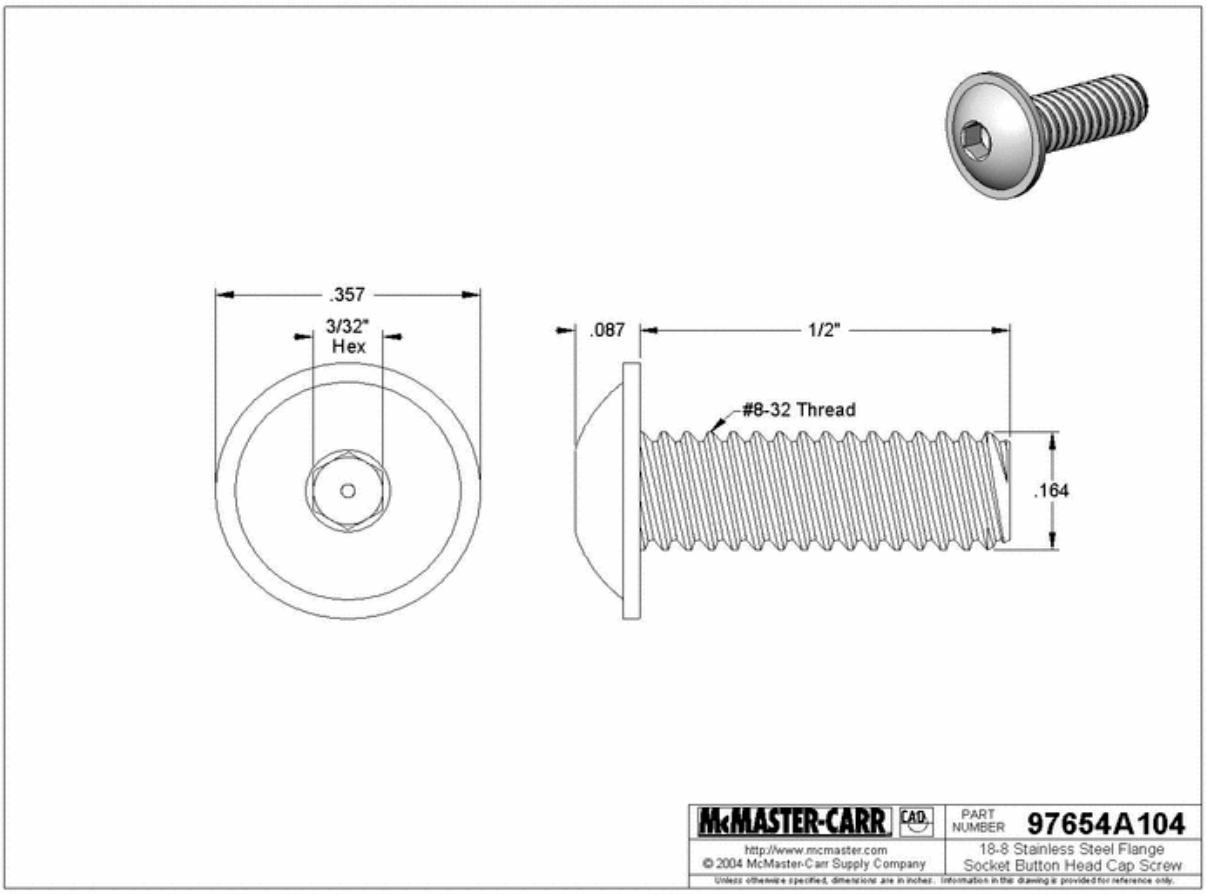
YOUR TASK: *Produce a simplified representation of all hardware to be used in the final assembly. Properly identify hardware in the BOM and on the assembly drawing.*

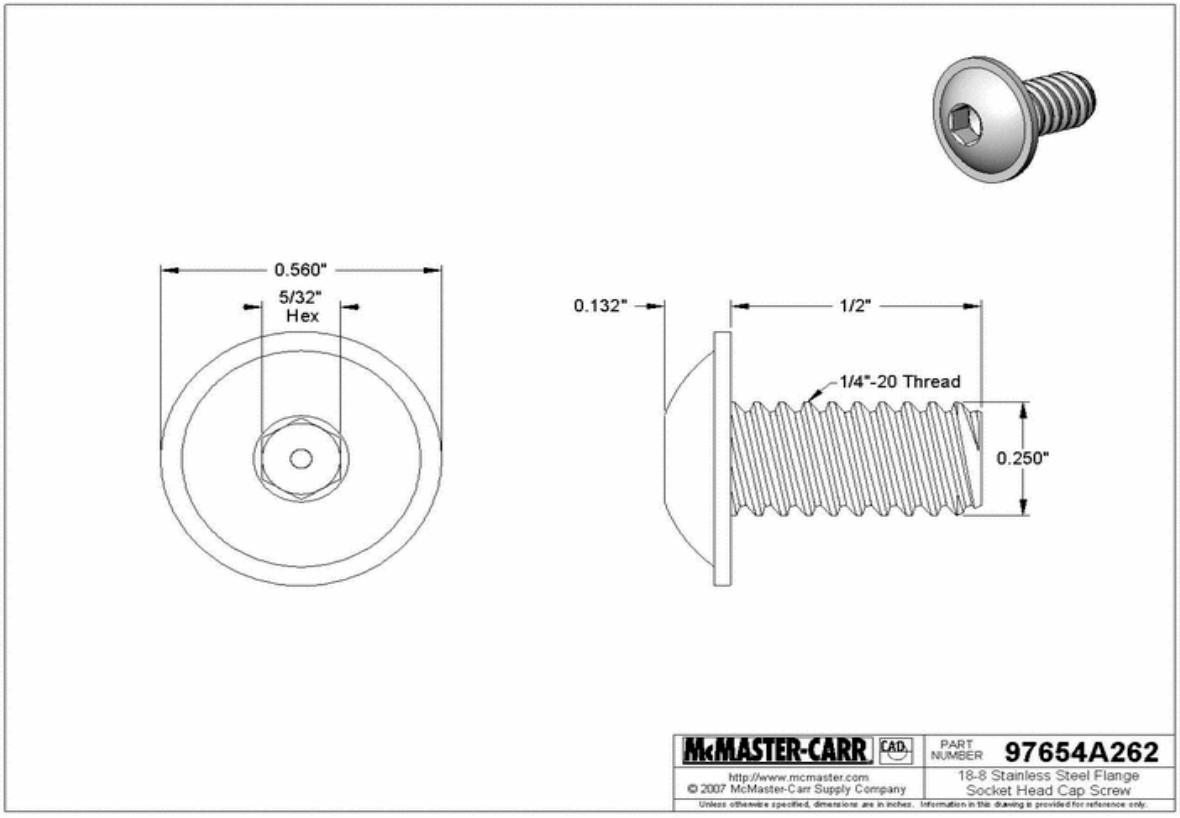



3/8"-24 Thread
9/16"
21/64"
McMASTER-CARR CAD
PART NUMBER 95195A170
http://www.mcmaster.com
© 2009 McMaster-Carr Supply Company
Information in this drawing is provided for reference only.
18-8 Stainless Steel
Left-Hand Threaded Hex Nut


0.183"
3/32"
Hex
0.112"
1/2"
0.112"
#4-40 Thread
McMASTER-CARR CAD
PART NUMBER 92196A110
http://www.mcmaster.com
© 2008 McMaster-Carr Supply Company
18-8 Stainless Steel
Socket Head Cap Screw
Unless otherwise specified, dimensions are in inches. Information in this drawing is provided for reference only.


For 3/8"
Screw Size
0.63"
0.39"
Washer thickness may vary from
0.05" to 0.07" in thickness.
McMASTER-CARR
CAD
http://www.mcmaster.com
© 2009 McMaster-Carr Supply Company
PART NUMBER 98017A200
300 Series Stainless Steel Washer
Mil. Spec. NAS 1149-C0663R


.357
3/32"
Hex
.087
1/2"
#8-32 Thread
.164
McMASTER-CARR
CAD
http://www.mcmaster.com
© 2004 McMaster-Carr Supply Company
PART NUMBER 97654A104
18-8 Stainless Steel Flange
Socket Button Head Cap Screw



Thurston Jewelers Slotting Saws

M-2 Grade High Speed Steel

Designed for slotting thin materials, requiring light, delicate cuts such as wire, thin tubing, or similar profiles.

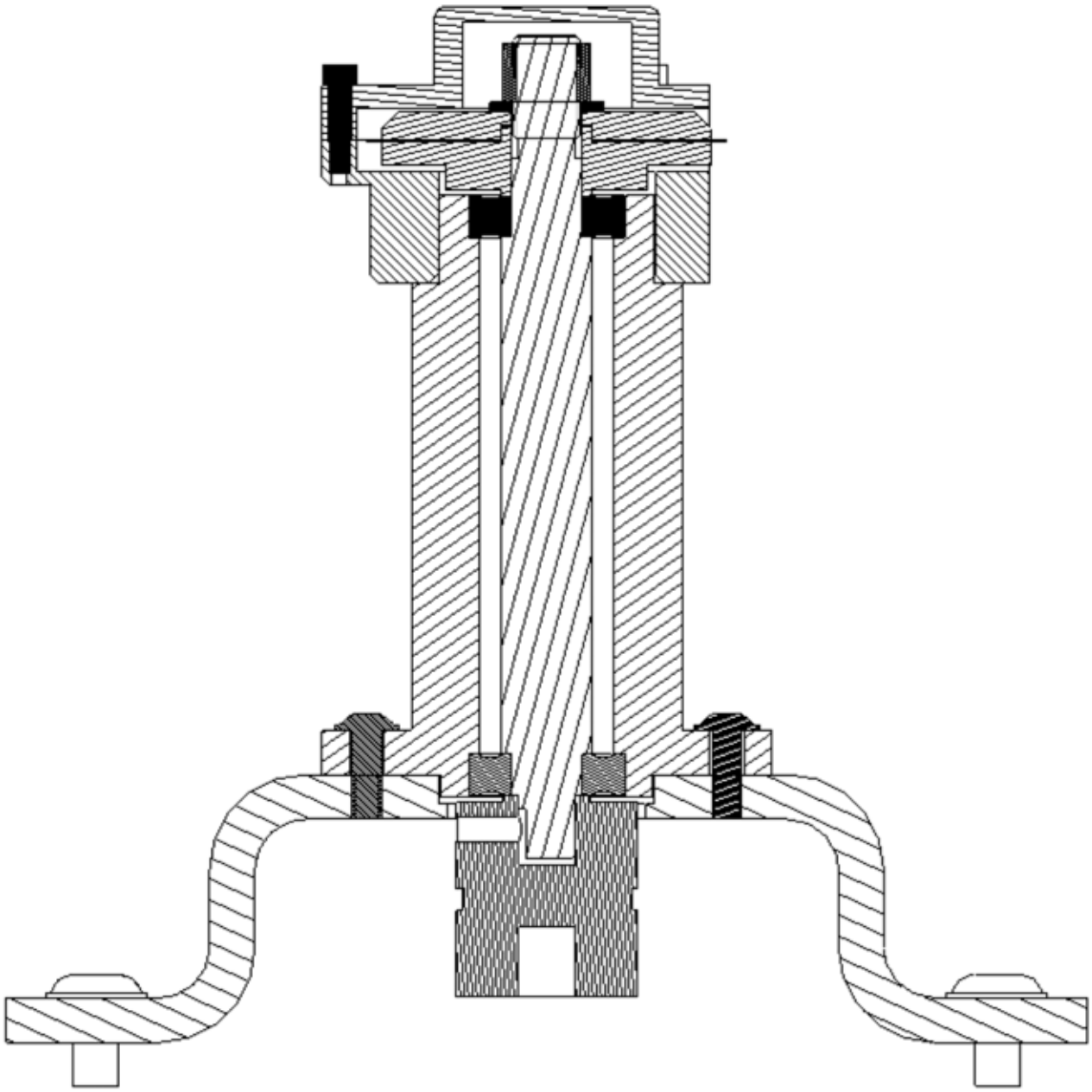
Ground tooth profile.

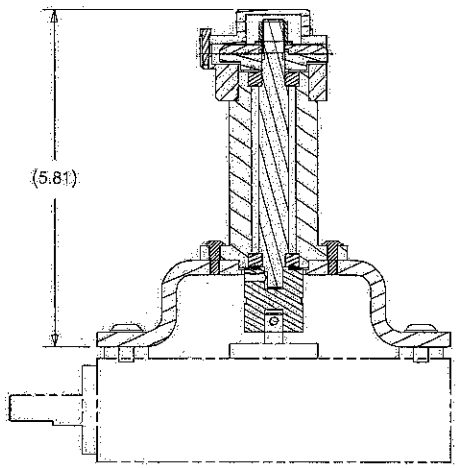
Concave ground sides insure proper side relief.

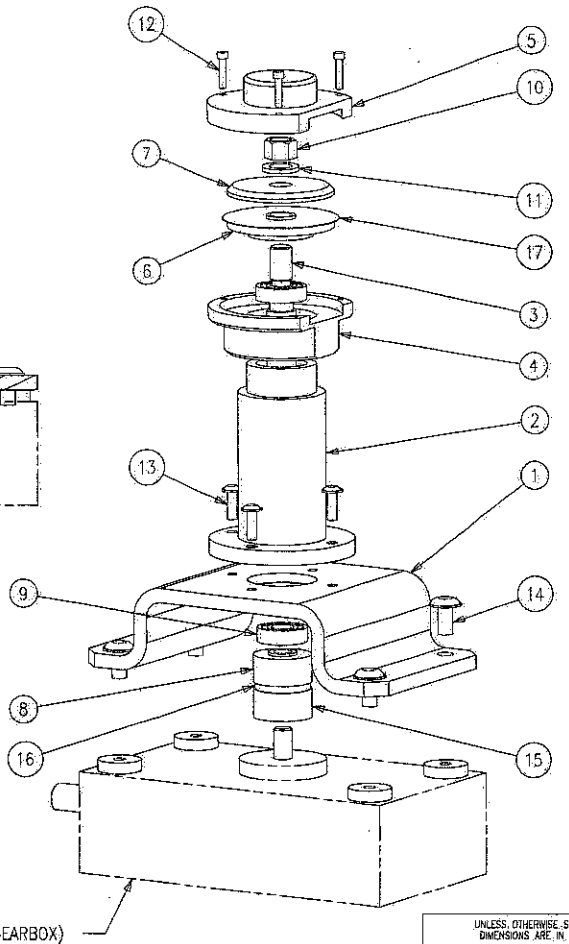
All blades individually straightened.

CATALOG NO.	DIAMETER	THICKNESS	SIZE OF HOLE	NO. TEE INCH
65CC	2	.012	3/8	30 TPI
65	2	.012	1/2	30 TPI

Full section view for reference







(SMITH #041810 GEARBOX)

JUDGES: If Gearbox is shown then a reference note, as shown, should be present.

JUDGE REFERENCE ONLY

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ITEM NO.	QTY	PART NO.	DESCRIPTION
17	1	THURSTON #65	JEWELERS SAW BLADE
16	1	MCMASTER 59985K63	COUPLING DISC - ACETAL
15	1	MCMASTER 59985K3-5/16	COUPLING HUB
14	4	MCMASTER 97654A262	1/4-20 X 1/2 LG BHSCS
13	4	MCMASTER 97654A104	#8-32 X 1/2 LG BHSCS
12	3	MCMASTER 92196A110	#4-40 X 1/2 LG SHCS
11	1	MCMASTER 98017A200	WASHER - SST
10	1	MCMASTER 95195A170	3/8-24 LH HEX NUT
9	2	MCMASTER 5972K164	BALL BEARING, STEEL
8	1	M9456A08	COUPLING HUB - ALTER
7	1	M9456A07	UPPER BLADE HOLDER
6	1	M9456A06	LOWER BLADE HOLDER
5	1	M9456A05	UPPER BLADE GUARD
4	1	M9456A04	LOWER BLADE GUARD
3	1	M9456A03	SHAFT
2	1	M9456A02	HOUSING
1	1	M9456A01	MOUNTING FRAME

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE: FRACTIONS ± 1/16, DECIMAL .XX ± .03, .XXX ± .004, ANGLE ± 1°

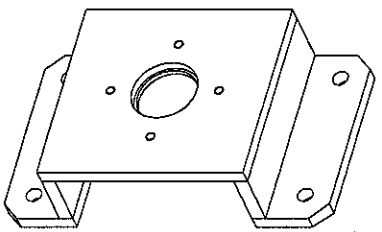
SkillsUSA
LEESBURG, VA

WEIGHT: 1.87 #
MATERIAL: NA
SCALE: 1:2
SHT NO.: 1/1
DWG NO.: M9456A00

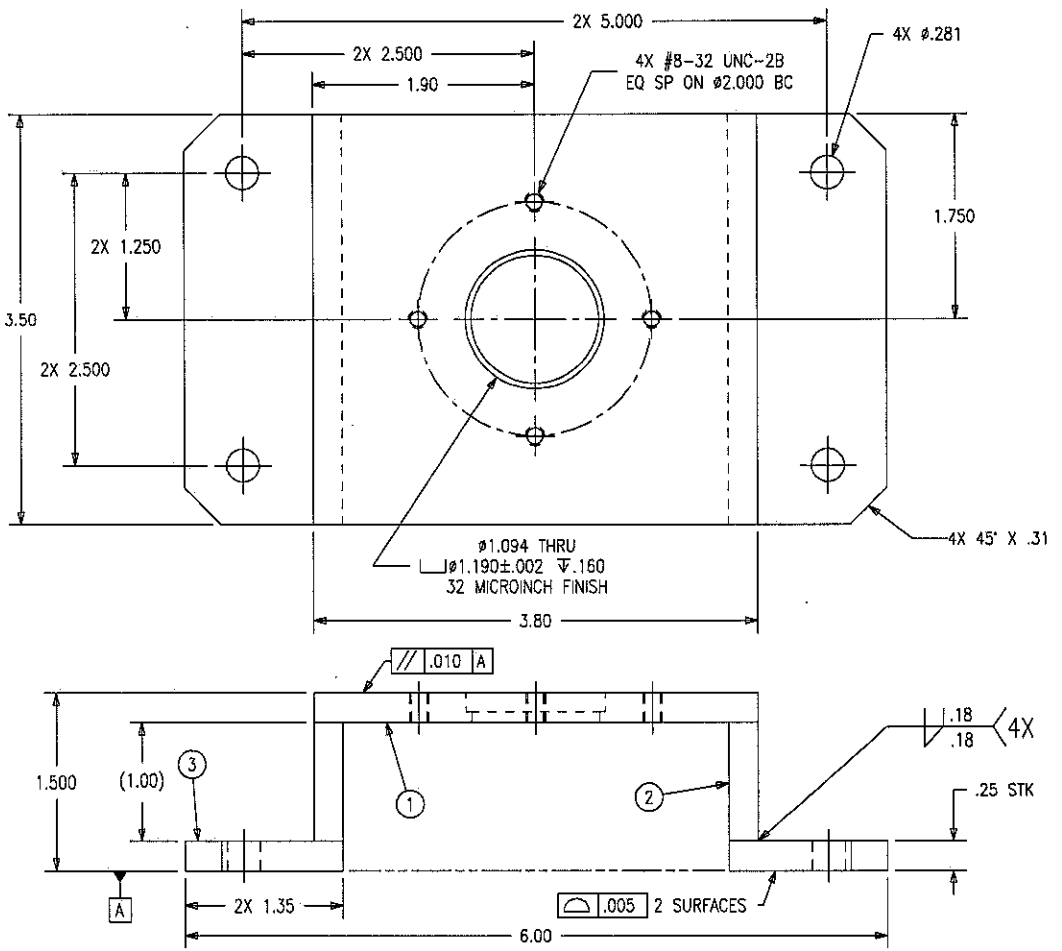
DRAWING NAME: SEAM SAW ASSEMBLY
CONTESTANT #: 000
CONTESTANT INITIALS: XYZ

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. BREAK EDGES AND CORNERS
2. FINISH: 63 MICROINCHES OR BETTER
3. HARD BLACK ANODIZE .0010 THK PER MIL-A-8625, TYPE III, CLASS 2

Purpose of counterbore note.



SCALE 1:2



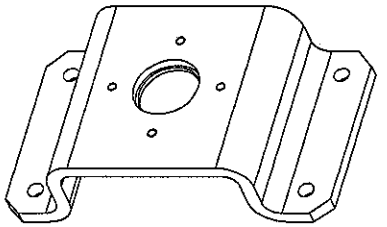
ITEM	QTY	DESCRIPTION
3	2	MOUNTING TAB
2	2	SIDE
1	1	TOP

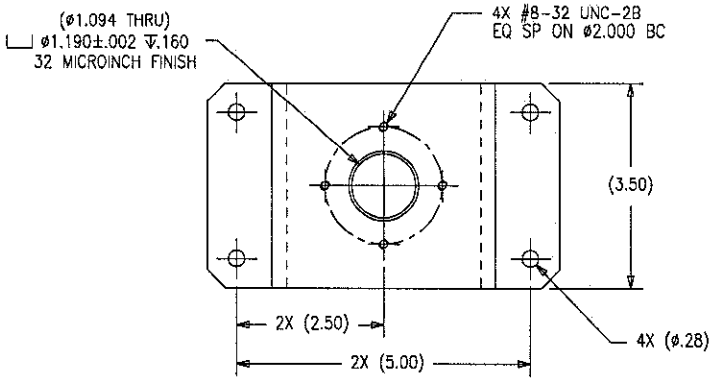
JUDGE REFERENCE ONLY

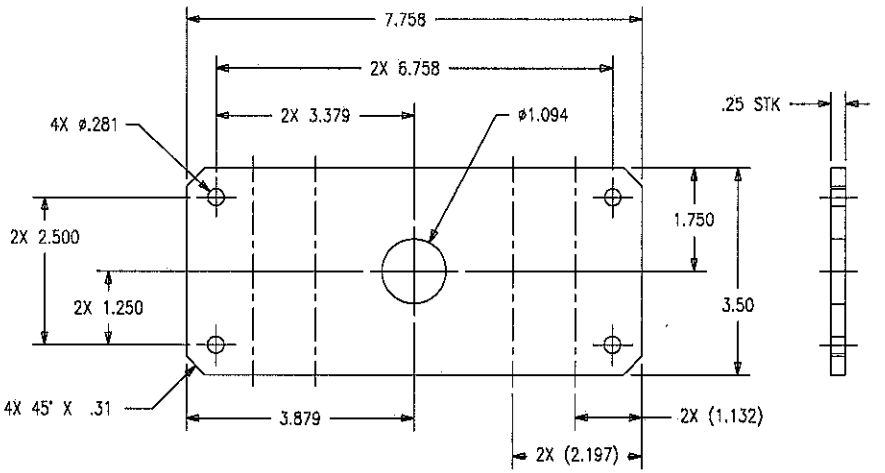
000

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/16, DECIMAL .XX ± .03 .XXX ± .004, ANGLE ± 1°	WEIGHT: 0.69 #	DRAWING NAME: MOUNTING FRAME
	MATERIAL: ALUM 5052 H32	
SkillsUSA LEESBURG, VA	SCALE: 1:1 SHT NO.: 1/1	CONTESTANT #: 000
	DWG NO.: M9456A01	CONTESTANT INITIALS: XYZ

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. BREAK EDGES AND CORNERS
2. FINISH: 63 MICROINCHES OR BETTER
3. BEND K-FACTOR: .47
4. HARD BLACK ANODIZE .0010 THK PER MIL-A-8625, TYPE III, CLASS 2







LASER CUT FLAT PATTERN

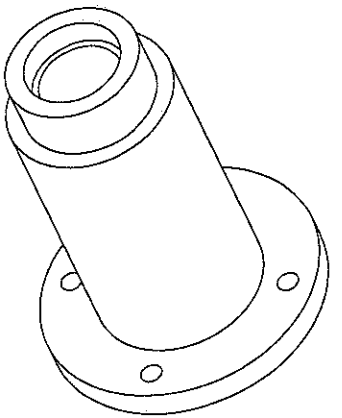
Purpose of counterbore note.

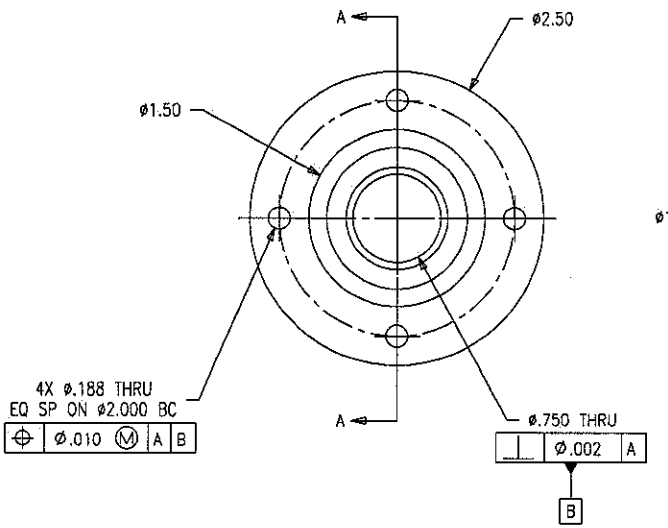
JUDGE REFERENCE ONLY

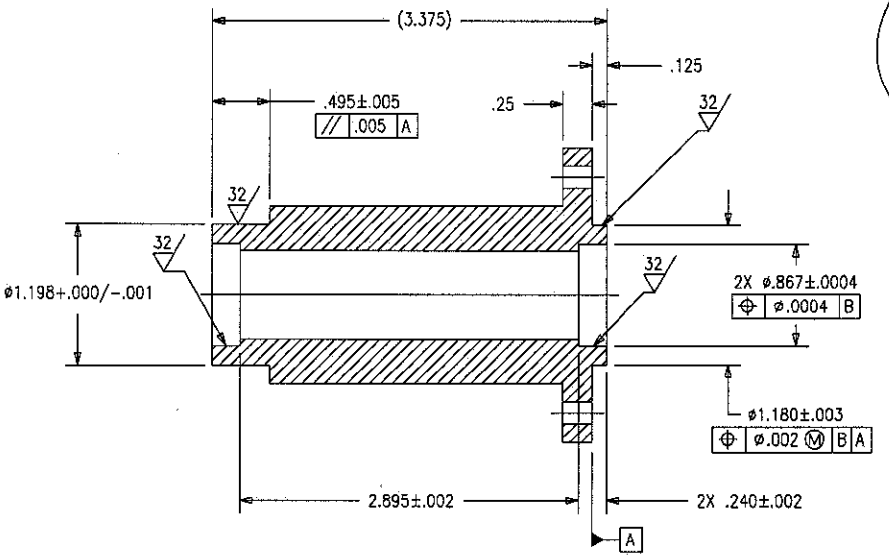
000

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/16, DECIMAL .XX ± .03, .XXX ± .004, ANGLE ± 1°	WEIGHT: 0.63 #		DRAWING NAME: MOUNTING FRAME
	MATERIAL: ALUM 5052 H32		
SkillsUSA LEESBURG, VA	SCALE: 1:2	SHT NO.: 1/1	CONTESTANT #: 000
	DWG NO.: M9456A01		CONTESTANT INITIALS: XYZ

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. BREAK EDGES AND CORNERS
2. FINISH: 63 MICROINCHES OR BETTER
3. HARD BLACK ANODIZE .0010 THK PER MIL-A-8625, TYPE III, CLASS 2







SECTION A-A

JUDGE REFERENCE ONLY

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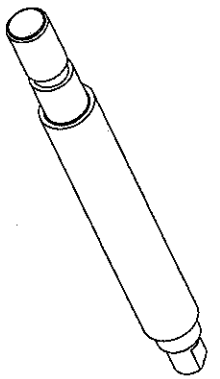
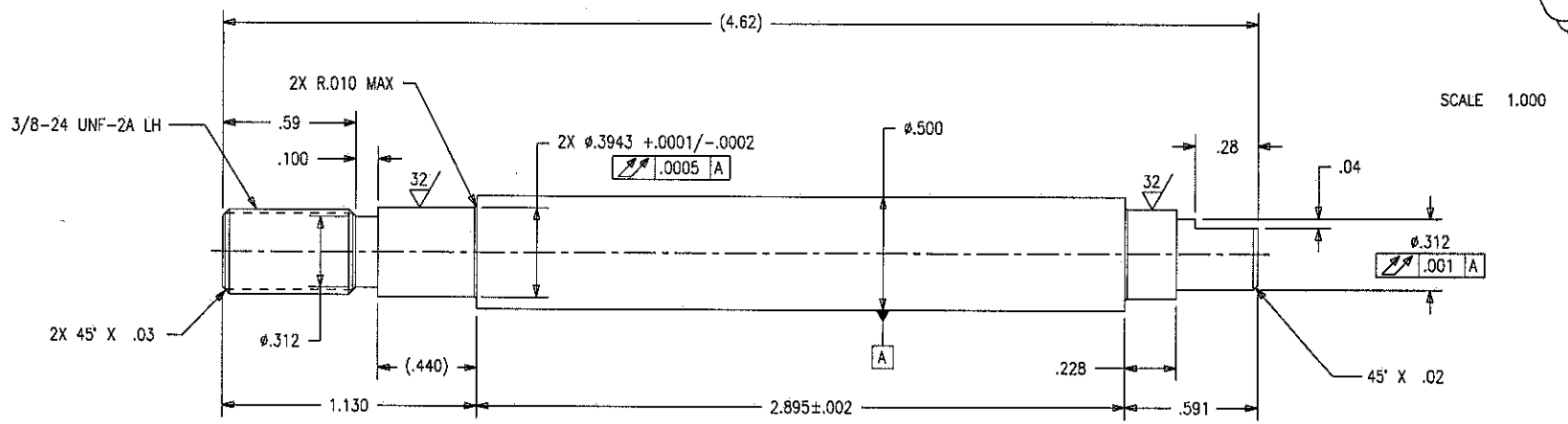
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/16, DECIMAL .XX ± .03, .XXX ± .004, ANGLE ± 1°	WEIGHT: 0.46 #		DRAWING NAME: HOUSING
	MATERIAL: ALUM 6061 T6		
SkillsUSA LEESBURG, VA	SCALE: 1:1	SHT NO.: 1/1	CONTESTANT #: 000
	DWG NO.: M9456A02		CONTESTANT INITIALS: XYZ

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. BREAK EDGES AND CORNERS
2. FINISH: 63 MICROINCHES OR BETTER
3. PASSIVATE

Purpose of Passivation note.



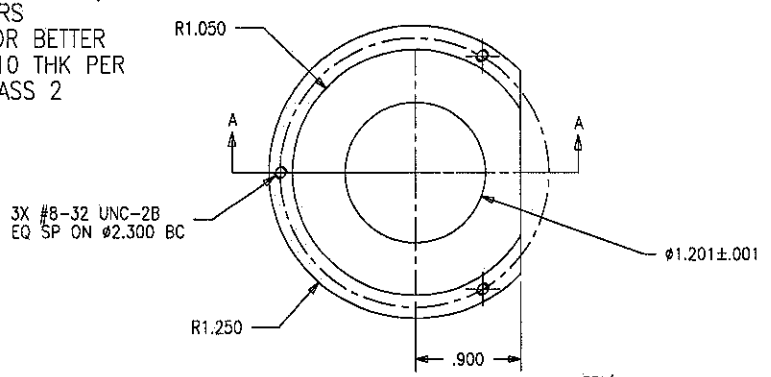


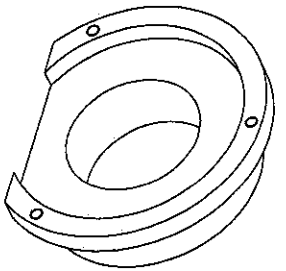
JUDGE REFERENCE ONLY

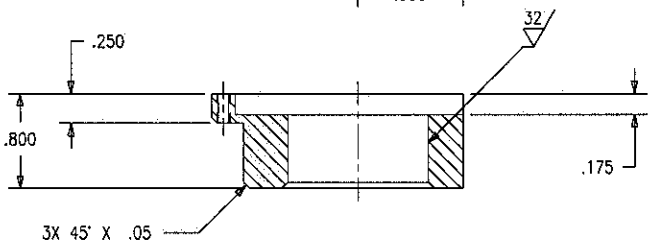
000

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± 1/16 DECIMAL .XX ± .03 .XXX ± .004 ANGLE ± 1°	WEIGHT: 0.22 #		DRAWING NAME: SHAFT
	MATERIAL: 316 L SST		
SkillsUSA LEESBURG, VA	SCALE: 2:1	SHT NO.: 1/1	CONTESTANT #: 000
	DWG NO.: M9456A03		CONTESTANT INITIALS: XYZ

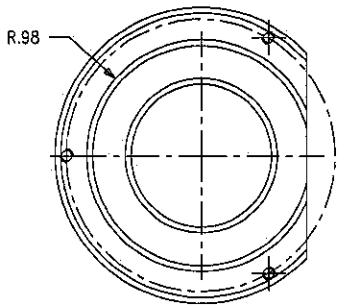
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. BREAK EDGES AND CORNERS
2. FINISH: 63 MICROINCHES OR BETTER
3. HARD BLACK ANODIZE .0010 THK PER MIL-A-8625, TYPE III, CLASS 2







SECTION A-A

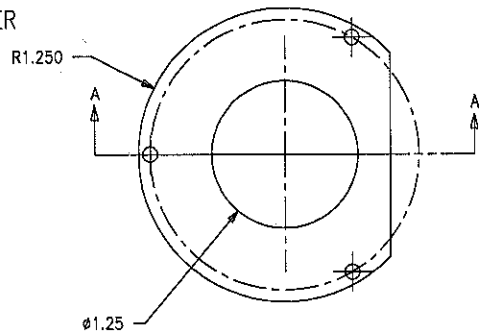


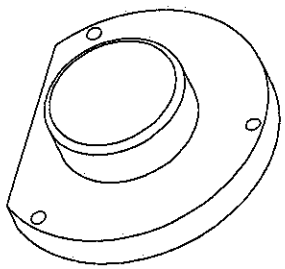
JUDGE REFERENCE ONLY

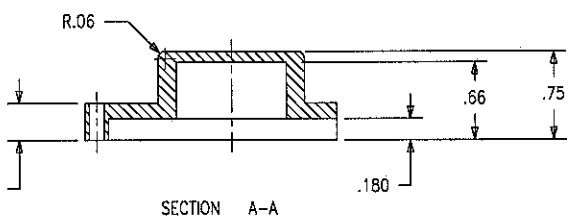
000

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± 1/16 DECIMAL .XX ± .03 .XXX ± .004 ANGLE ± 1°	WEIGHT: 0.14 #		DRAWING NAME: LOWER BLADE GUARD
	MATERIAL: ALUM 6061 T6		
SkillsUSA LEESBURG, VA	SCALE: 1:1	SHT NO.: 1/1	CONTESTANT #: 000
	DWG NO.: M9456A04		CONTESTANT INITIALS: XYZ

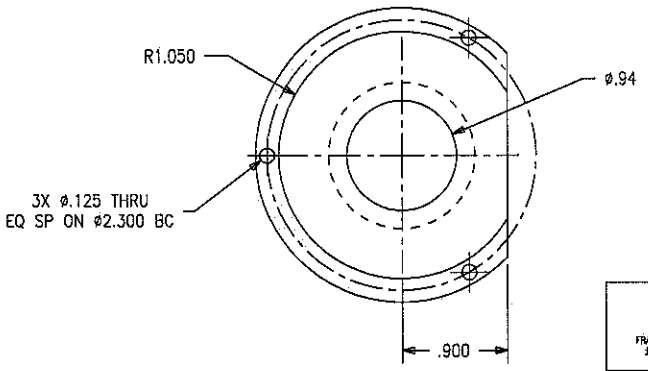
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. BREAK EDGES AND CORNERS
2. FINISH: 63 MICROINCHES OR BETTER
3. HARD BLACK ANODIZE .0010 THK PER MIL-A-8625, TYPE III, CLASS 2







SECTION A-A



JUDGE REFERENCE ONLY

000

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± 1/16 DECIMAL .XX ± .03 .XXX ± .004 ANGLE ± 1°	WEIGHT: 0.10 #		DRAWING NAME: UPPER BLADE GUARD
	MATERIAL: ALUM 6061 T6		
SkillsUSA LEESBURG, VA	SCALE: 1:1	SHT NO.: 1/1	CONTESTANT #: 000
	DWG NO.: M9456A05		CONTESTANT INITIALS: XYZ

	Skills Area			Max Points
Seam Saw Assy M9456A00				
PN# M9456A00	Views	2	VW	12
PN# M9456A00	Dimensioning	1	DIM	10
PN# M9456A00	Weld Symbols/BOM		W/B	68
PN# M9456A00	GD&T		GDT	17
PN# M9456A00	Title Block Data		TB	18
PN# M9456A00	Neatness/Quality		NQ	20
Mounting Frame M9456A01				
PN# M9456A01	Views	4	VW	24
PN# M9456A01	Dimensioning	24	DIM	96
PN# M9456A01	Weld Symbols/BOM		W/B	34
PN# M9456A01	GD&T	2	GDT	12
PN# M9456A01	Title Block Data		TB	18
PN# M9456A01	Neatness/Quality		NQ	20
Housing M9456A02				
PN# M9456A02	Views	3	VW	18
PN# M9456A02	Dimensioning	13	DIM	52
PN# M9456A02	Weld Symbols/BOM	4	W/B	16
PN# M9456A02	GD&T	5	GDT	30
PN# M9456A02	Title Block Data		TB	18
PN# M9456A02	Neatness/Quality		NQ	20
Shaft M9456A03				
PN# M9456A03	Views	2	VW	12
PN# M9456A03	Dimensioning	16	DIM	64
PN# M9456A03	Weld Symbols/BOM	2	W/B	8
PN# M9456A03	GD&T	2	GDT	12
PN# M9456A03	Title Block Data		TB	18
PN# M9456A03	Neatness/Quality		NQ	20
Lower Blade Guard M9456A04				
PN# M9456A04	Views	4	VW	24
PN# M9456A04	Dimensioning	10	DIM	40
PN# M9456A04	Weld Symbols/BOM	1	W/B	4
PN# M9456A04	GD&T		GDT	5
PN# M9456A04	Title Block Data		TB	18
PN# M9456A04	Neatness/Quality		NQ	20
Upper Blade Guard M9456A05				
PN# M9456A05	Views	4	VW	24
PN# M9456A05	Dimensioning	10	DIM	40
PN# M9456A05	Weld Symbols/BOM		W/B	0
PN# M9456A05	GD&T	3	GDT	0
PN# M9456A05	Title Block Data		TB	18
PN# M9456A05	Neatness/Quality		NQ	20

Interview Scores		50
Written Test		100
	New total	1000

Clothing Penalty	-10
Resume Penalty	-10
Time	-10