Ferris State University
Manufacturing Engineering Technology

Project X

2008

Frank Kruger
Preston Ostrander
Brian Wyns
Nicholas Yax

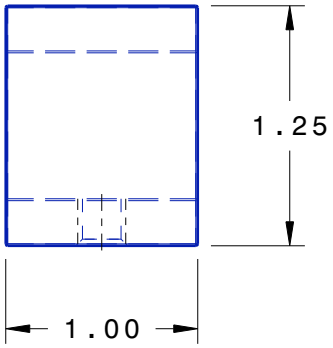
Project–X 2008

Vise Stop
Part Number: PX – 2008

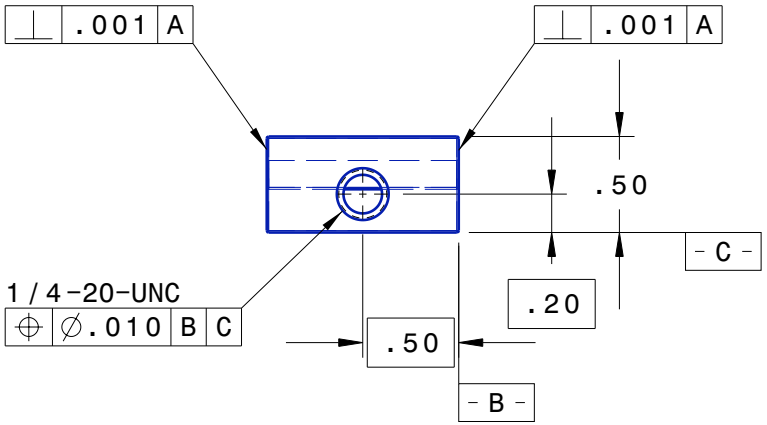
Launch: February 25, 2008
Complete: March 7, 2008

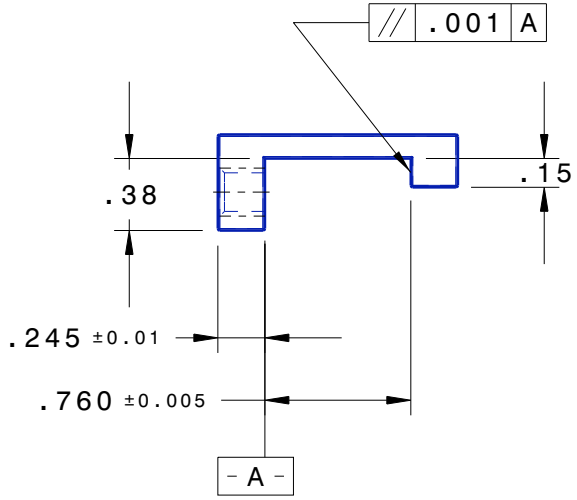
Overview

1. Determine the most economical method for manufacturing the simple part, in small lots.
2. Develop a simple routing that shows order of operations and equipment used at each operation.
3. Develop process dimensions and tolerances that are consistent with anticipated work holding datums.
4. Design work holding systems for the machining of a simple piece part using standard work holding components.
5. Assure work holding systems are consistent with anticipated process tolerance stacks and will not hinder achieving process dimensions and tolerances.
6. Completely document a manufacturing operation using Operation Sheets, Operation Setup Sheets, Tooling Layouts, and Standard Operating Procedures where applicable.
7. Run production following your process plan to produce the required number of parts.



NOTES:
BREAK ALL SHARP EDGES .01R MAX





TOLERANCE UNLESS OTHERWISE SPECIFIED:
.X = +/-.1
.XX = +/-.01
.XXX = +/-.001

Title: VISE STOP FRAME

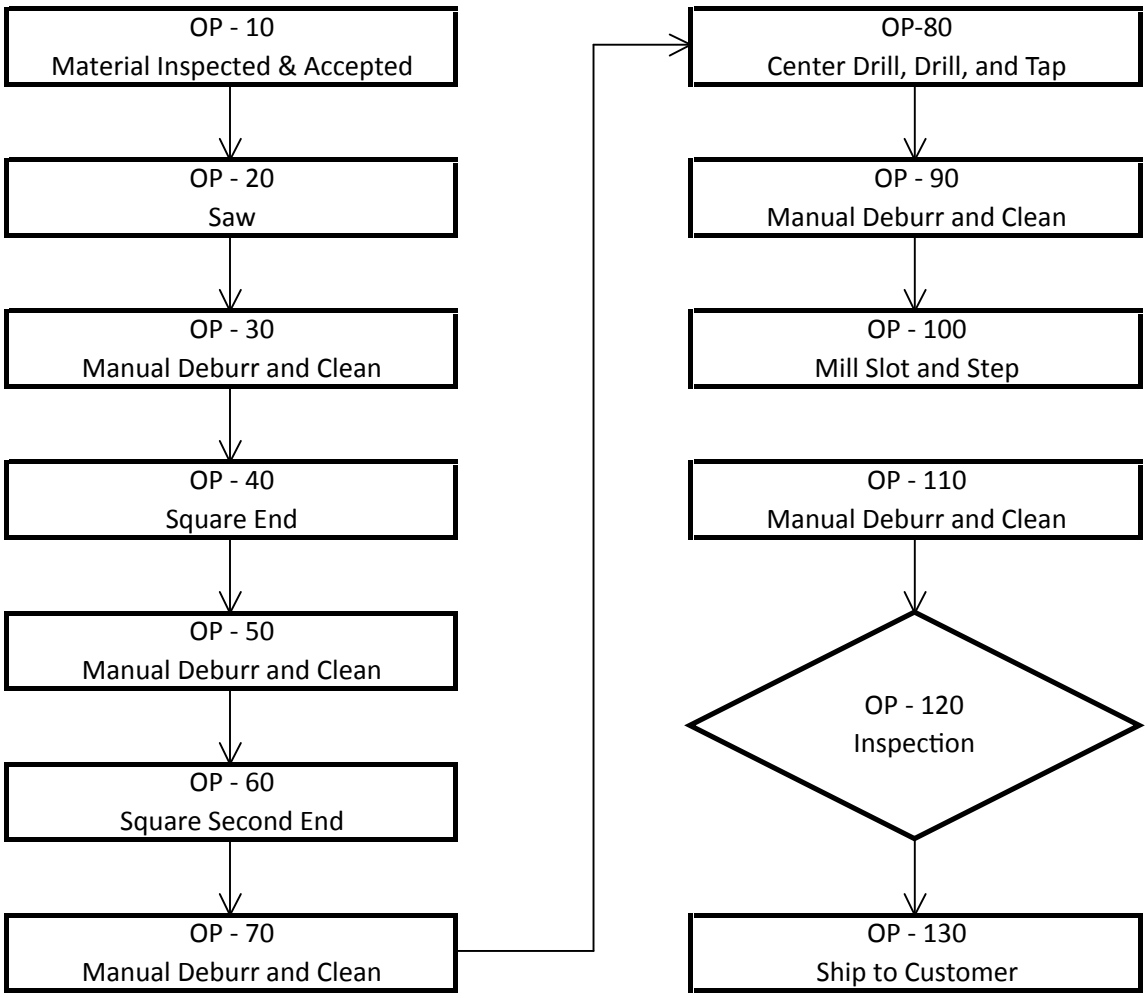
Part Number: PX-2008

Units: INCHES Scale: 1:1

Material: 1018 C.R.S.

Process Flow Chart

Job Information:	
Customer: Ferris State University	Job: Vise Stop



Sign-Off / Approval	
Documented By/ Date:	Approved By/ Date:

PROCESS ROUTING

PART #- PX-2008
PART NAME- VISE STOP
ENGINEERS- FRANK KRUGER
PRESTON OSTRANDER
NICK YAX
BRIAN WYNS

OP 10- MATERIAL RECEIVED, INSPECT AND DETERMINE CONFORMANCE

OP 20- SAW RAW STOCK INTO SLUGS FOR MACHINING

OP 30- MANUALLY DEBURR ALL SHARP EDGES AND CLEAN

OP 40- CLEAN UP ONE END OF PART TO ESTABLISH DATUM

OP 50- MANUALLY DEBURR SHARP EDGES AND CLEAN

OP 60- SQUARE REMAINING END TO 1.00” +-.005

OP 70- MANUALLY DEBURR SHARP EDGES AND CLEAN

OP 80- CENTERDRILL, DRILL, AND RIGID TAP HOLE

OP 90- MANUALLY REMOVE CHIPS AND COOLANT FROM HOLE, CLEAN

OP 100- MILL SLOT AND STEP FEATURES IN PART

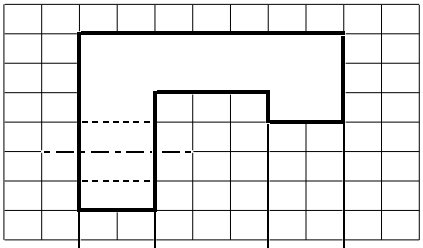
OP 110- MANUALLY DEBURR SHARP EDGES AND CLEAN

OP120- FINAL INSPECTION

OP 130- SHIPPING

Part Number: PX-2008 Part Name: Vise Stop Engineer's Name: KRUGER, WYNS, OSTRANDER, YAX

Notes:



line no	Op no	Stock Adders	Machine to Mean	Machine to +/-tol	a	b	c	d	e	f	g	h	i	j	k	l	Balance Dimensions Mean	Balance Dimensions +/-tol	Line Equation	Stock Removal Allowances Mean	Stock Removal Allowances +/-tol
1			1.249	.001							1						AS PURCHASED				
2	80	-.01	.995	.005							2						SOLID				
3																					
4	80	.01	.255	.005									4				SOLID				
5																					
6																					
7																					
8																					
9	80		1.005	.003							9								2 - 9	.01	.008
10								10									.76	.004	1 - 9		
11	80		.760	.005							11								4 - 11	.01	.007
12																					
13																					
14																					
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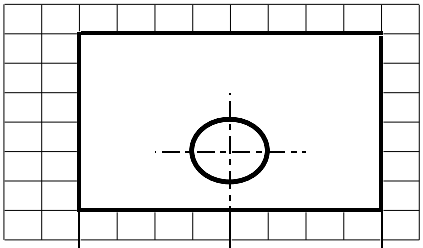
26																					
27																					
28																					
29																					
30																					

PF	Description	Dimensions		Product Drawing Balance Dimensions	Resultant Data		Tolerance Path
31		1.249	0.010	31	1.249	.001	1
32		0.760	0.005	32	.760	.005	11
33		0.245	0.010	33	.245	.004	10, 9, 1
34							
35							
36							

a b c d e f g h i j k l

Part Number: PX-2008 Part Name: Vise Stop Engineer's Name: KRUGER, WYNS, OSTRANDER, YAX

Notes:



line no	Op no	Stock Adders	Machine to Mean	Machine to +/-tol	a	b	c	d	e	f	g	h	i	j	k	l	Balance Dimensions Mean	Balance Dimensions +/-tol	Line Equation	Stock Removal Allowances Mean	Stock Removal Allowances +/-tol
1	50	.02, .02	1.040	0.010						1							SAW				
2																					
3	60	.02	1.020	0.005						3									1 - 3	0.020	0.015
4																					
5																					
6	60		1.000	0.005						6									3 - 6	0.020	0.010
7																					
8																					
9	70		0.500	0.0035					9								SOLID				
10																					
11																					
12																					
13																					
14																					
15																					
16																					
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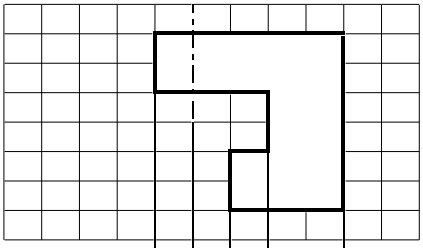
27																					
28																					
29																					
30																					

PF	Description	Dimensions		Product Drawing Balance Dimensions	Resultant Data		Tolerance Path
31		1.000	0.010	31	1.000	0.010	6
32		0.500	0.0035	32	0.500	0.005	9
33							
34							
35							
36							

a b c d e f g h l j k l

Part Number:	PX-2008	Part Name:	Vise Stop	Engineer's Name:	KRUGER, WYNS, OSTRANDER, YAX

Notes:



line no	Op no	Stock Adders	Machine to Mean	Machine to +/-tol	a	b	c	d	e	f	g	h	i	j	k	l	Balance Dimensions Mean	Balance Dimensions +/-tol	Line Equation	Stock Removal Allowances Mean	Stock Removal Allowances +/-tol
1			0.499	0.001								1					As Purchased				
2																					
3	70		0.200	0.0035						3							Solid				
4																					
5	80		0.230	0.005							5						Solid				
6																					
7	80		0.380	0.005							7						Solid				
8												8					0.150	0.010	7 - 5		
9																					
10																					
11																					
12																					
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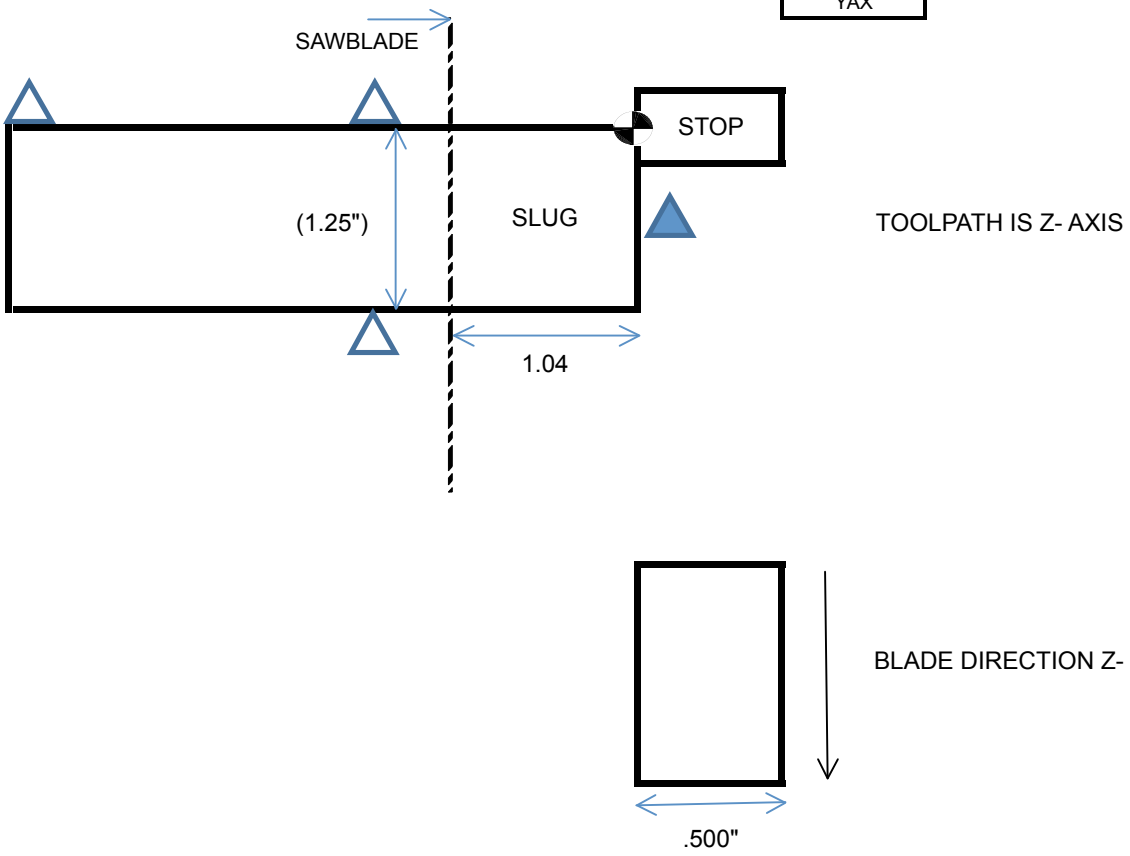
29																					
30																					

PF	Description	Dimensions		Product Drawing Balance Dimensions	Resultant Data		Tolerance Path
31		0.380	0.010	31	0.380	0.005	4
32		0.150	0.010	32	0.150	0.010	8, 7, 5
33		0.499	0.001	33	0.499	0.001	1
34		0.200	0.0035	34	0.200	0.010	3
35							
36							

a b c d e f g h I j k l

Op 20	Operation Set Up Sheet						
Op Description:	SAW SLUGS					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	WELLS BANDSAW	**Engineers:**	KRUGER, WYNS OSTRANDER, YAX	**Revision:**	N/A

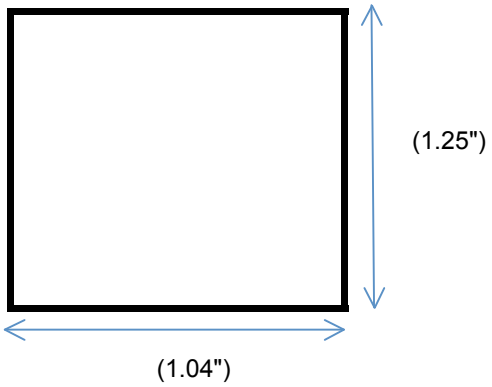


Tool Path **Locator** **Clamp** **Target Datum**

Set Up Notes

VISE SQUARENESS MUST BE CHECKED BEFORE CUTTING
SET STOP TO CUT SLUGS 1.040 +-.025
STOP MUST REMAIN FREE OF CHIPS TO ENSURE REPEATABILITY
CHECK EVERY 5TH PART TO ENSURE CONSISTENCY
BLADE SPEED SET TO 150 SFPM
BLADE FEED SET TO 5 ON FLOW CONTROL

Op 30	Operation Sheet						
Op Description:	MANUAL DEBURR AND CLEAN					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	N/A	**Engineers:**	KRUGER WYNS OSTRNADER YAX	**Revision:**	N/A



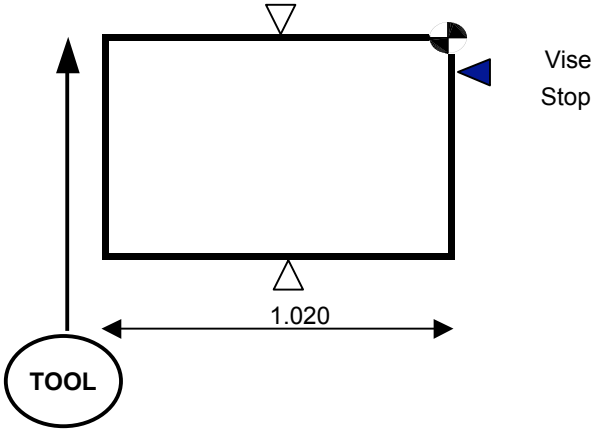
Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

MANUALLY DEBURR ALL EDGES WITH FILE

WIPE COOLANT, CHIPS AND SWARF OFF PART WITH SHOP RAG

Op 40	Operation Sheet						
Op Description:	SQUARE END					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER WYNS OSTRANDER YAX	**Revision:**	N/A

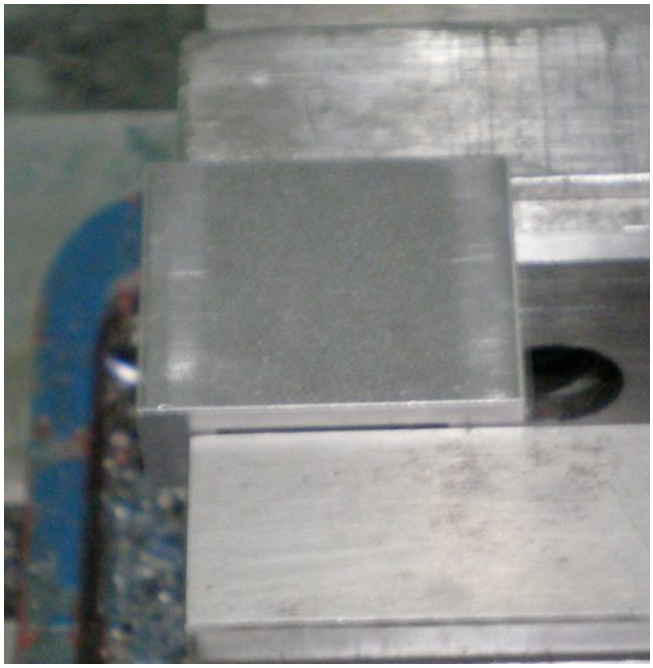


Tool Path **Locator** **Clamp** **Target Datum**

Reference Documentation

PX-2008-40-SU	Setup Sheet
PX-2008-40-TL	Tool Layout

Op 40	Setup Sheet						
Op Description:	SQUARE END					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER WYNS OSTRANDER YAX	**Revision:**	N/A



Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

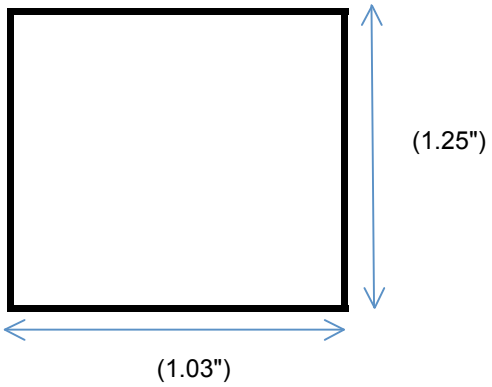
VISE SQUARENESS MUST BE CHECKED BEFORE CUTTING
SET UP VISE STOP SO .125" ACCESSIBLE MATERIAL FOR ENDMILL
SETUP MUST REMAIN FREE OF CHIPS TO ENSURE REPEATABILITY
CHECK EVERY 5TH PART TO ENSURE CONSISTENCY

Operation Control Plan

Operation Sequence				Tool		
Sequence	**Element Description**	**RPM**	**Feed**	**Control**	**Qty**	**Description**
60.1	MILL END	2500	12 IPM	NC	1	1/2" CARBIDE UNCOATED 2-FLUTE ENDMILL

Op 40	Tool Layout						
Op Description:	SQUARE END					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER WYNS OSTRANDER YAX	**Revision:**	N/A
40.1	1/2" CARBIDE 2-FLUTED END MILL, UNCOATED						

Op 50	Operation Sheet						
Op Description:	MANUAL DEBURR AND CLEAN					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	N/A	**Engineers:**	KRUGER WYNS OSTRNADER YAX	**Revision:**	N/A



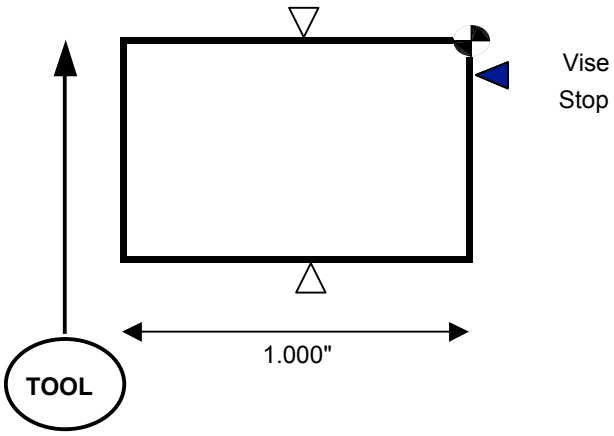
Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

MANUALLY DEBURR ALL SHARP EDGES WITH FILE

WIPE COOLANT, CHIPS AND SWARF OFF PART WITH SHOP RAG

Op 60	Operation Sheet						
Op Description:	SQUARE END & MACHINE TO SIZE					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER, WYNS, OSTRANDER YAX	**Revision:**	N/A

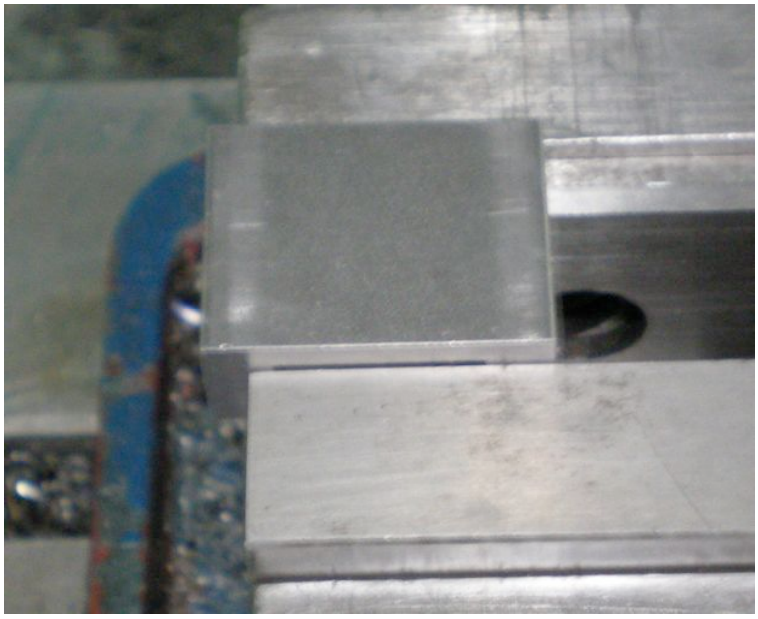


Tool Path **Locator** **Clamp** **Target Datum**

Reference Documentation

PX-2008-60-SU	Setup Sheet
PX-2008-60-TL	Tool Layout

Op 60	Setup Sheet						
Op Description:	SQUARE END & MACHINE TO SIZE					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER, WYNS, OSTRANDER YAX	**Revision:**	N/A



→ **Tool Path** ▶ **Locator** ▷ **Clamp** **Target Datum** **<Reference>**

Set Up Notes

VISE SQUARENESS MUST BE CHECKED BEFORE CUTTING
SET UP VISE STOP SO .125" ACCESSIBLE MATERIAL FOR ENDMILL
SETUP MUST REMAIN FREE OF CHIPS TO ENSURE REPEATABILITY
CHECK EVERY 5TH PART TO ENSURE CONSISTENCY

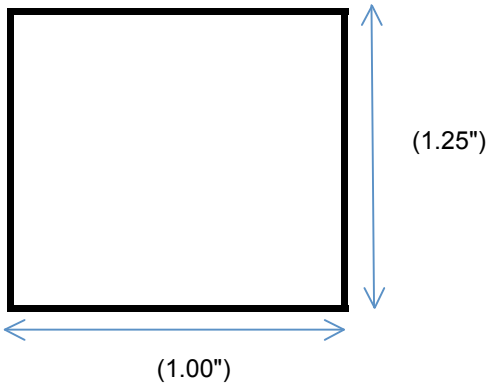
Operation Control Plan

Operation Sequence				**Tool**		
Sequence	**Element Description**	**RPM**	**Feed**	**Control**	**Qty**	**Description**
60.1	MILL END	2500	12 IPM	NC	1	1/2" CARBIDE UNCOATED 2-FLUTE ENDMILL

Op 60	Tool Layout						
Op Description:	SQUARE END & MACHINE TO SIZE					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER WYNS OSTRANDER YAX	**Revision:**	N/A

60.1	1/2" CARBIDE 2-FLUTED END MILL, UNCOATED	

Op 70	Operation Sheet						
Op Description:	MANUAL DEBURR AND CLEAN					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	N/A	**Engineers:**	KRUGER WYNS OSTRNADER YAX	**Revision:**	N/A



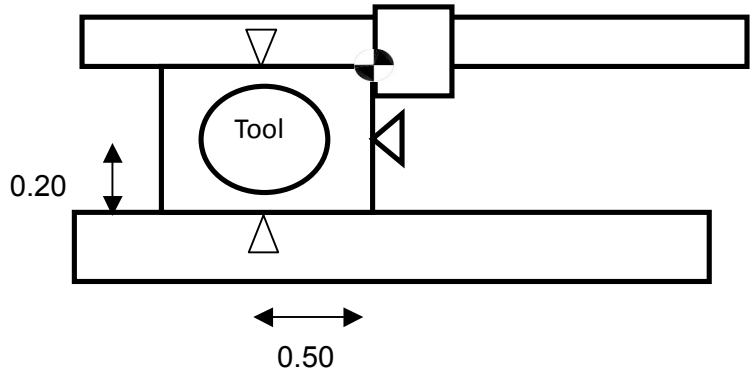
Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

MANUALLY DEBURR ALL SHARP EDGES WITH FILE

WIPE COOLANT, CHIPS AND SWARF OFF PART WITH SHOP RAG

Op 80	Operation Setup Sheet						
Op Description:	CENTER DRILL, DRILL, AND TAP					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM1	**Engineers:**	KRUGER WYNS OSTRANDER YAX	**Revision:**	N/A



Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

VISE SQUARENESS MUST BE CHECKED BEFORE CUTTING
SET STOP TO INSURE PROPER HOLE LOCATION
KEEP VISE CLEAN AND FREE OF CHIPS
CHECK EVERY FIFTH PART TO ENSURE CONSISTENCY

Reference Documentation

PX-2008-80-TL Tool Layout

Operation Sequence				Tool		
Sequence	**Element Description**	**RPM**	**Feed**	**Control**	**Qty**	**Description**
80.1	CENTER DRILLING	2000	4 ipm	NC	1	Center Drill
80.2	DRILLING	1500	4 ipm	NC	1	# 7 Drill
80.3	TAPPING	100	5 ipm	NC	1	.25-20-UNC RIGID TAP

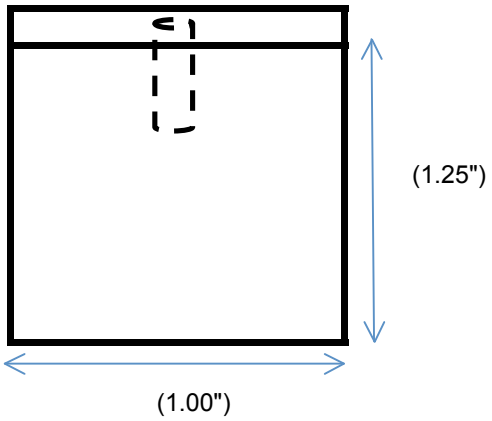
Op 80	Tool Layout						
Op Description:	CENTER DRILL, DRILL AND TAP					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM1	**Engineers:**	KRUGER WYNES OSTRANDER YAX	**Revision:**	N/A

80.1 # 3 CENTER DRILL

80.2 # 7 DRILL

80.3 1/4-20-UNC OSG HI PRO TAP

Op 90	Operation Sheet						
Op Description:	MANUAL CLEAN					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	N/A	**Engineers:**	KRUGER WYNS OSTRNADER YAX	**Revision:**	N/A



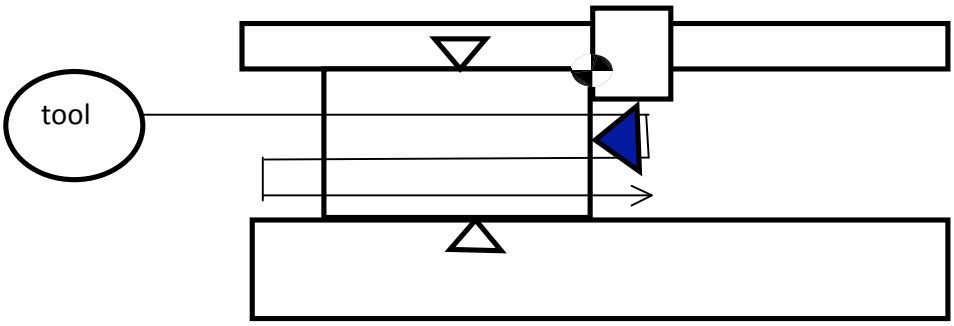
Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

BLOW CHIPS AND COOLANT OUT OF TAPPED HOLE

WIPE COOLANT, CHIPS AND SWARF OFF PART WITH SHOP RAG

Op 100	Operation Sheet						
Op Description:	Mill Slot and Step					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM-1	**Engineers:**	KRUGER WYNES OSTRANDER YAX	**Revision:**	N/A



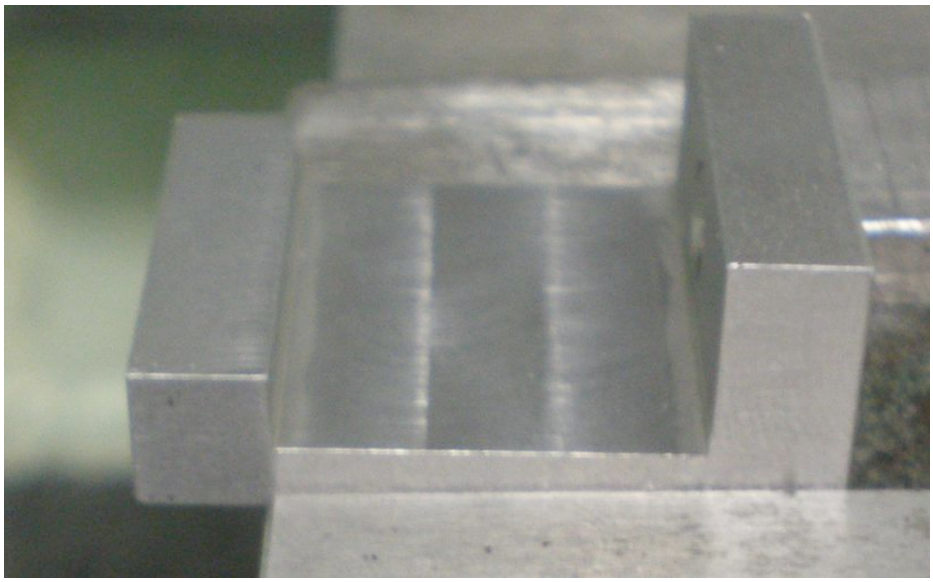
Tool Path **Locator** **Clamp** **Target Datum**

Reference Documentation

PX-2008-100-SU Setup Sheet

PX-2008-100-TL Tool Layout

Op 100	Setup Sheet						
Op Description:	CENTER DRILL, DRILL, AND TAP					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM1	**Engineers:**	KRUGER WYNS OSTRANDER YAX	**Revision:**	N/A



Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

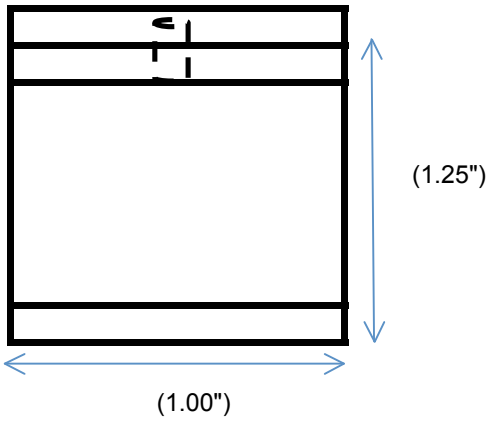
VISE SQUARENESS MUST BE CHECKED BEFORE CUTTING
SET STOP TO INSURE PROPER HOLE LOCATION
KEEP VISE CLEAN AND FREE OF CHIPS
CHECK EVERY FIFTH PART TO ENSURE CONSISTENCY

Operation Control Plan

Operation Sequence				**Tool**		
Sequence	**Element Description**	**RPM**	**Feed**	**Control**	**Qty**	**Description**
100.1	MILL SLOT AND STEP	2500	12	NC	1	END MILL

Op 100	Tool Layout							
Op Description:	MILL SLOT AND STEP						**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008				**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	HURCO VM1	**Engineers:**	KRUGER WYNS OSTRANDER YAX		**Revision:**	N/A
100.1	1/2 IN. UNCOATED END MILL							

Op 110	Operation Sheet						
Op Description:	MANUAL DEBURR AND CLEAN					**Date:**	3/6/08
Part Name:	VISE STOP	**Part No:**	PX-2008			**Material:**	1018 CRS
Department:	FSU SWN 122	**Machine:**	N/A	**Engineers:**	KRUGER WYNS OSTRNADER YAX	**Revision:**	N/A



Tool Path **Locator** **Clamp** **Target Datum** **<Reference>**

Set Up Notes

MANUALLY DEBURR ALL SHARP EDGES WITH FILE

WIPE COOLANT, CHIPS AND SWARF OFF PART WITH SHOP RAG

Indicating Vice

Purpose: To insure that vice is aligned to x-axis of vertical milling machine.

Scope: Applies to cnc and manual vertical milling machines and their vices.

Equipment: Test indicator, dead blow hammer, adjustable wrench, Indicol holder.

Steps:

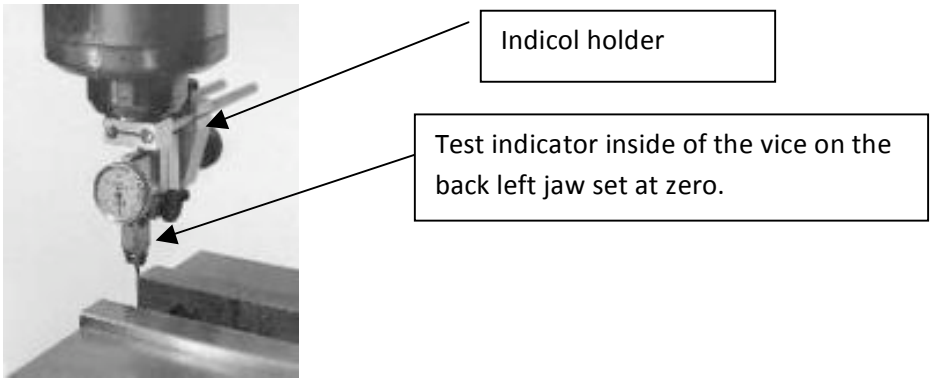
1. Place indicol around mill spindle.

2. Insert test indicator into indicol.

3. Loosen vice, with adjustable wrench.

4. Snug right nut of vice.

5. Move test indicator to back left jaw as shown.



6. Preload indicator ½ travel and Set to zero by moving mill table about y- axis.

7. Move test indicator to right side of jaw, while observing needle move.

8. Tap vice with dead blow hammer, until test indicator goes back towards zero.

9. Repeat steps 7 through 10 until Total Indicator Reading is within spec.

10. Tighten vice with adjustable wrench.

11. Repeat steps 7 through 9.

11. Process is complete when total indicator reading is zero.