INTRODUCTION

Hurco Machining Centers and Conversational Part Programming WinMax Mill

Class Worksheets

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INTRODUCTION

The following topics are covered in this Introduction to Hurco Machining Centers:

Input Screen Hierarchy Chart 2
Coordinate System 3
Determining Angles 4
Formulas 4
Milling Types 5
Climb Milling vs. Conventional Milling 6
Reminders for First Time at Machine 7
G Code Table 8
Miscellaneous Functions - M Codes 12
Cutting Speeds & Feeds 14
Patterns Operations 15
Program Parameters 22

Input Screen Hierarchy Chart

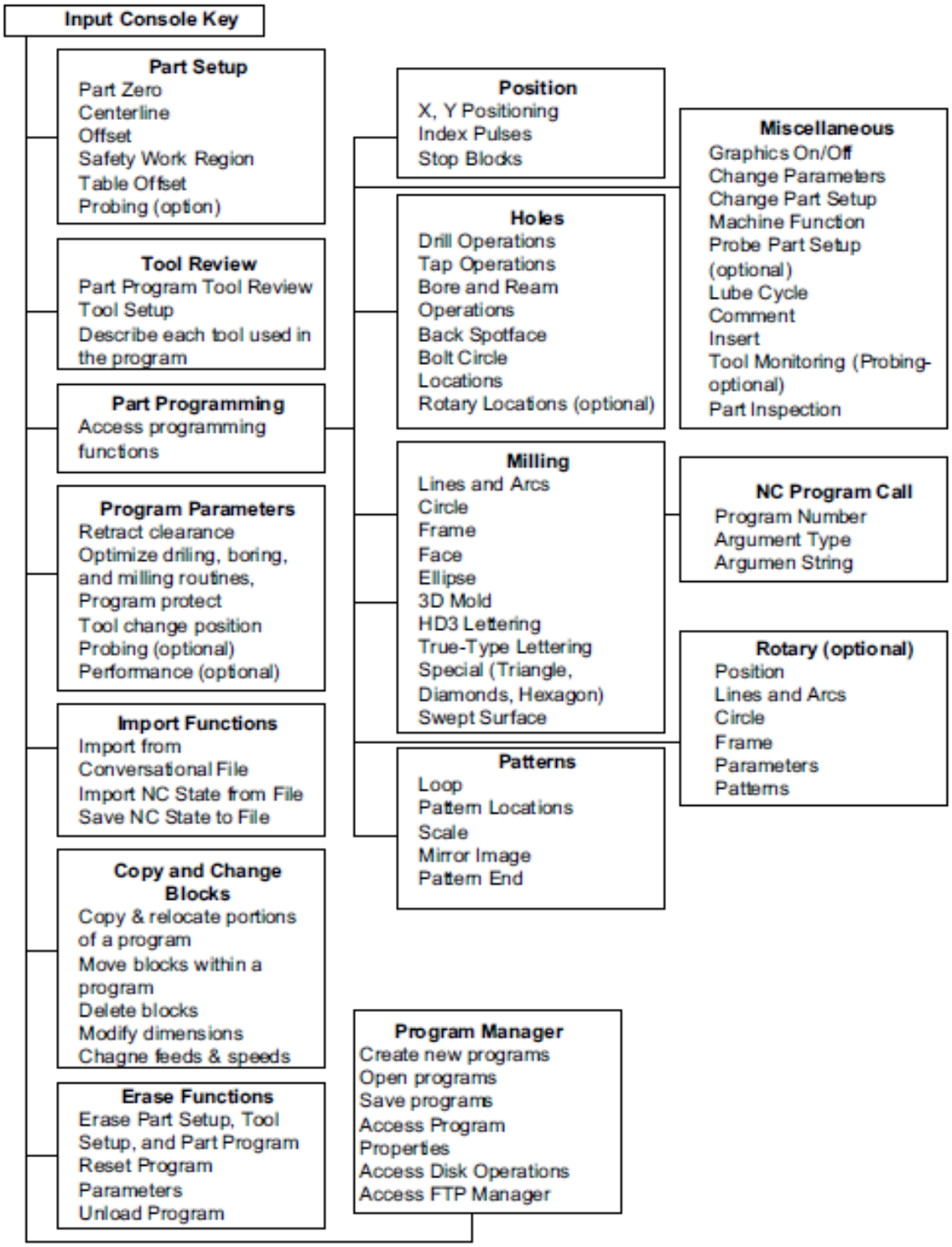


Figure 1. Input Screen Hierarchy Chart

Coordinate System

Spindle (tool movement) relative to Part Zero:

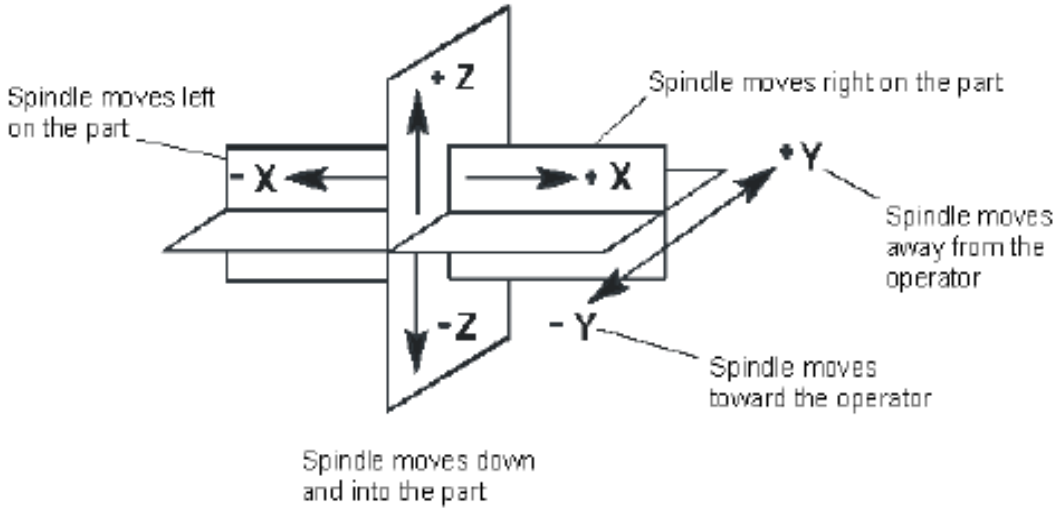


Figure 2. Axis Motion

Determining Angles

- Rotation always starts from 3 o'clock.
- CCW is a positive angle.
- CW is a negative angle.

Hurco Compass

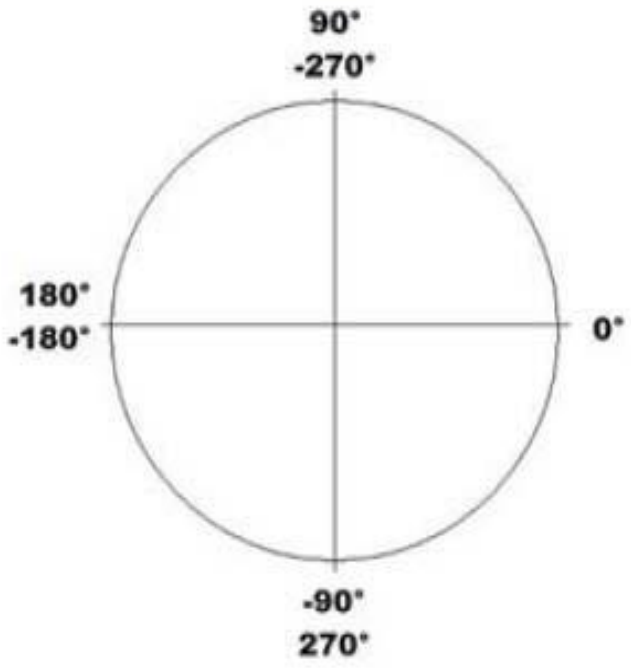


Figure 3. Angles

Formulas

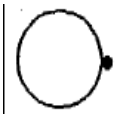
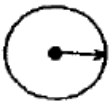
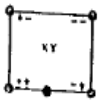
Surface Ft. Per Minute = (RPM x 3.14 x Tool Dia.) / 12

Chip Load = Feed in IMP / (RPM x Number of Teeth)

Feed in IPM = Chip Load x RPM x Number of Teeth

RPM = (12 x SFPM) / (3.14 x Tool Dia.)

Milling Types

	Center-line	Inside	Outside	Inside Tangent	Outside Tangent	Pocket
Pecks	x	x	x	x	x	x
Finish Pass Sides 0.008 Floor 0.004	x	x	x	x	x	x
Cutter Comp		x	x	x	x	x
Blend Offset (0.118)		x	x			x
Blend Overlap (0.118)		x	x			x
Pocket Overlap (10%)						x
Conventional /Climb Mill	x	x	x	x	x	x
Circle Center Point Radius In/Out = 3:00						
Ellipse X < Y Center Point X Radius Y Radius In/Out = 3:00						
Ellipse X > Y Center Point X Radius Y Radius In/out = 6:00						
Frame Reference Corner X Length Y Length In/Out = 6:00						

Climb Milling vs. Conventional Milling

Climb milling can increase tool life by up to 50%. It is growing in use, due to the availability of improved and more rigid machinery, and has been found to be most effective in the vast majority of milling applications. To determine whether climb or conventional milling is being used, look at the direction of the work table and the cutting tool at the point of cut. Climb milling is in use if the directions are the same. If they are opposite, conventional milling is in use.

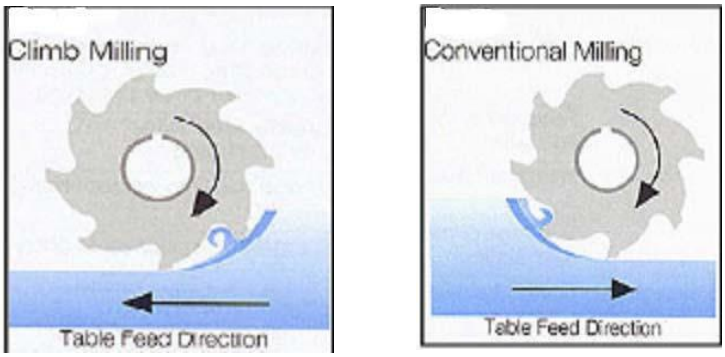


Figure 4. Climb and Conventional Milling

Climb Milling can be determined by the following method: with the spindle turning in a clockwise rotation, the tool will be on the left hand side of the cut as it travels away from you.

Conventional Milling can be determined by the following method: with the spindle turning in a clockwise rotation, the tool will be on the right hand side of the cut as it travels away from you.

Advantages of Climb Milling

- **Increased Tool Life**—Since chips pile up behind the cutter, tool life can be increased by as much as 50%.
- **Less Costly Fixture Devices**—Climb milling exerts a downward force and therefore does not "lift" the workpiece, resulting in easier fixturing.
- **Improved Surface Finishes**—Chips are less likely to be carried by the tooth, reducing marring of the machined surface.
- **Easier Chip Evacuation**—Chips fall behind the cutter resulting in faster and easier chip removal.
- **Decreased Power Requirements**—A higher rake angel can be used on the cutting tool resulting in lower power consumption.

Reminders for First Time at Machine

To Turn on Power to the Control

1. Main power switch ON.
2. Release EMERGENCY STOP.
3. Press MANUAL MODE key.
4. Press POWER key.
5. Press START (if flashing).

To Calibrate Machine

1. Make sure the control POWER key is lit.
2. Press MANUAL MODE key.
3. Press CALIBRATE MACHINE softkey.
4. Press START to calibrate.
5. Wait for Z, X, Y-axes to go to home positions.

To Program Part Setup

1. Make sure POWER key is lit.
2. Jog machine to align center of spindle over corner of part, or use dial indicator, edge finder, or wiggler to find X, Y part zero.
3. Use softkey to STORE MACHINE POSITION.
4. Program SAFETY WORK REGIONS.

To Use Test Mode

1. Press TEST MODE key.
2. Press CHECKFOR ERRORS softkey.
3. Correct all errors.
4. When NO ERRORS EXIST, check estimated RUN TIME.
5. Press DRY RUN.
6. Program MINIMUM Z dimension.
7. Press START for tool to trace over part at MINIMUM Z position.

To Run First Part

1. Press TEST MODE.
2. Press FEED & SPEED OPTIMIZATION softkey.
3. Adjust overrides (feedrates) while cutting, and press appropriate softkey to store new feedrate in program memory.
4. Press START key to begin machining cycle.

To Run Second Part

1. Press AUTO MODE key.
2. Press START key.

G Code Table

The following table lists the G codes, identifies the defaults (in the shaded areas), lists Modal (M) or Non-modal (N) types, identifies groups, and describes the G codes' functions.

Some G codes are strictly BNC or strictly ISNC, and are identified as such in this manual. Otherwise, the G codes apply to either dialect.

G Code	Type	Group	Function
G00	M	01	Positioning (Rapid Traverse)
G01	M		Linear Interpolation (Cutting Feed)
G02	M		Circular Interpolation/Helical CW
G02.4	M		3D Circular Interpolation CW
G03	M		Circular Interpolation/Helical CCW
G03.4	M		3D Circular Interpolation CCW
G04	N	00	Dwell, Exact Stop
G05.1	M	19	Surface Finish Parameters
G05.2	M		Data Smoothing
G05.3	M		Surface Finish Quality
G09	N	00	Decelerate Axis to Zero
G10	N		Data Setting
G11	N		Data Setting Mode Cancel
G15	M	17	Polar Coordinates Cancel
G16	M		Polar Coordinates
G17	M	02	XY Plane Selection
G18	M		ZX Plane Selection
G19	M		YZ Plane Selection
ISNC G20	M	06	Input in Inch
ISNC G21	M		Input in mm
G28	N	00	Return to Reference Point
G29	N		Return from Reference Point
G31	N		Skip Function

G Code	Type	Group	Function (Continued)
G40	M	07	Cutter Compensation Cancel
G41	M		Cutter Compensation Left
G41.2	M		3D Tool Geometry Compensation
G42	M		Cutter Compensation Right
G43	M	08	Tool Length Compensation + Direction
G43.4	M		5-Axis Linear Interpolation
G44	M		Tool Length Compensation - Direction
G45	N	00	Tool Offset Increase
G46	N		Tool Offset Decrease
G47	N		Tool Offset Double Increase
G48	N		Tool Offset Double Decrease
G49	M	08	Tool Length Offset Compensation Cancel
G50	M	11	Scaling Cancel
G51	M		Scaling
G50.1	M	18	Mirroring Cancel
G51.1	M		Mirroring
G52	N	00	Local Coordinate System Setting
G53	N		Machine Coordinate System Selection
G54	M	14	Work Coordinate System 1 Selection
G54.1	M		Aux Work Coordinate Systems
G55	M		Work Coordinate System 2 Selection
G56	M		Work Coordinate System 3 Selection
G57	M		Work Coordinate System 4 Selection
G58	M		Work Coordinate System 5 Selection
G59	M		Work Coordinate System 6 Selection
G61	M	15	Decelerates to Zero–Precision Cornering
G64	M		Cancels Precision Cornering
G65	N	12	Macro Command, Subprogram Call
G66	M		Modal Subprogram Call
G67	M		Modal Subprogram Call Cancel
G68	M	16	Coordinate Rotation

G Code	Type	Group	Function (Continued)
G68.2	M		Global Rotation NC Transform Plane
G68.3	M		Local Rotation NC Transform Plane
G69	M		Coordinate System Rotation Cancel
BNC G70	M	06	Input in Inch
BNC G71	M		Input in mm
G73	M	09	Peck Drilling Cycle
ISNC G74	M		Left-handed Tapping Cycle
ISNC G74 with M29	M		Rigid Tapping
BNC G74	M	01	Single-quadrant Circular Interpolation
BNC G75	M		Multi-quadrant Circular Interpolation
G76	M	09	Bore Orient Cycle
G80	M		Canned Cycle Cancel
G81	M		Drilling Cycle, Spot Boring
G82	M		Drilling Cycle, Counter Boring
G83	M		Peck Drilling Cycle
G84	M		Tapping Cycle
ISNC G84.2	M		Rigid Tapping Cycle
ISNC G84.3	M		Rigid Tapping Cycle
ISNC G84 with M29	M		Rigid Tapping Cycle
G85	M		Boring Cycle
BNC G86	M		Bore Orient Cycle
ISNC G86	M		Bore Rapid Out Cycle
BNC G87	M		Chip Breaker Cycle
ISNC G87	M		Back Boring Cycle
BNC G88	M		Rigid Tapping Cycle
ISNC G88	M		Boring Cycle Manual Feed Out, Dwell
G89	M		Boring Cycle Bore and Dwell
G90	M	03	Absolute Command
G91	M		Incremental Command
G92	N	00	Programming of Absolute Zero Point

G Code	Type	Group	Function (Continued)
G93	M	05	Inverse Time
G94	M		Feed per Minute
G98	M	10	Return to Initial Point in Canned Cycle
G99	M		Return to R Point in Canned Cycle

Table 1. G Codes in order of Codes

Miscellaneous Functions - M Codes

Miscellaneous Functions (M codes) cause machine-related action (e.g., coolant control and tool changes). Each Miscellaneous Function is explained below. Multiple M codes can be used within an NC block.

M Code	Definition
M00	Cancels the spindle and coolant functions; stops part program execution
M01	Program stop often used when the operator wants to refixture the part
M02	Marks the end of the program; stops the spindle, coolant, and axes feed
M03	Starts clockwise rotation of the spindle
M04	Starts counterclockwise rotation of the spindle
M05	Switches the spindle off
M06	Requests an automatic tool change
M07	Switches on secondary coolant systems
M08	Switches on primary coolant system
M09	Switches off both the primary and secondary coolant
M10	Switches on both the primary and secondary coolant
M12	Clamp Rotary C Axis
M13	Unclamp Rotary C Axis
M20	Advances the indexer one position
M21	Initiates lubrication
M25	Retracts the Z axis to the home position (tool change height)
M26	Select Part Probe Signal
M27	Select Tool Probe Signal
ISNC M29	Enables rigid tapping
M30	Program End
M31	Resets the rotary axis encoder position
M32	Clamps the rotary A axis
M33	Unclamps the rotary A axis
M34	Clamps the rotary B axis
M35	Unclamps the rotary B axis
M36	Switches off the servos
M38	Reads and places the state of the laser OK signal
M39	Reads and places the state of the laser static signal
M40	Reads and places the state of the laser dynamic signal

M Code	Definition
M41	Deactivates two-touch probing when using the G31 command
M42	Enables automatic two-touch probing with the G31 command. If the part probe touches during a G31 move, the probe will automatically back up and then attempt a second touch at a reduced feedrate.
M43	Increases the barrier air.
M44	Reduces barrier air.
M45	Opens the shutter.
M46	Closes the shutter.
M47	Turns the laser emitter on.
M48	Turns the laser emitter off.
M49	Turns the laser receiver on.
M50	Turns the laser receiver off.
M52	Enables auxiliary output 1.
M53	Enables auxiliary output 2.
M54	Enables auxiliary output 3.
M55	Enables auxiliary output 4.
M56	Rotates the pallet changer for a non-confirmation pallet change.
M57	Rotates the pallet changer to pallet 1.
M58	Rotates the pallet changer to pallet 2.
M59	Turns chip conveyor forward mode on.
M60	Turns chip conveyor reverse mode on.
M61	Stops the chip conveyor.
M62	Disables auxiliary output 1.
M63	Disables auxiliary output 2.
M64	Disables auxiliary output 3.
M65	Disables auxiliary output 4.
M68	Enables washdown coolant system.
M69	Disables washdown coolant system.
M76	Normal A Axis operation (default).
M77	Reverses A Axis operation.
M78	Normal B Axis operation (default).
M79	Reverses B Axis operation.
M80	C Axis is right-handed (default).
M81	C Axis is left-handed.
M98	Subprogram call.
M99	Jump; Return from subprogram.

M Code	Definition
M126	Shortest Rotary Angle Path Traverse
M127	Cancels Shortest Rotary Angle Path Traverse (M126)
M128	Tool Center Point Management
M129	Cancels Tool Center Point Management (M128)
M140	Retract Along Tool Vector
M200	Tilt Axis Preference

Table 2. M Codes

Cutting Speeds & Feeds

Alloy	Material	Feed Per Tooth		
		SFM	Rough	Finish
Aluminum	2024	Max Rpm	.008	.005
	6061 (T1-T3)	Max Rpm	.005	.0025
	6061 (T4-T6)	Max Rpm	.010	.005
	7075	Max Rpm	.010	.005
Brass	Brass	750	.005	.0025
Copper	Copper	600	.005	.0025
Composites	G10 Fiberglass	1000	.006	.003
	Graphite	1000	.010	.005
	Graphite / Epoxy	800	.003	.0015
	Plastics	1300	.010	.005
Magnesium	Magnesium	Max Rpm	.010	.005
Cast Iron	Ductile	350	.0035	.0015
	Gray	500	.005	.0025
Inconel	625 / 718	100	.00075	.0035
Steel	1018 / 1020	350	.0015	.0015
	4130	260	.0015	.0005
	4140	220	.0015	.0005
	4340	280	.0015	.0005
Stainless	303	500	.002	.001
	304	225	.001	.0005
	316	240	.001	.0005
	15-5 / 17-4PH	200	.001	.0005
	440C	200	.001	.0005
Tool Steel	A2	350	.0015	.0005
	D2	260	.0015	.0005
	H13	230	.0015	.0005
	P20	350	.0025	.0015
Titanium	Commercial	700	.0025	.0015
	6 AL-4V	400	.002	.0015
	6 AL-6V	230	.0005	.0003

Table 3. Cutting Speeds & Feeds (Carbide only)

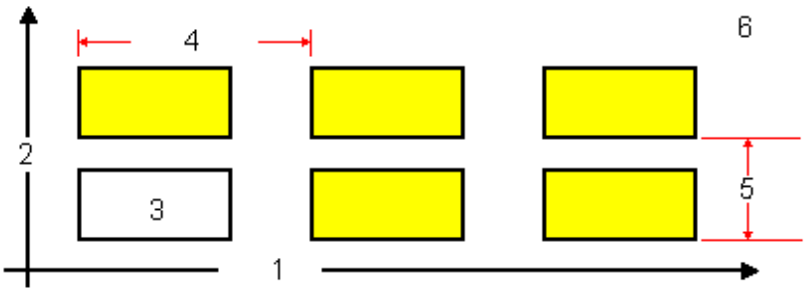
Patterns Operations

Patterns operations repeat or modify a sequence of data blocks. Save programming time by duplicating part geometry to complete a part program or create multiple parts from one program.

Patterns may only be nested 10 levels deep.

Loop Rectangular

This routine repeats a pattern a specified number of times along lines parallel to the X and Y axes. The original pattern is always milled at its programmed location. Always program a Pattern End data block following a Loop Rectangular block.



1	X Axis
2	Y Axis
3	Original Pattern
4	X Distance
5	Y Distance
6	X Number = 3; Y Number = 2

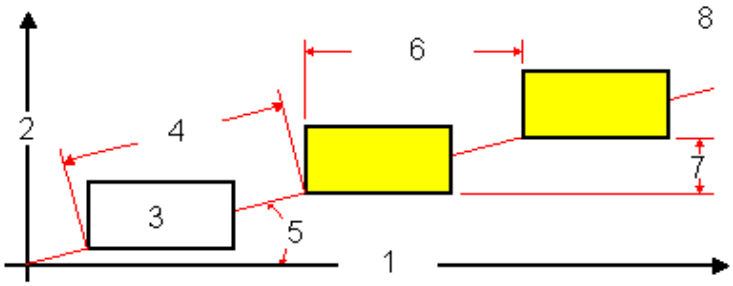
Figure 5. Loop Rectangular

The Loop Rectangular fields are defined as follows:

- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **X Number—**Determines the number of times the programmed routine will be repeated along a line parallel to the X axis.
- **Y Number—**Determines the number of times the programmed routine will be repeated along a line parallel to the Y axis.
- **X Distance—**Determines the distance between the patterns along the X axis lines. (Negative values indicate direction.)
- **Y Distance—**Determines the distance between the patterns along the Y axis lines. (Negative values indicate direction.)

Loop Linear

This routine repeats a pattern a specified number of times along a line defined in the X-Y plane. Even though the defined line of this pattern is not parallel to the X or Y axes, the original pattern is always milled at its programmed location and orientation does not change with respect to the X and Y axes. Always program a Pattern End data block following a Loop Linear block.



1	X Axis
2	Y Axis
3	Original Pattern
4	Distance
5	Angle
6	X Distance
7	Y Distance
8	Number = 3

Figure 6. Loop Linear

The Loop Linear fields are defined as follows:

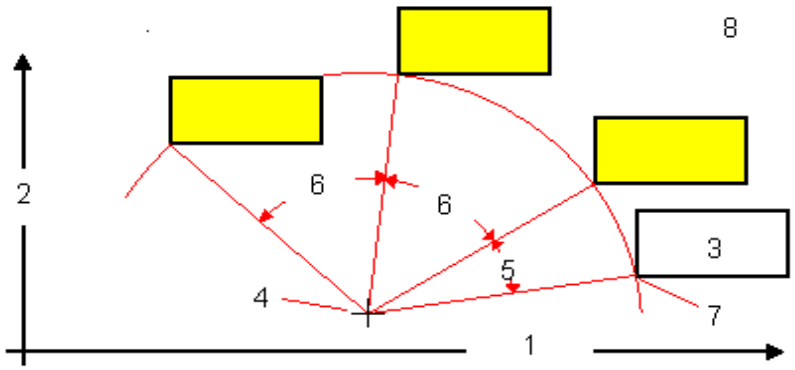
- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **Number—**Determines the number of times the pattern will be repeated along the defined line.
- **X Distance** and **Y Distance—**Determine the distances between the repeated pattern in the direction of the X and Y axes (+ or -).

  If the X or Y Distance measurement is entered, the control automatically calculates the values for the Angle and Distance fields. The calculated values, which appear grayed out, may be stored by pressing the **Store Value** softkey or the ENTER key when the cursor is on the field. If you do not want to use the calculated value, type in a different value.

- **Angle—**Determines the angle (in degrees) between the defined line and the X positive axis. A positive value is counterclockwise (CCW) from the 3 o'clock position, and a negative value is clockwise (CW) from the 3 o'clock position.
- **Distance—**Determines the dimensional value between repeated patterns along the defined line.

Loop Angular

This routine repeats a programmed pattern a specified number of times along a circular path. Pattern orientation does not change with respect to the X and Y axes. The original programmed pattern is not executed at its original position unless the routine places it at that location. The pattern is only shown in the locations specified by the routine. Always program a Pattern End data block following a Loop Angular block.



1	X Axis
2	Y Axis
3	Original Pattern
4	XY Center
5	Start Angle
6	Rotate Angle
7	XY Reference
8	Number = 3

Figure 7. Loop Angular

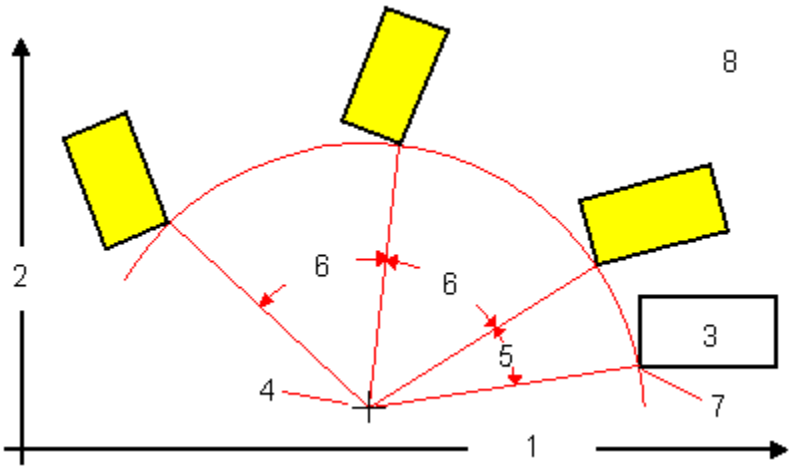
The Loop Angular fields are defined as follows:

- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **Number—**Determines the number of times the pattern is repeated along the specified circular path.
- **X Center** and **Y Center—**Identify the X and Y coordinates of the reference point about which the pattern is rotated.
- **Start Angle—**Identifies the angle value between the original pattern and the location of the first pattern created by this routine.
- **Rotate Angle—**Identifies the angle between the repeated patterns.
- **X Reference** and **Y Reference—**Identify the X and Y coordinates of the reference point (the only point in the pattern always on the circular path defined by this routine).

Loop Rotate

This routine repeats a pattern along a circular path. Loop Rotate moves the pattern around the X-Y center point and executes the pattern only at the programmed locations.

The original programmed pattern is not executed at its original position, unless this routine places it at that location. The pattern is only shown in the specified locations. Always program a Pattern End data block following a Loop Rotate block.



1	X Axis
2	Y Axis
3	Original Pattern
4	XY Center
5	Start Angle
6	Rotate Angle
7	XY Reference
8	Number = 3

Figure 8. Loop Rotate

The Loop Rotate fields are defined as follows:

- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **Number—**Determines the number of times the pattern will be repeated along the specified circular path.
- **X Center** and **Y Center—**Determine the X and Y coordinates used to define the circular path of the repeated pattern.
- **Start Angle—**Determines the angle value between the original pattern and the location of the first pattern created by this routine. If this location is the same as the original programmed pattern, the value in this field will be zero.
- **Rotate Angle—**Identifies the angle between the repeated patterns being executed by this routine.

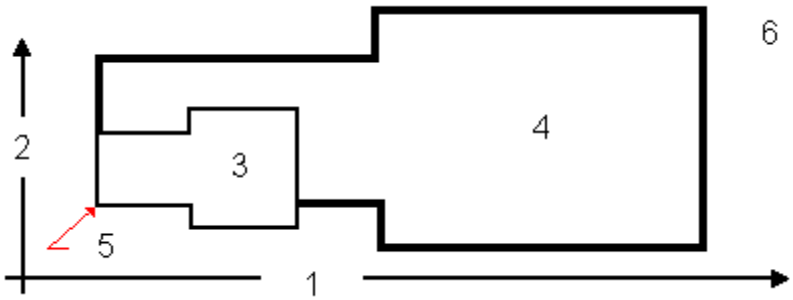
Pattern Locations

Enter a Pattern Location block each time a programmed pattern is to be repeated. The pattern is repeated by offsetting the pattern with each displacement specified in the Pattern Location block. Always program a Pattern End data block following a Pattern Location block.

- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **X Offset**, **Y Offset**, and **Z Offset—**Identify the location where the pattern is to be executed in the X, Y, and Z axes. If this is Location #1 and the pattern is to be at its original location, this coordinate must be zero. The value for this field is the offset for the X or Y axis.

Scale

This routine scales a programmed pattern down or up in a range of 0.100 to 10.000 (10% to 1000%) respectively. Always program a Pattern End data block following a Scale block.



1	X Axis
2	Y Axis
3	Original Pattern
4	Scaled Pattern
5	XY Reference
6	X Scale = 3; Y Scale = 2; Z Scale = not shown

Figure 9. Pattern Scale

The Scale fields are defined as follows:

- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **X Reference**, **Y Reference**, and **Z Reference**—Determine the X, Y, and Z coordinates of the point from which the scaling will be performed.
- **X Scale**, **Y Scale**, and **Z Scale—**Determine the scaling factor from the X, Y, and Z axes. If scaling is not executed from the axis, enter 1.0000.
  - A value that is less than 1.0000 scales down the pattern.
  - A value that is greater than 1.0000 scales up the pattern.

When you use Cutter Compensation in the program, the X and Y scale factors must be equal, except for these selections where the X and Y scale factors can be different:

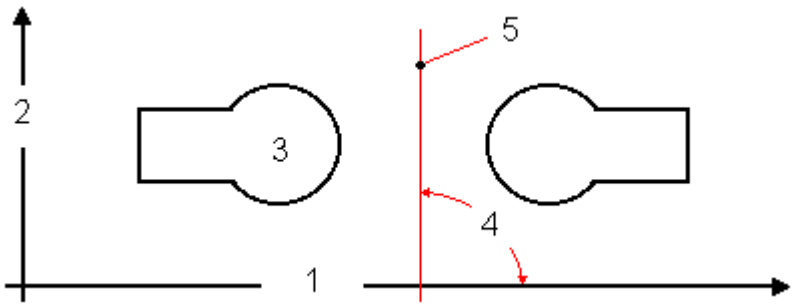
- Circle (ON)
- Frame (ON)
- Ellipse (ON)
- Contour (ON)
- True-Type Font (ON)
- HD3 Lettering

When using Z scaling, the Peck Depth, Retract Clearance Plane, Peck Clearance Plane, and Z Safety Plane values are not affected.

Z Bottom and Z Start are the values commonly affected by Z scaling.

Mirror Image

This pattern programs a part as a mirror image of an existing programmed part. The routine can execute the mirror image alone or the original part and the mirror image. Always program a Pattern End data block following a Mirror Image block.



1	X Axis
2	Y Axis
3	Original Pattern
4	Angle
5	XY Point on Mirror Line

Figure 10. Mirror Image

The Mirror fields are defined as follows:

- **Block—**Identifies the block number for this operation. The system determines the number by the position of this data block in the program.
- **Keep Original—**Select Yes for this field if the original will be cut as well as the mirror image. If only the mirror image is to be produced, select No for this field.
- **X** and **Y—**Identify the X and Y coordinates for a point on a line about which this routine occurs as measured from part zero to the mirror line.
- **Angle—**Enter the orientation in degrees of the mirror line (which passes through the X-Y dimensions above). This is measured from the 3 o'clock position. A positive value is CCW.

Pattern End

There are no fields to enter in this data block. It is a marker at the end of the sequence of data blocks used in a Pattern operation. Press the Review List softkey to view a part program summary and determine the position of the Pattern End data blocks.

There must be an equal number of Pattern blocks and Pattern End data blocks. Use the right and left arrow keys to scroll through the blocks, press the **Insert Before** softkey to insert a pattern End block before a displayed data block.

Program Parameters

Program parameters are displayed on tabs for General 1, General 2, Milling 1, Milling 2, Holes, Probing, and Performance. The Performance tab in WinMax is active when the SelectSurface Finish Quality option is enabled. The programmer has the option to make changes to any or all of the program parameters and save them as user defaults. The user defaults and original WinMax defaults can be restored by using the appropriate softkey. Parameters can be altered with the Change Parameters data block during program execution. Refer to Conversational Part Programming for details.

Refer to NC Part Programming for information about NC Parameters.

Softkeys on the Program Parameters screen are:

- **SAVE AS USER DEFAULTS *F4***—saves the selected field's value as the user-defined default value
- **RESTORE USER DEFAULTS *F5*—**restores the user-defined values to a field that has been populated with other values
- **RESTORE WINMAX DEFAULTS *F6*—**restores the WinMax-defined values to a field that has been populated with other values.

  Change Parameters program blocks load the user-defined parameters set in Program Parameters.

- **NC Parameters *F7***—accesses NC Configuration Parameters. These parameters are available only with NC Part Programming.

General Parameters 1

These are the fields on the General 1 tab:

- **Retract Clearance—**Determines the Z coordinate to which the Z axis positions before rapid table positioning. This includes a tool moving from one drilled hole to another, or from one milling operation to another (programmed in separate data blocks or generated as a patterns operation).
  - The default is the maximum programmable Z travel. This is the difference between the Z-Axis MAX Travel and the Z-Axis MIN Travel as indicated on the Machine Specifications screen.
  - The range is 0 through 99.9999 inches (0 through 2514.6 mm).

    If the next operation has a different Z Start value, the CNC always retracts to the highest dimension. When a Position block is programmed, the tool always retracts to The safety plane programmed as Z Top of the Safety Work Region.
- **Rapid Traverse—**Determines the feedrate that the table (X and Y axes) moves between one point in the part program to the next point in the program (rapid table positioning).
  - The default is 400 ipm (10160.0 mm/min).
  - The Range MAX value is user-defined in the Maximum Rapid Traverse Rate field on the Machine Specifications screen. The Range MIN value is 0.1 ipm (2.54 mm/min).
- **Peck Clearance Plane—**Determines the relative distance to the previous peck level. In conversational programming, the tool retracts to Z Start after each peck. The tool then rapids down to a position which is the Peck Clearance distance above the previous peck level before plunging to the next peck level at plunge feedrate.

  Peck Clearance Plane only applies to conversational programs.
  - The default is 0.05 inches (1.27 mm).
  - The range is 0 through 99.9999 inches (0 through 2514.6 mm).
- **Chord Error—**Determines the maximum distance the cutter deviates from the true arc path.
- **Override Lockout—**Disables the Axis Feed dial on the jog unit of Hurco controls when set to On. The default is Off.

General Parameters 2

These are the fields on the General 2 tab:

- **Depletion Retract—**Specifies the dimension above the part surface to which the Z axis retracts. The Z axis retracts while waiting for additional data to be transmitted into the current program during execution of an NC part program.
  - The default is 0.005 inches (.127 mm).
  - The range is 0 through 99.9999 inches (0 through 2514.6 mm).

  Depletion Retract only applies to NC programs.
- **Interrupt Cycle Z Retract—**Retracts the Z axis to Retract Clearance when you press the Interrupt Cycle console button on a Hurco control.
  - Select No to keep the spindle in its current position when the button is pressed.
  - The default is Yes.
- **First Peck Offset—**Permits modifying the depth of the first peck in milling and hole operations. Use this feature whenever a first peck needs to be deeper or shallower than subsequent pecks.

  The permitted range is –10.0000 to + 10.0000 inches or –254.00 to +254.000 millimeters.

  The First Peck Offset value is added to the operation's peck depth in calculating the first peck only. Use a positive First Peck Offset value for deeper peck and negative value for shallower peck. A First Peck Offset of 0.000 will run the pecks normally, without any First Peck Offset.

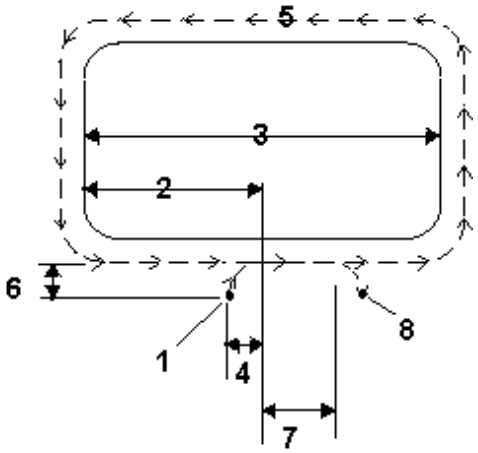
  For example, if the peck depth in a drill operation is set to 0.2000 inches and First Peck Offset is set to +0.0500 inches, then the first peck will be 0.2500 inches down from Z start plane and all subsequent pecks will be 0.2000 inches deep. If the First Peck Offset is set to –0.0500 inches, the result is a first peck only 0.1500 inches down from Z start plane and every subsequent peck will be 0.2000 inches deep.
- **Move to Safe Pos During TC—**Indicates whether or not the table will move to the right/front of the machine when the operator is changing a tool. If this field is set to Yes when a part program block calls for a tool change, the table will move out of the way.
- **Include Offset Z in Tool Zero Cal**—Indicates whether or not the Offset Z value in Part Setup is added to the zero calibration value when tool lengths are adjusted. Default is Yes.

Milling Parameters 1

Milling parameters apply to cutter motions during conversational milling operations only.

Milling 1 Parameters fields are defined as follows:

- **Blend Offset—**Determines the distance from the entry point of the part surface and the Z plunge point where the tool enters the work piece. This field is used in milling circles, frames, and ellipses.
  - The default is 0.1250 inches (3.175 mm).
  - The range is 0 through 1.0 inch (0 through 25.4 mm).
- **Blend Overlap—**Determines the distance the tool travels past the entry point before it is withdrawn from the part. This field is used in milling circles, frames, and ellipses.
  - The default is 0.1250 inches (3.175 mm).
  - The range is 0 through 1.0 inch (0 through 25.4 mm).



1	Start Point
2	1/2 X Length
3	X Length
4	Blend Offset
5	Tool Path
6	Blend Offset
7	Blend Overlap
8	End Point

Figure 11. Blend Offset and Blend Overlap

- **Finish Feed (%)**—Allows you to specify a different feed for finishing operations without changing the tool. The specified percentage is a multiplier of the feed entered in Tool Setup. This multiplier is applied whenever the tool is entered for the finishing operation of a milling block. (See example below.)

  ⇨ If this parameter is changed in either Program Parameters or with a Change Parameters block, all existing data blocks that are affected by the multiplier will be updated.

- **Finish Speed (%)**—Allows you to specify a different speed for finishing operations without changing the tool. The specified percentage is a multiplier of the speed entered in Tool Setup. This multiplier is applied whenever the tool is entered for the finishing operation of a milling block. (See example below.)

  ⇨ If this parameter is changed in either Program Parameters or with a Change Parameters block, all existing data blocks that are affected by the multiplier will be updated.

Finish Feed / Finish Speed example:

Program Parameters: Finish Speed %=120, Finish Feed %=80

Tool Setup: Speed=5000, Feed=100

When a program block is created, the speed is automatically set to 5000 and the feed is set to 100. When the tool is entered into the finishing operation, the multipliers are applied, and finish speed is set to 6000 (5000 x 120%), finish feed is set to 80 (100 x 80%).

⇨ The Finish Feed and Finish Speed parameters are not applied if the roughing feed or speed in a data block is changed.

Values entered manually into the Finish Feed or Finish Speed fields in the data block take precedence over these parameters.

If the Tool & Material Library option is enabled, separate roughing and finishing defaults can be set for each tool. If finishing defaults are defined for a tool, those values take precedence over the Finish Feed and Finish Speed multiplier parameters.

- **Finish XY—**Determines the amount of material in the X-Y axis direction to be removed by the finish pass.
  - The default is 0.2 mm (0.007874 inches).
  - The range is 0 through 25.4 mm (0 through 1.0 inches).

  ⇨ Stock is removed up to a **maximum** of 90% of tool diameter.

  For example, if 25 mm is entered in the Finish XY field, and the tool has a diameter of 10 mm, the XY stock removed on the finish pass will be 9 mm (90% of the 10 mm tool diameter), despite the number entered in the Finish XY field.

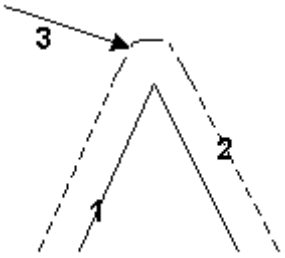
- **Finish Z—**Determines the amount of material in the Z axis dimension to be removed by the finish pass.
  - The default is 0.1 mm (0.003937inches).
  - The range is 0 through 1.0 inch (0 through 25.4 mm).

- **Milling Direction—**Determines the milling type. Select Conventional or Climb milling for canned milling cycles (e.g., frame, circle, and ellipse) and for contours (e.g., line, arc).
  - The default is Climb.
  - The choices are Conventional or Climb.
- **Default Pocket Overlap—**Determines the cutter step-over movement in a pocket milling operation. After the first pass, the tool follows a path produced by offsetting the boundary by the tool radius, plus the pocket overlap for each pass while avoiding islands inside the boundary.
  - The default is 50%.
  - The range is 0 through 99%.
- **Cutter Comp Param—**Determines the programmed tool automatically follows the finished contour of the part with cutter compensation. Without cutter compensation, the center line of the programmed tool follows the print line.
  - **Insert Arc—**Inserts a tangent arc to connect two line segments, or a line segment and an arc segment (when the two cutter compensated segments are offset and do not intersect).

1	Programmed Tool Path
2	Cutter Compensated Path
3	Using the Insert Arc Parameter

Figure 12. Cutter Compensation using the Insert Arc parameter

  - **Insert Line—**Joins the cutter compensated lines and arcs as described below:
    - Two line segments are extended until they intersect (provided they form a 90º or greater angle). If the lines form an angle of less than 90º, a line is inserted to connect them.
    - Line and arc segments have the line segment extended, and a tangent line to the arc segment inserted and extended until the lines intersect (provided they form a 90º or greater angle). If the segments form an angle of less than 90º, a line is inserted to connect them.
    - Two arc segments have tangent lines (to the arcs) inserted and extended until the lines intersect (provided the extended tangent lines form a 90º or greater angle). If the extended tangent lines form an angle of less than 90º, a line or arc is inserted to connect them.



1	Programmed Tool Path
2	Cutter Compensated Path
3	Completed Path Using the Insert Line Parameter

Figure 13. Cutter Compensation using the Insert Line parameter

Milling Parameters 2

The Milling 2 Parameters fields are related to the Helical Plunge Option:

- Mill Plunge Type
- Mill Plunge Ramp Slope
- Mill Plunge Helix Radius
- Finish Plunge Type
- Finish Plunge Ramp Slope
- Finish Plunge Helix Radius
- Operator Specify Pocket Start
- Inward Pocket Plunge Near Center

Refer to Helical Plunge in *WinMax Mill Options* for details about these parameters.

Holes Parameters

The Holes Parameters fields are defined below:

- **Bore Orient Retract—**Determines the distance the boring tool moves away from the part surface at the end of the boring cycle. Used only when a Bore Orient data block is included in the part program.
  - The default is 0.05 mm (0.019685 inches).
  - The range is 0 through 99.9999 inches (0 through 2514.6 mm).
- **Drill Dwell—**Determines the pause (dwell) in seconds before the tool retracts at the bottom of a drill operation. The most often changed Holes Parameter is Drill Dwell. This parameter controls the length of time the drill stays at the bottom of a hole after it has drilled the hole. This parameter is not used for NC programs.
  - The default is 0.5 seconds.

  - The range is 0 through 20 seconds. (Set this to 0.0 seconds, and the drill immediately pulls out of the hole after it is drilled.)
- **Bore Dwell—**Determines the pause in seconds before the tool retracts at the bottom of a Bore operation. This parameter is not used for NC programs.
  - The default is 1.0 seconds.
  - The range is 0 through 20 seconds.

Probing Parameters

The Probing Parameters are:

- **Automatic Tool Monitoring**—indicate if tools that were calibrated with the probe should be automatically checked with each tool change.
- **Zero Cal (Length) Tolerance—**indicate the zero calibration (tool length) used when checking for a defective tool.
- **Diameter Tolerance**—indicate the diameter tolerance used when checking for a defective tool.
- **Retain Probed Part Setup**—allows the probed part setup and/or tool calibrations to be retained for new program runs. Choices are:
  - **Do Not Retain**—no updates will be made to part zero or tool lengths.
  - **Retain All**—retains part setup and tool calibrations.

⇨ Previous versions of WinMax may have included additional selections which have subsequently been removed; older programs that contained a selection other than **Do Not Retain** or **Retain All** will be converted to Retain All upon opening, and a message will appear informing the user.

For example, the following table shows Part Setup values for a sample program before and after a Probed Part Setup is executed:

Original Part Setup values	Probed Part Setup values
Part Zero X = 20.0000 Part Zero Y = 10.0000 Probe Z = 15.0000 Skew Angle = 0.0000 Zero Cal = 18.0000 (Tool Setup)	Part Zero X = 19.1234 Part Zero Y = 11.1111 Probe Z = 16.5555 Skew Angle = 2.0045 Zero Cal = 17.4444 (Tool Setup)

If Retain Probed Part Setup is set to **Do Not Retain**, the original values for Part Setup and Zero Cal will be restored. Part Setup and Tool Setup will contain the original data (20, 10, 15, 0, and 18).

If Retain Probed Part Setup is set to **Retain All**, Part Setup and Tool Setup will contain the probed values (19.1234, 11.1111, 16.5555, 2.0045, and 17.4444).

⇨ OFFSET Z is not affected in any way by the probe block or the parameter setting.

Performance Parameters

Surface Finish Quality (SFQ) is enabled with the SelectSurface Finish Quality option. SFQ parameters can be modified in either Conversational or NC programming. The default SFQ for roughing is 80 and finishing is 20. Recommended values are:

SFQ	Desired Result
1-20	High precision parts /finishing
21-79	Good surface quality / finishing, semi-finishing
80-100	High throughput / roughing

Table 4. Recommended SFQ values

⇨ If SelectSurface Finish Quality is not enabled, conversational roughing tools use SFQ of 80 and conversational finishing tools use SFQ of 20; NC default is 50.

Smoothing Tolerance specifies the maximum allowable deviation from the tool path. The range is 0.0000 to 0.0500 inches (0.0000 to 1.2700 mm); default is 0.0005 inches (0.01270 mm). This corresponds to NC code G05.2.

Mill Intro Class Assistance Sheet

Note: when navigating the WinMax control the most important button is the **INPUT** button – from the input screen the operator can find all the menu soft-keys necessary to setup, program, and run the part program.

Creating a New Program:

1. **Program Manager**
    - Press the INPUT button on the control panel
    - Press the PROGRAM MANAGER softkey
    - Press the NEW softkey
    - Press the CONVERSATIONAL PROGRAM softkey

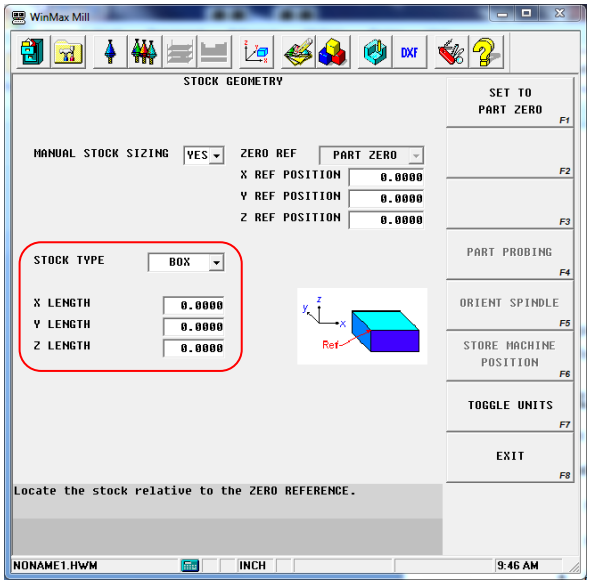
    Note: a program will be created with the name NONAME + the next available number.

Programming & Preparation

2. **Part Setup:**

    Define Stock Geometry: setup the stock geometry for the part program (this information is used for graphic verification only)

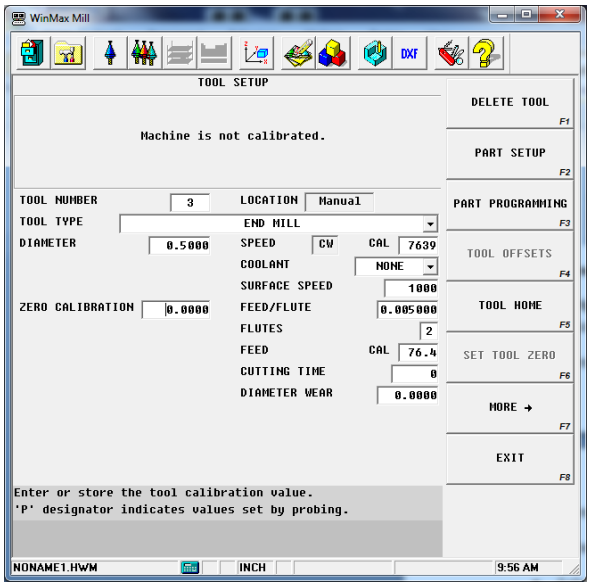
    - Press the INPUT button on the control panel
    - Press the PART SETUP softkey
    - Press the MORE softkey
    - Press the STOCK GEOMETRY softkey
    - Answer YES to the first question – “Manual Stock Sizing”
    - Fill in necessary stock information



3. Tool Review:

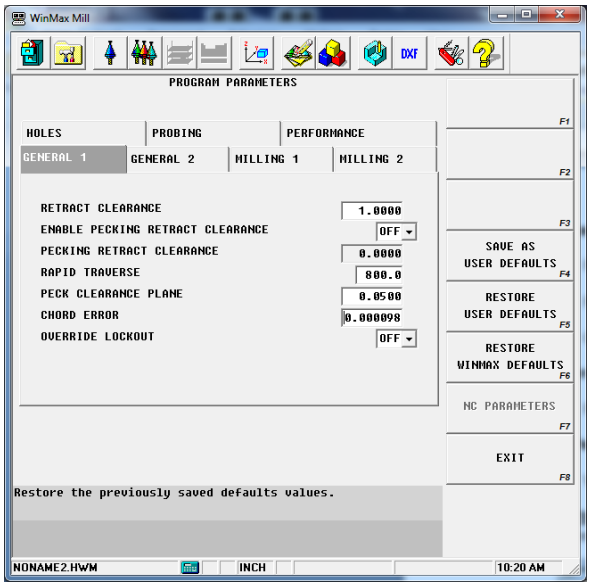
Tool Description: describe **ALL** necessary tools for the program – use the tool list on the class print. Be sure to associate speeds and feeds for each tool to assist in programming.

- Press the INPUT button on the control panel
- Press the TOOL REVIEW softkey
- Press the TOOL SETUP softkey
- Enter the desired TOOL NUMBER in the provided field
- Select the desired TOOL TYPE
- Enter the TOOL DIAMETER in the provided field
- Enter the speeds & feeds information (Example: 1000 Surface Speed; .005 Feed/Flute; 2 Flute)
- **NOTE**: the Zero Calibration Field should be left at 0.0000” – this field is only used when actually setting up the tools at the machine.



4. **Part Programming:**
    - Press the INPUT button on the control panel
    - Press the PART PROGRAMMING softkey
    - Create the necessary conversational blocks of the part program.
5. **Graphic Verification:**
    - Press the DRAW button to display the part program in graphics to verify the part program.
6. **Program Parameters:**
    - Verify the PROGRAM PARAMETERS settings.

    Note: the most commonly used parameter is RETRACT CLEARANCE at the top of the first screen (General Tab).

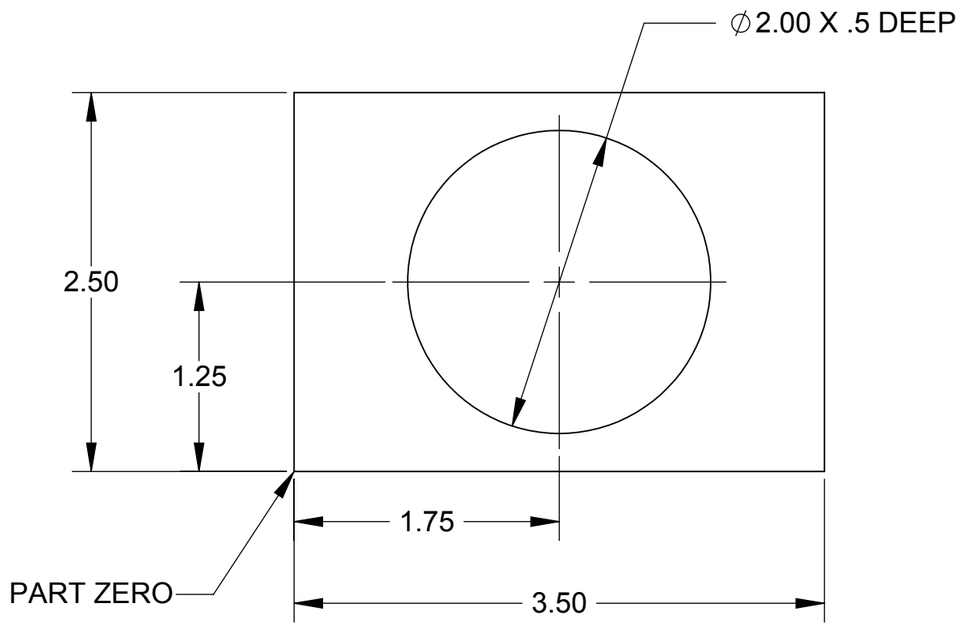


Saving a Part Program:

1. **Program Manager**
    - Press the INPUT button on the control panel
    - Press the PROGRAM MANAGER softkey
    - Highlight the desired program to be saved on the screen
    - Press the SAVE AS softkey
    - Rename the program to the desired program name (Example: INTRO 5)
    - Select the desired directory for the program to be stored in (create a new directory if necessary by using the CREATE DIRECTORY softkey)
    - Press the SAVE softkey

TOOL LIST

5/8 CENTER CUT END MILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1x2.5x3.5 6061-T651 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **INTRO-1**

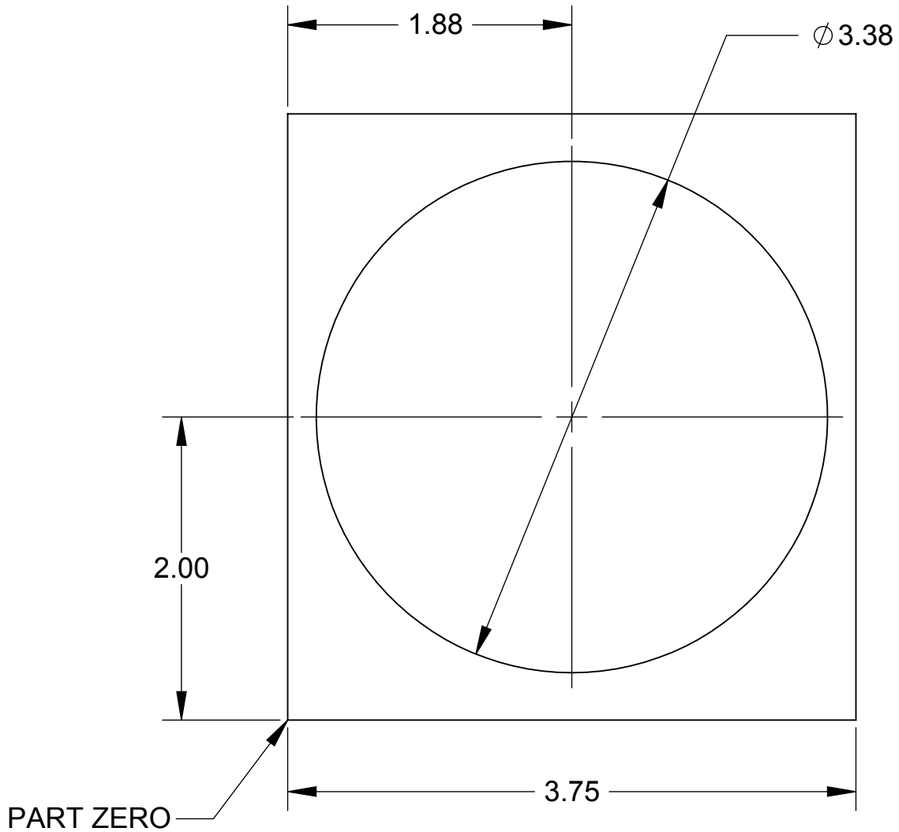
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

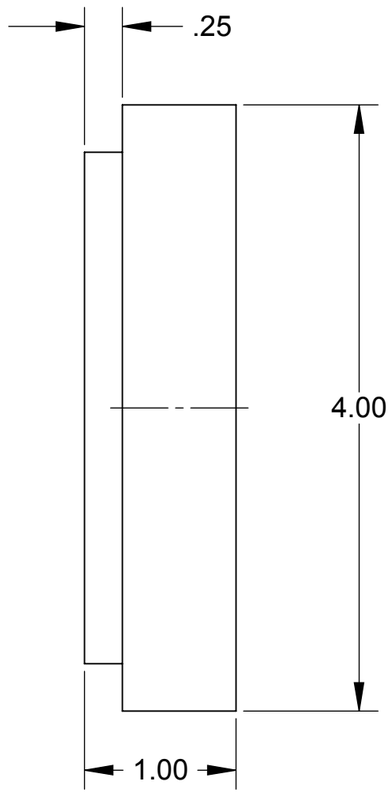
SCALE	SIZE	DRAWING	SHT	REV.
1:1	B	INTRO-1	1 OF 1	A

UNIT OF MEAS. PC

TOOL LIST

3/4 CENTER CUT END MILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1x3.75x4 1045 CRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **INTRO-2**

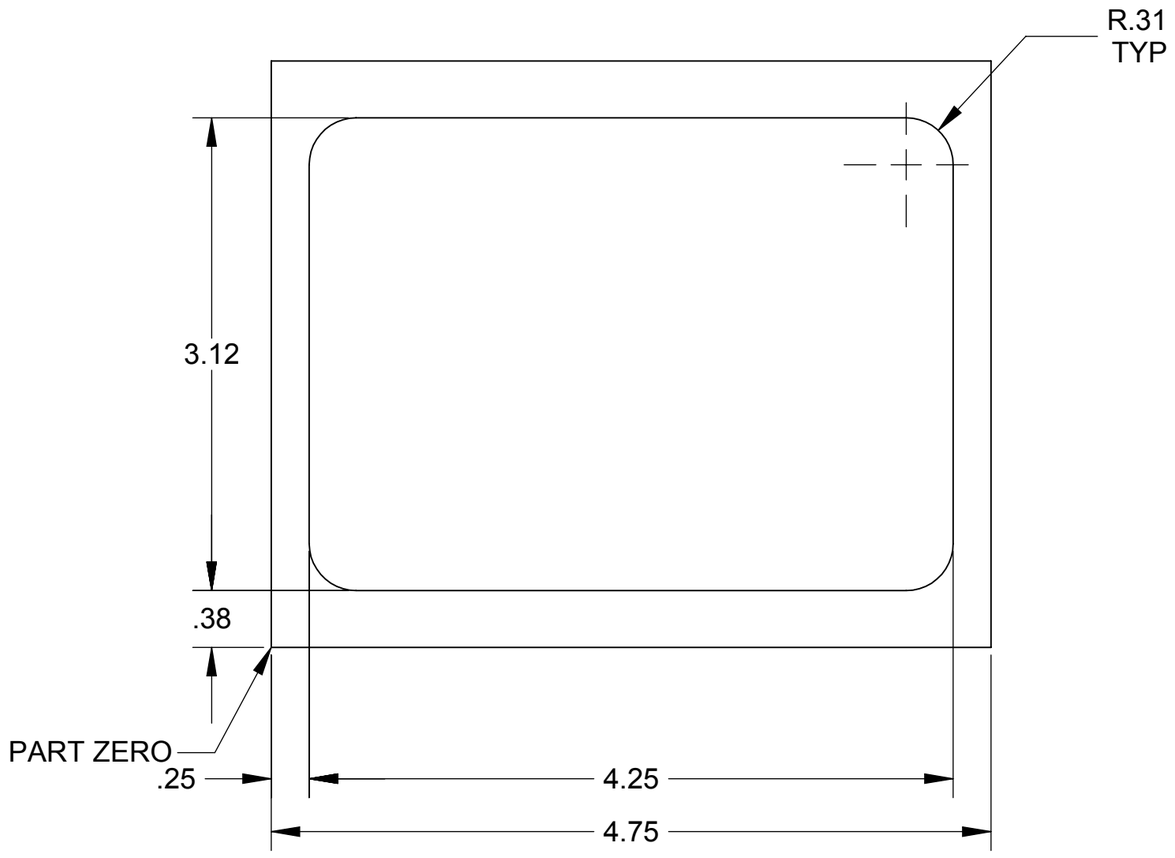
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

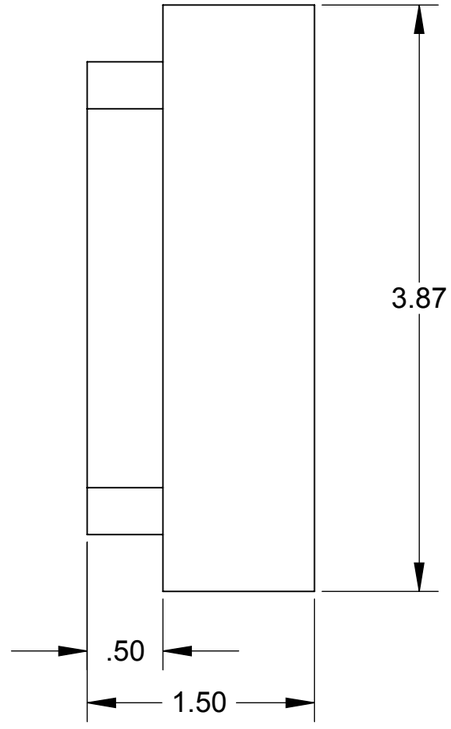
SCALE	SIZE	DRAWING	SHT	REV.
1:1	B	INTRO-2	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

9/16 END MILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.5X3.87X4.75 TITANIUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: INTRO-3

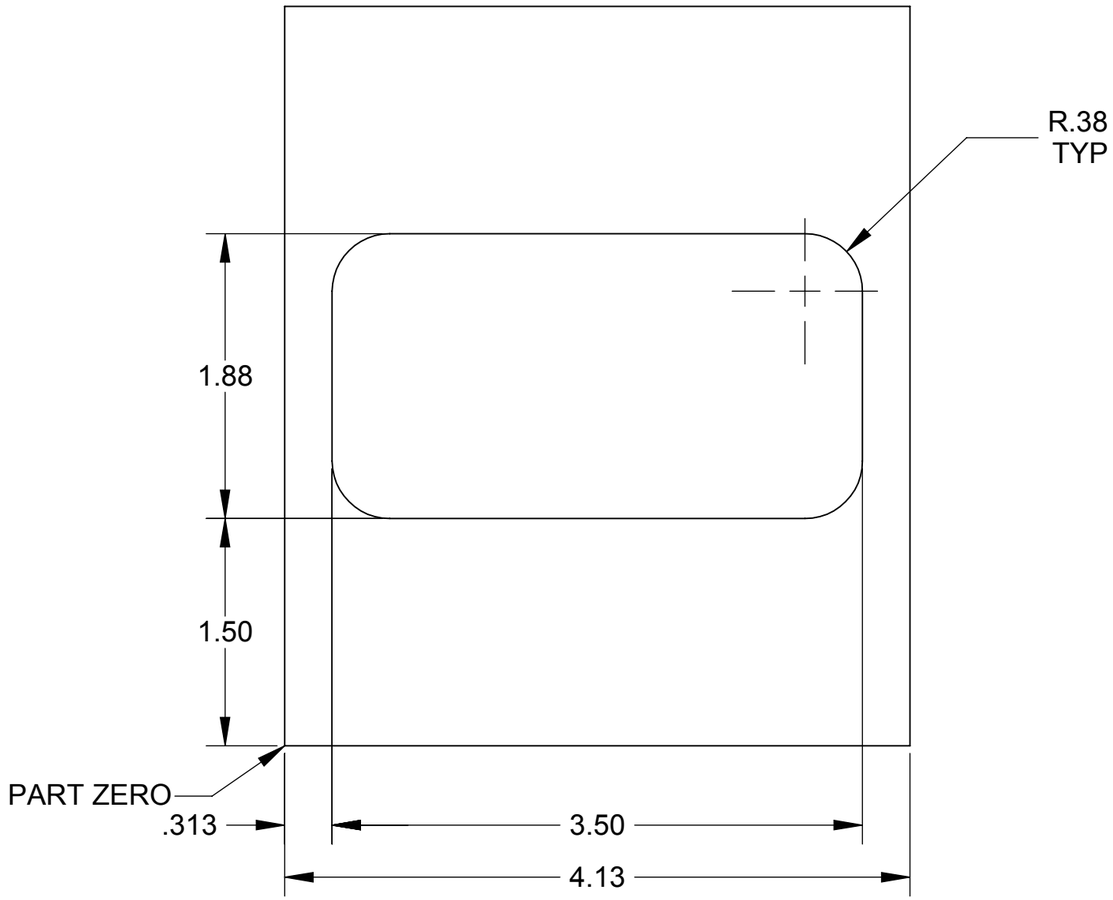
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

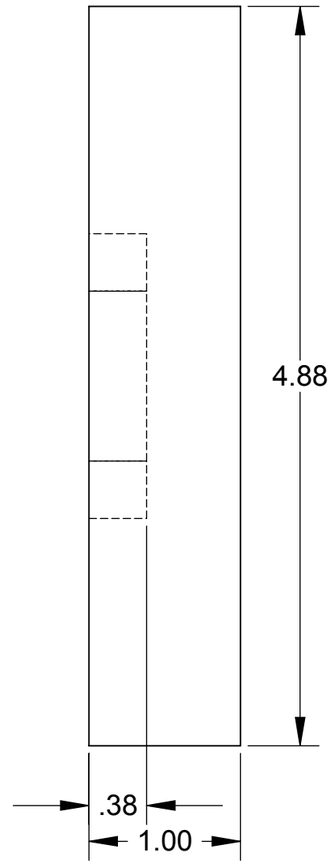
SCALE	SIZE	DRAWING	SHT	REV.
1:1	B	INTRO-3	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

11/16 CENTER CUT END MILL
3" 45° FACEMILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1X4.125X4.875 CARBON STEEL	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

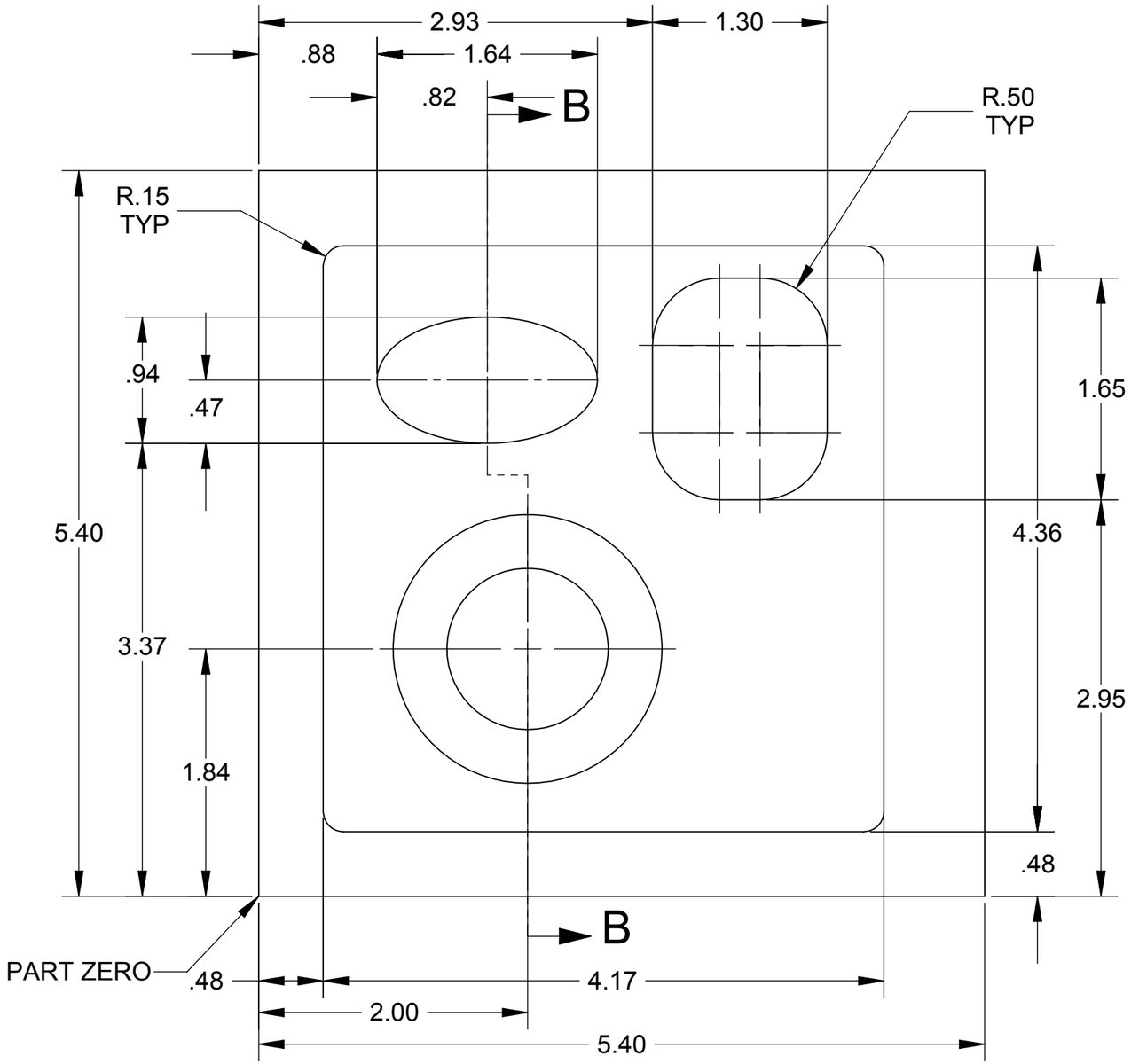
THIRD ANGLE PROJECTION

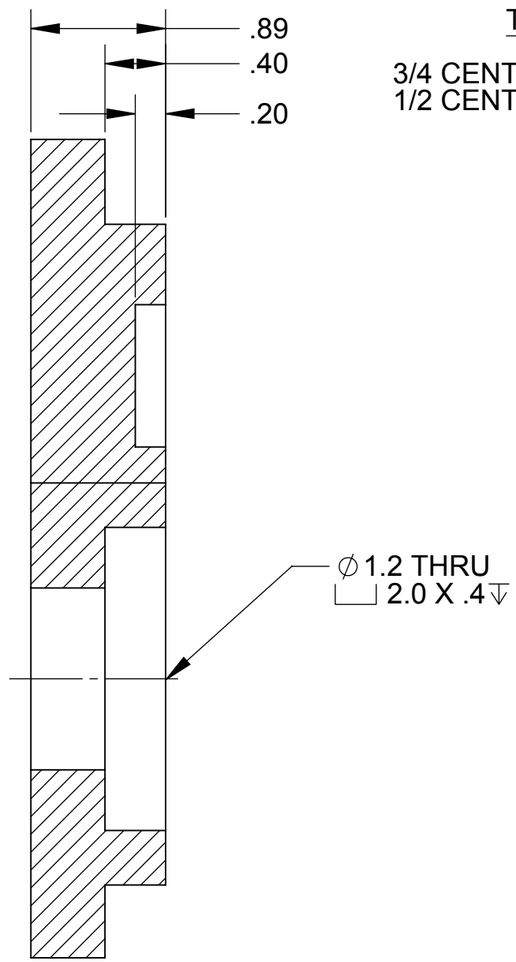
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **INTRO-4**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 1:1
UNIT OF MEAS.: PC
SIZE: B
DRAWING: INTRO-4
SHT 1 OF 1
REV. A





SECTION B-B

TOOL LIST

3/4 CENTER CUT END MILL
1/2 CENTER CUT END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.89x5.4x5.4 5056 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: INTRO-5

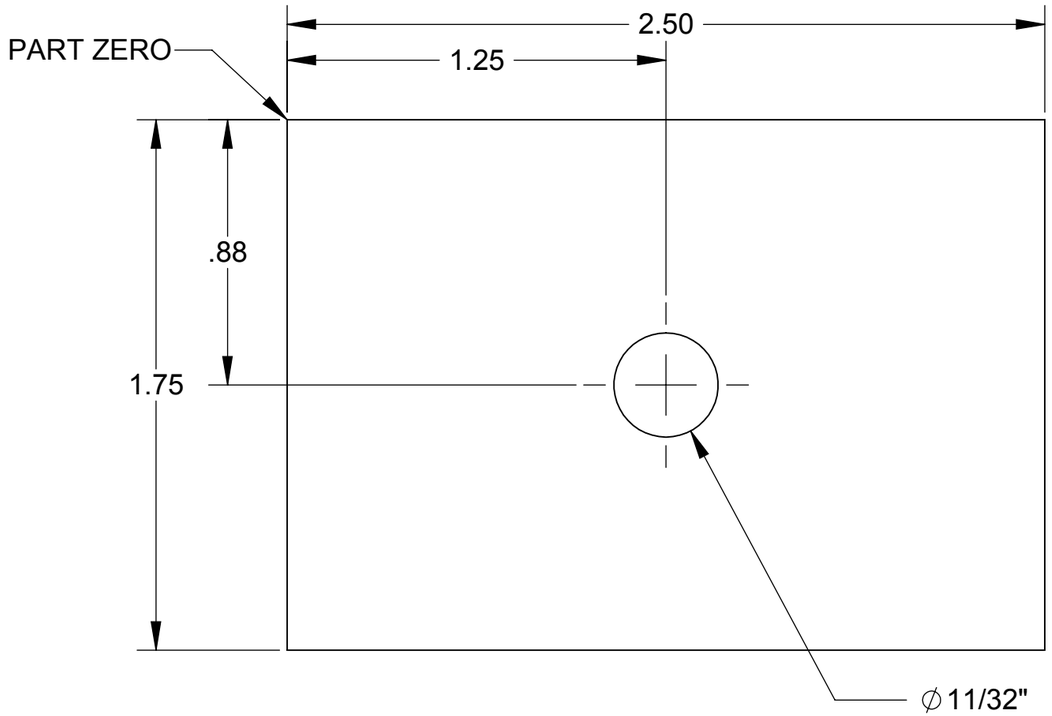
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

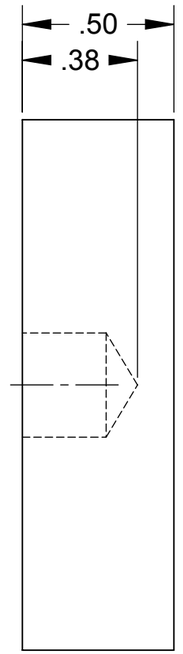
SCALE	SIZE	DRAWING	SHT	REV.
1:1	B	INTRO-5	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

11/32 DRILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.5x1.75x2.5 2024 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **INTRO-6**

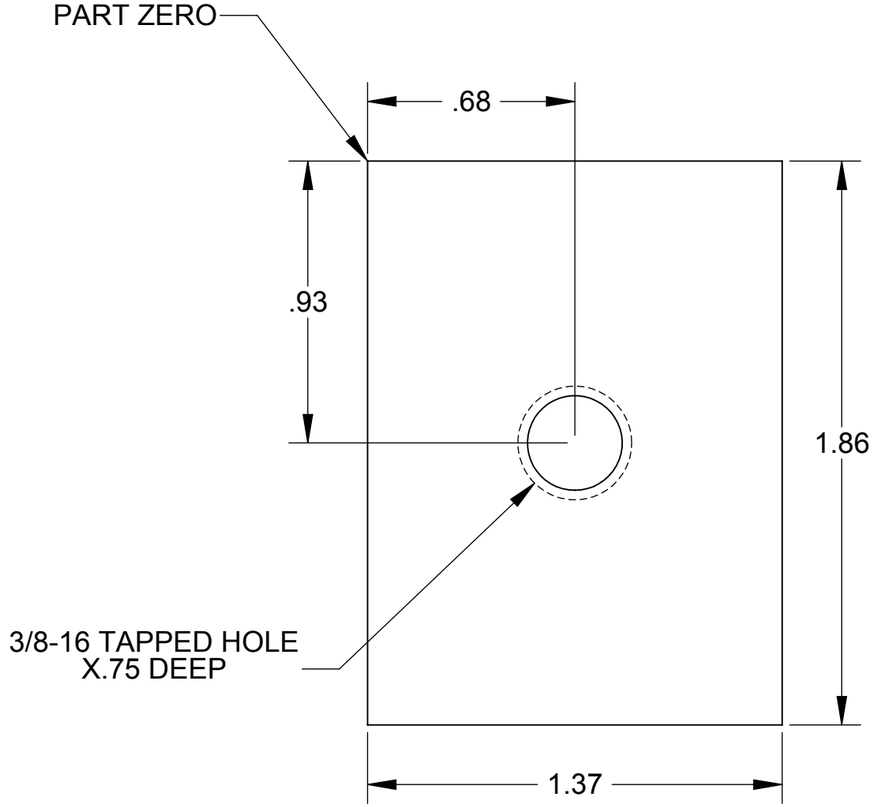
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

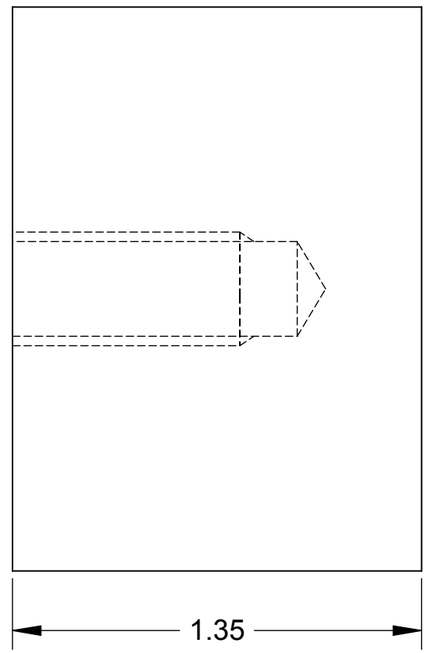
SCALE	SIZE	DRAWING	SHT	REV.
2:1	B	INTRO-6	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

1/8 CENTER DRILL
5/16 DRILL
3/8-16 TAP





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.35x1.368x1.86 1045 CRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

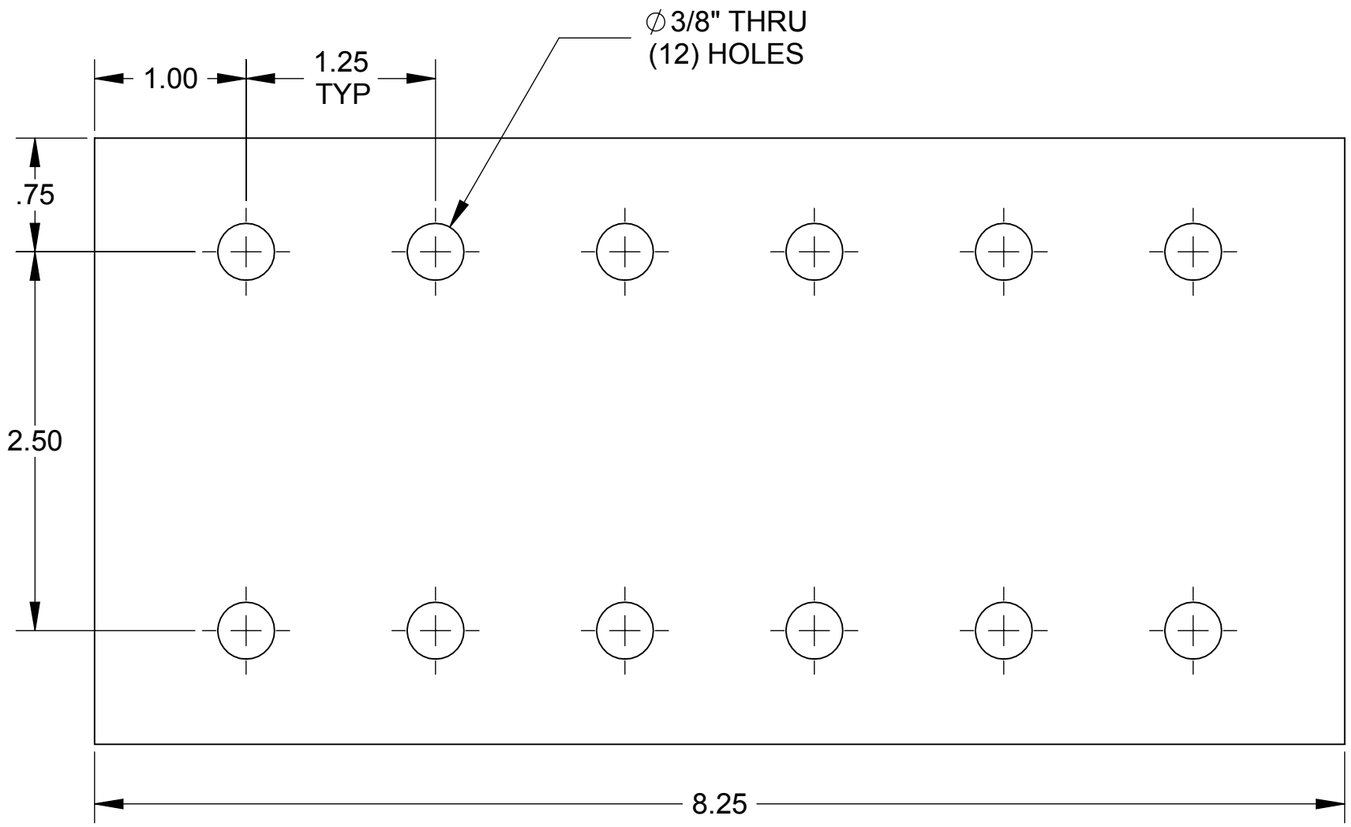
THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **BLOCK, PIVOT**

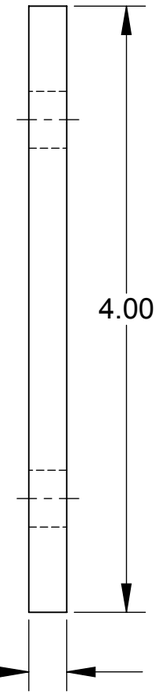
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 2:1
UNIT OF MEAS.: PC
SIZE: B
DRAWING: INTRO-7
SHT 1 OF 1
REV. A



TOOL LIST

1/8 CENTER DRILL
3/8 DRILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.25x4.0x8.0 6061 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **PLATE, SPACER**

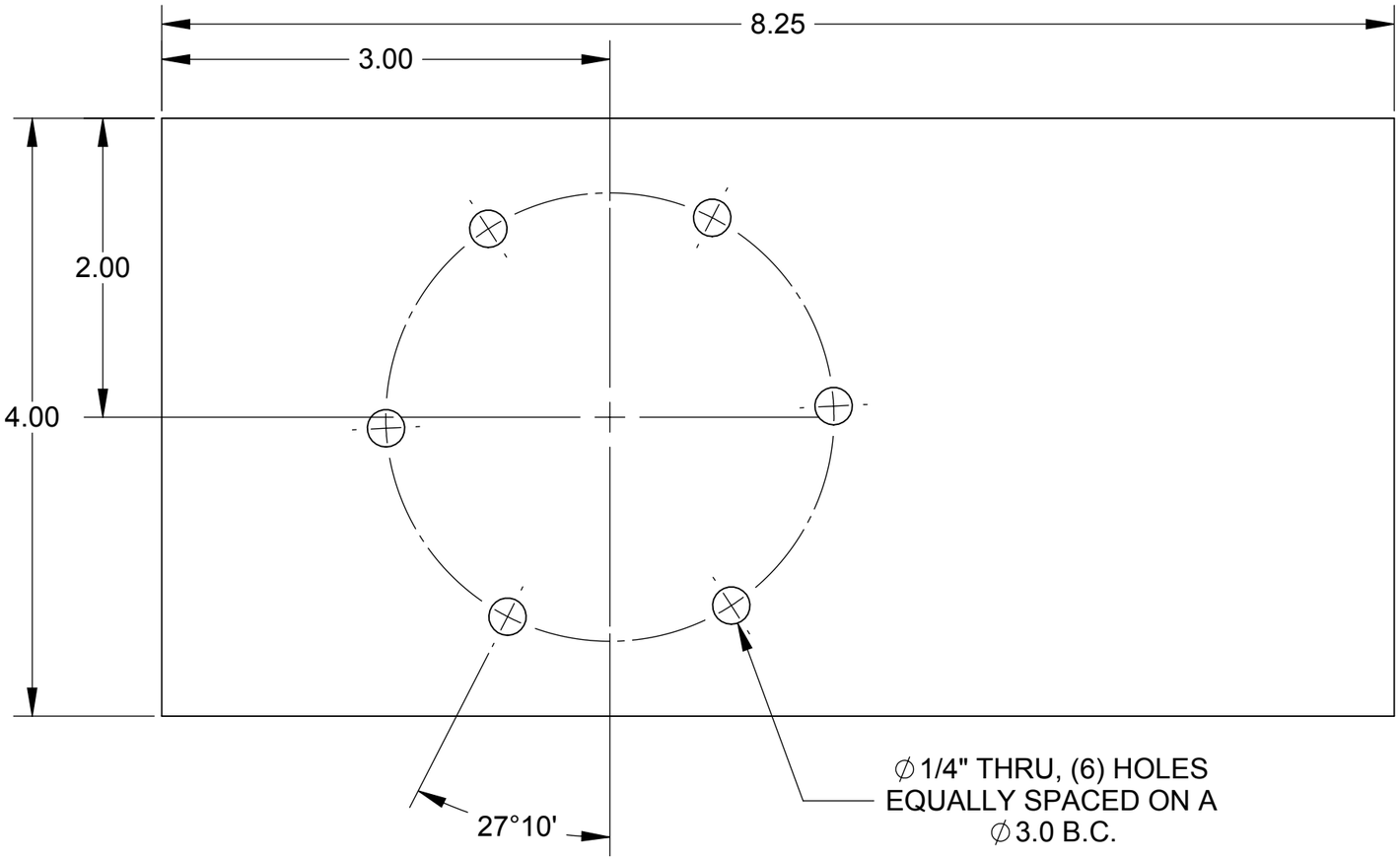
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

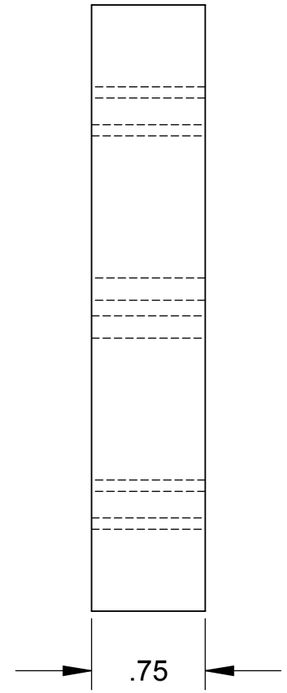
SCALE	SIZE	DRAWING	SHT	REV.
1:1	B	INTRO-8	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

1/8 CENTER DRILL
1/4 DRILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.75x4.0x6.0 6061 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

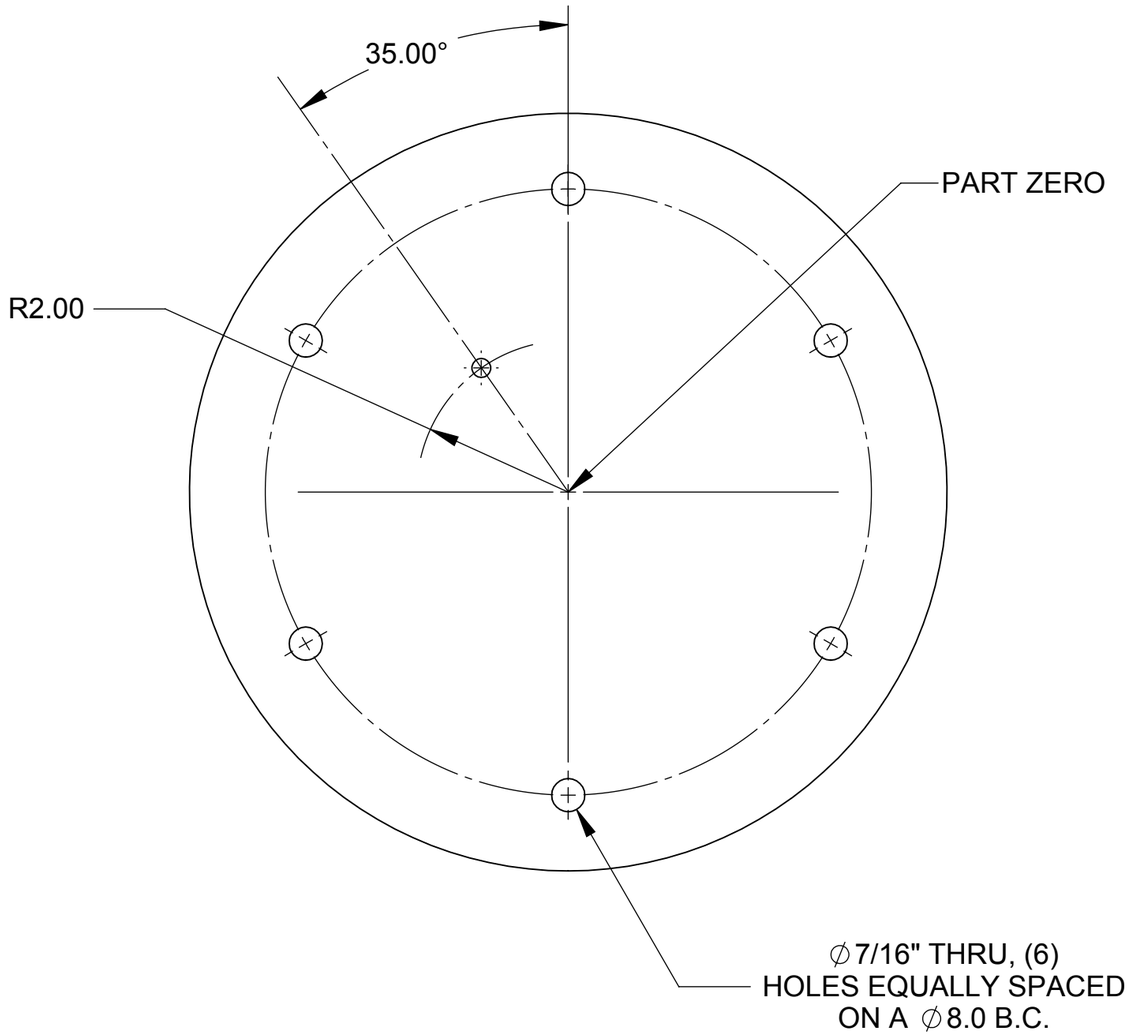
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

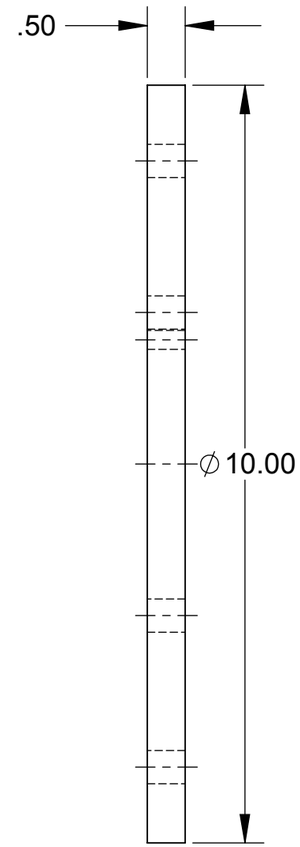
DESCRIPTION: **PLATE, MOUNTING**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	B	INTRO-9	1 OF 1	A

UNIT OF MEAS.: PC





TOOL LIST

1/8 CENTER DRILL
1/4 DRILL
7/16 DRILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.5x10 DIA GRAY CAST IRON	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

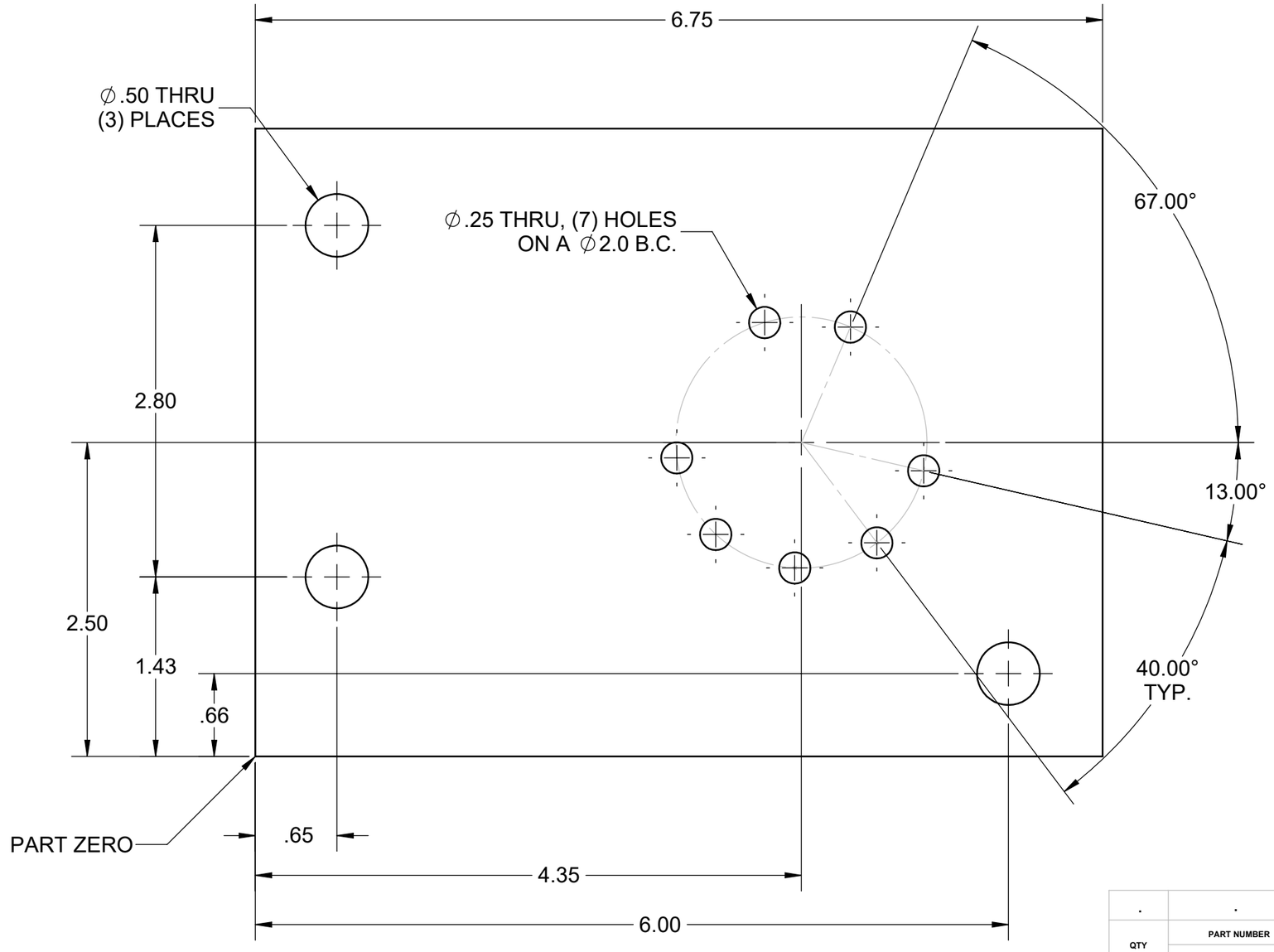
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **PLATE, INDEX**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

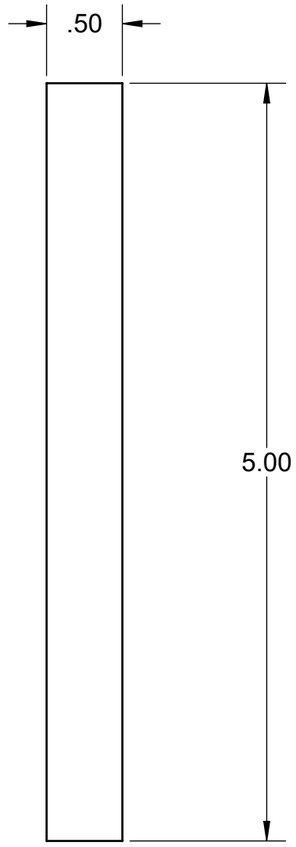
SCALE	SIZE	DRAWING	SHT	REV.
1:2	B	INTRO-10	1 OF 1	A

UNIT OF MEAS.: PC



TOOL LIST

1/8 CENTER DRILL
1/4 DRILL
1/2 DRILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.5x5.0x6.75 1018 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE	.	.	.	.	.	.

757-4006-034

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS:
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS: ±3

GENERAL TOLERANCES: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS IN METRIC

From	0.5	±0.1
To	6	
Over	6	±0.2
To	30	
Over	30	±0.3
To	120	
Over	120	±0.5
To	400	
Over	400	±0.8
To	1000	
Over	1000	±1.2
To	2000	
ANGULAR		±0°30'

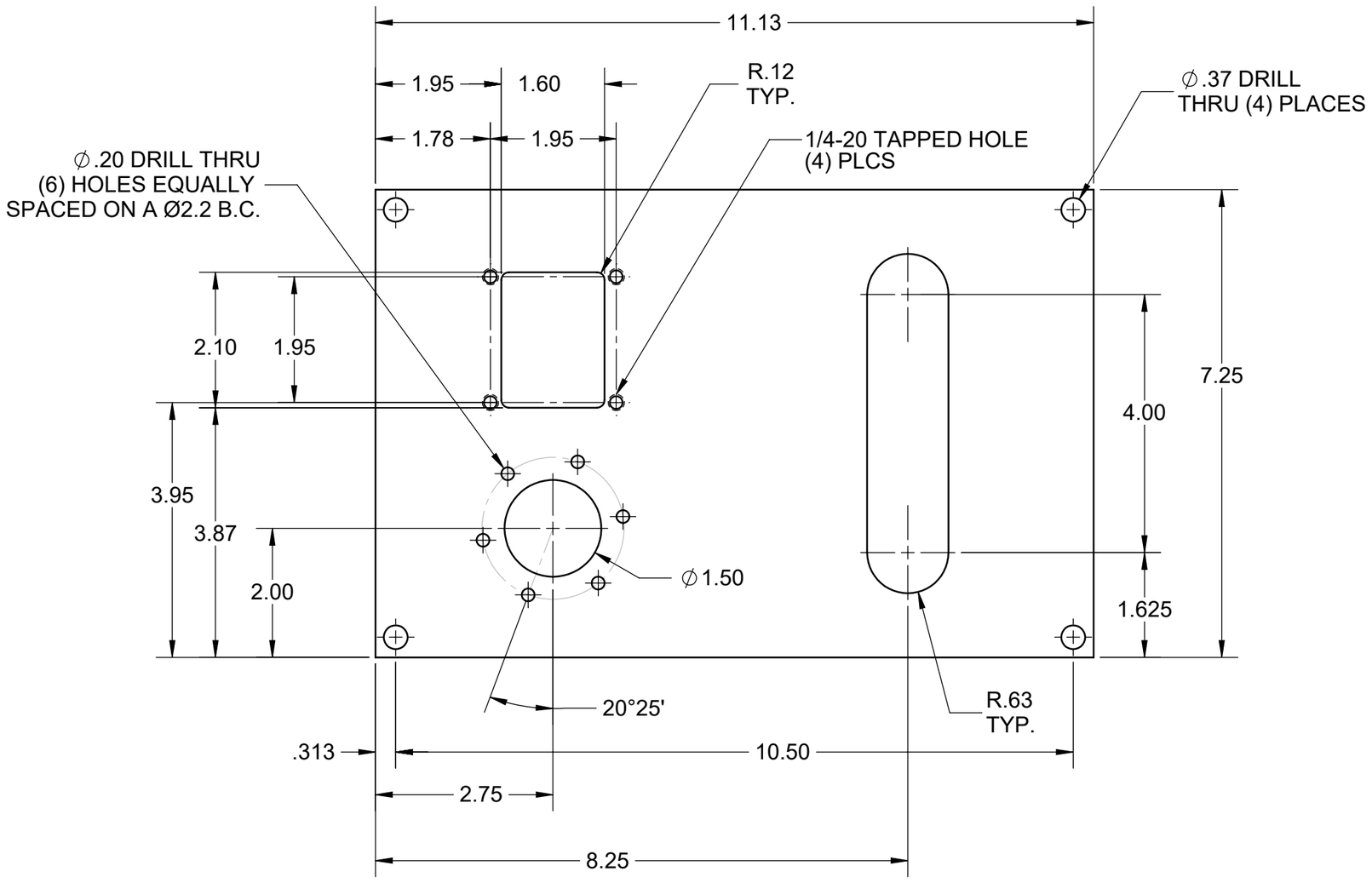
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

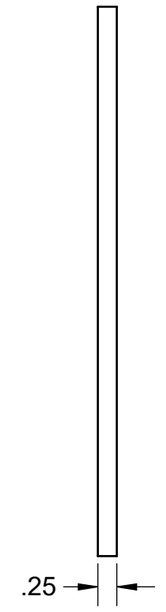
DESCRIPTION: **PLATE, TOOLING**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-11	1 OF 1	A

UNIT OF MEAS.: PC





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.25X7.25X11.126 1018 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE	.	.	.	.	.	.

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS:
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS: ±3

GENERAL TOLERANCES: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS IN METRIC

From	0.5	±0.1
To	6	
Over	6	±0.2
To	30	
Over	30	±0.3
To	120	
Over	120	±0.5
To	400	
Over	400	±0.8
To	1000	
Over	1000	±1.2
To	2000	
ANGULAR		±0°30'

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

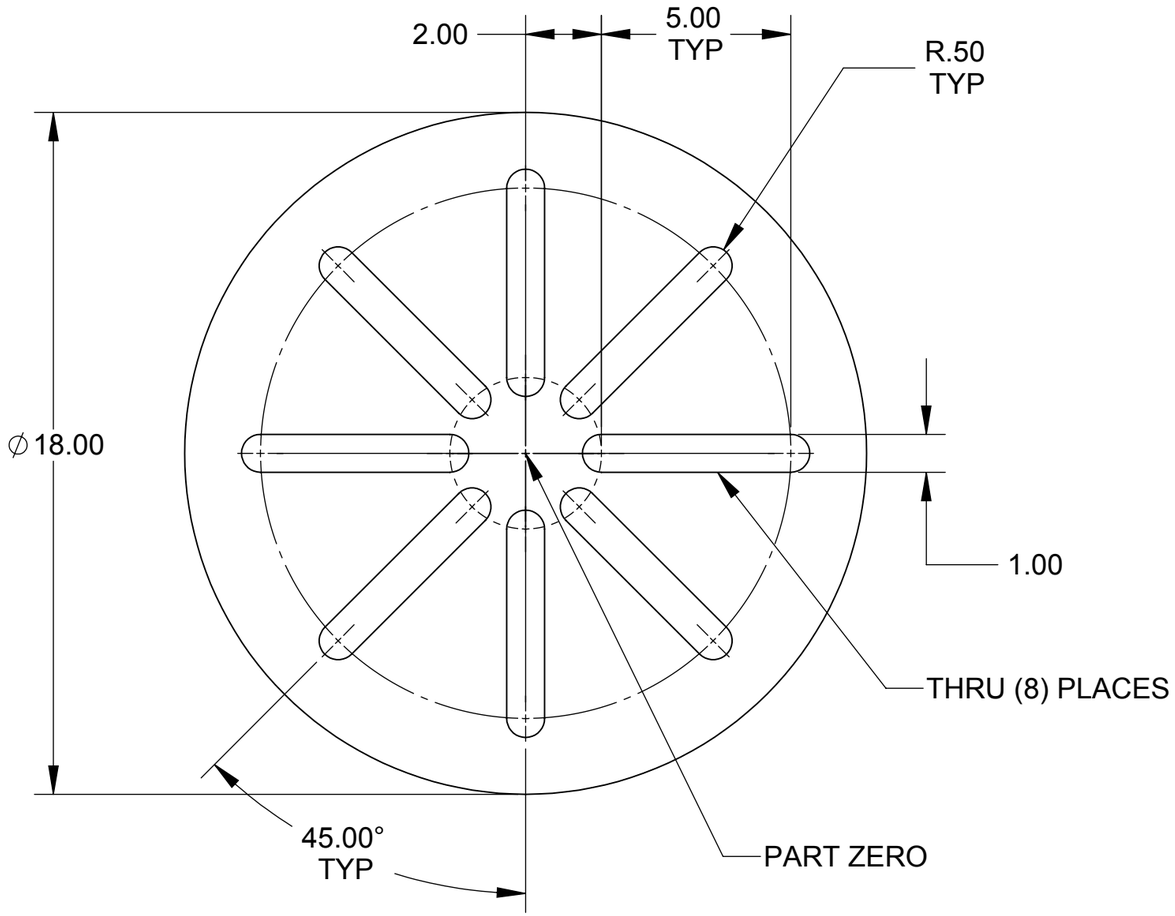
DESCRIPTION: **PLATE, GUIDE**

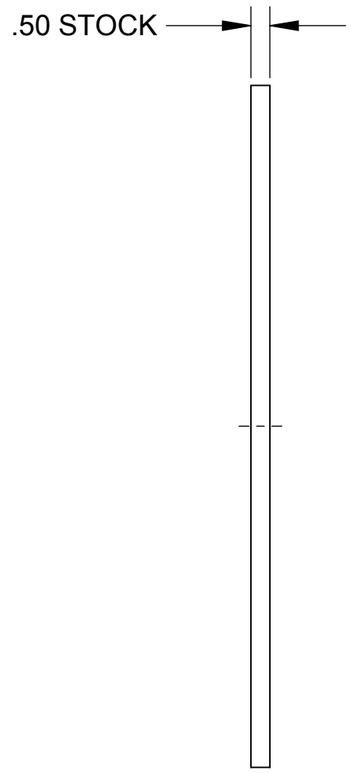
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
.	.	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:2	A3	INTRO-12	1 OF 1	A

UNIT OF MEAS. PC

757-4006-034





TOOL LIST

3/4 CENTER CUT END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.5x18.0 DIA BAR 6061-T651 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

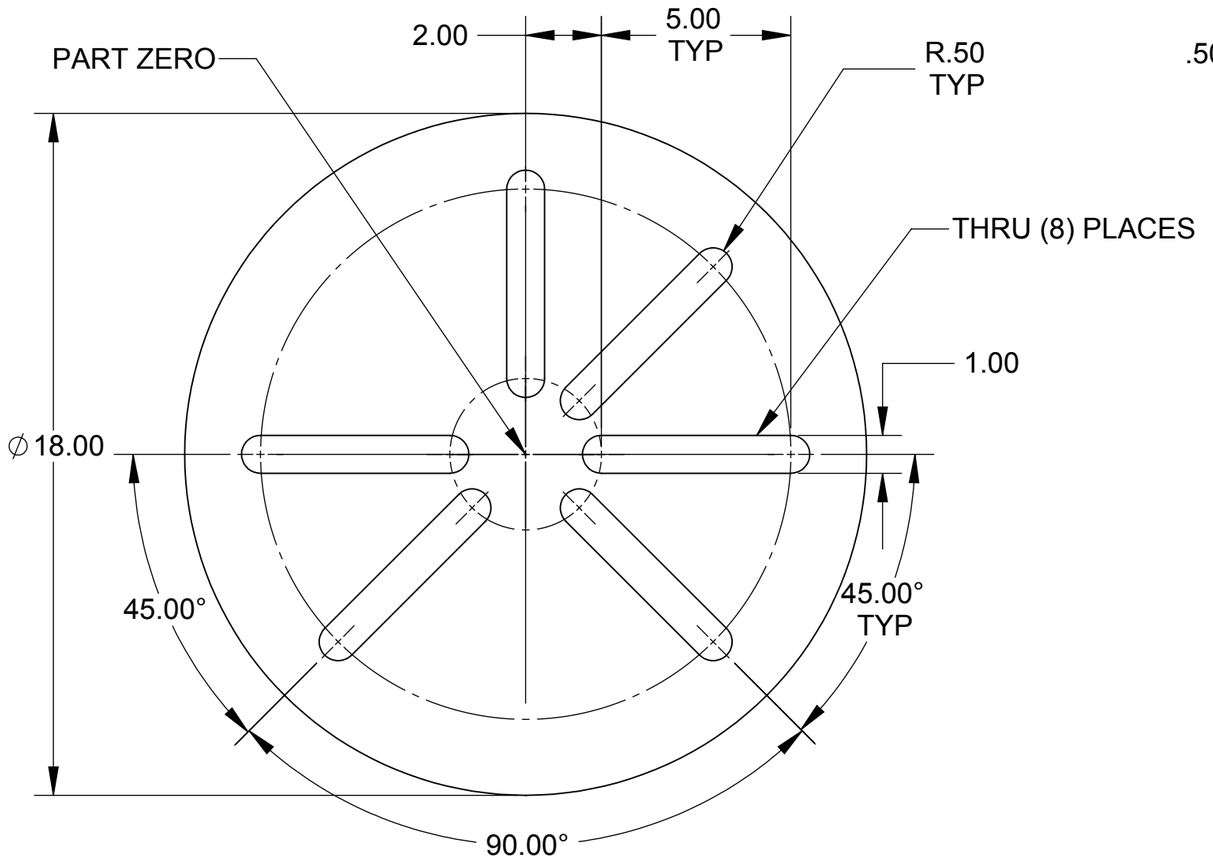
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **TABLE, INDEX**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

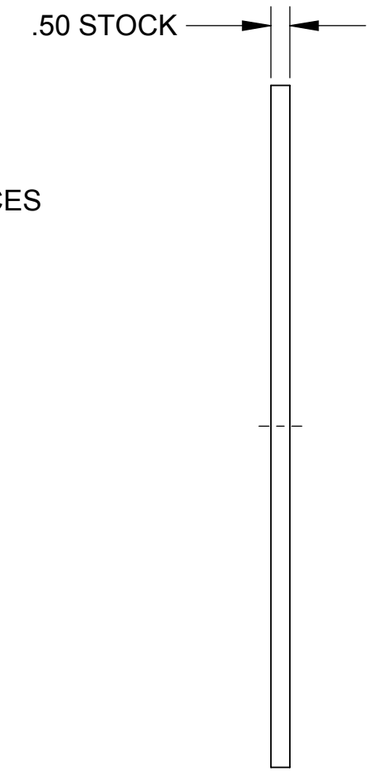
SCALE	SIZE	DRAWING	SHT	REV.
1:4	A3	INTRO-13	1 OF 1	A

UNIT OF MEAS.: PC



TOOL LIST

3/4 CENTER CUT END MILL



PARTS LIST

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.5x18.0 DIA BAR 6061-T651 ALUMINUM	.

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **TABLE, INDEX**

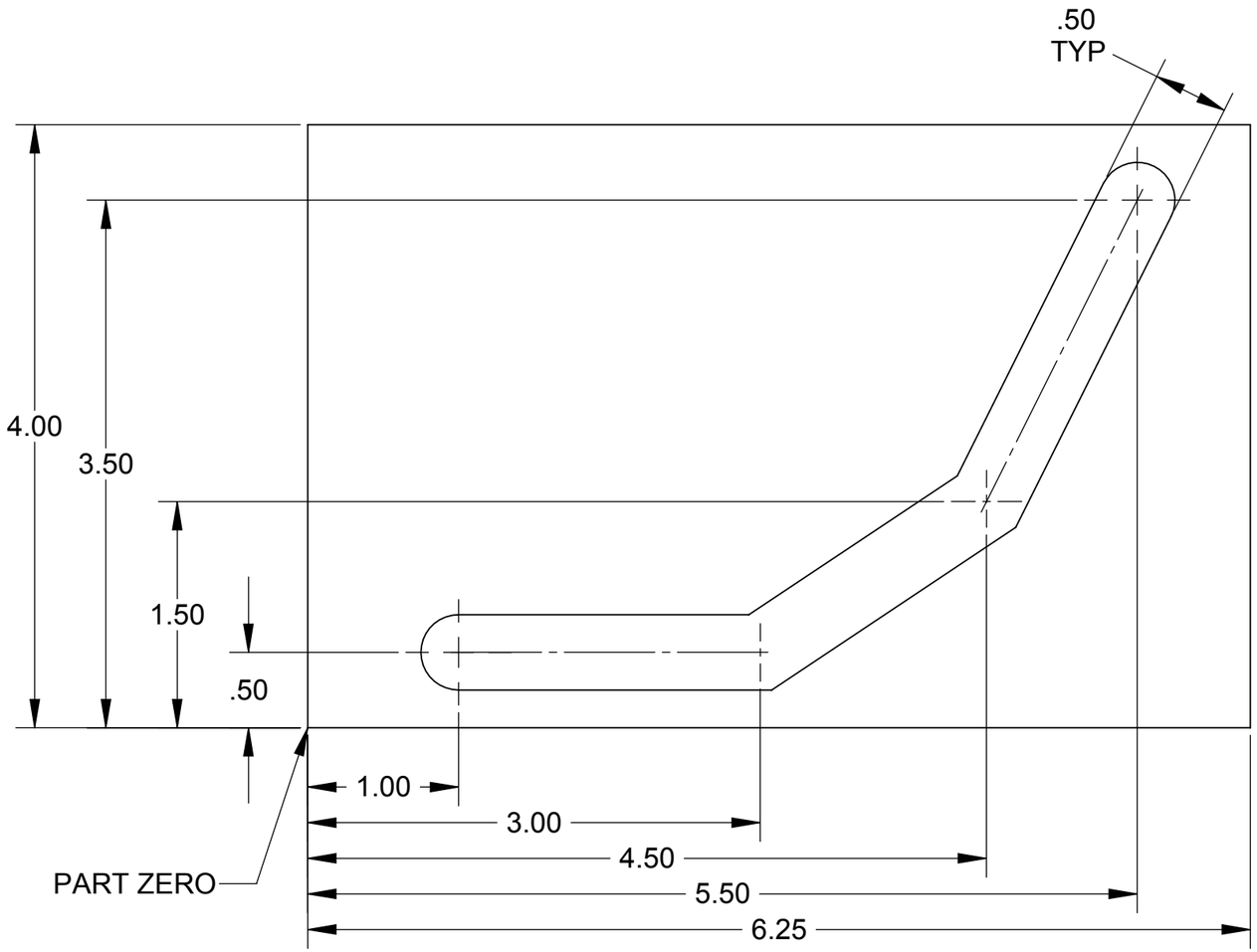
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

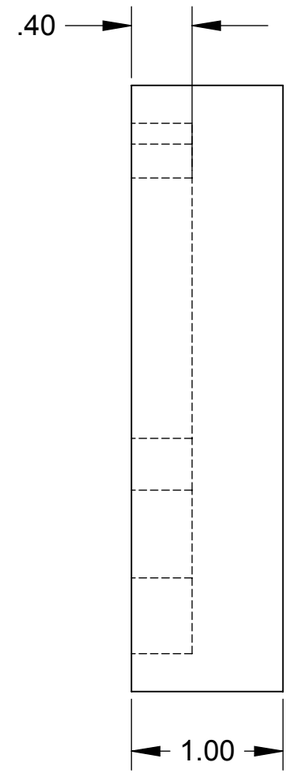
SCALE	SIZE	DRAWING	SHT	REV.
1:4	A3	INTRO-14	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

1/2 CENTER CUTTING END MILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.0x4.0x6.25 4140 CRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

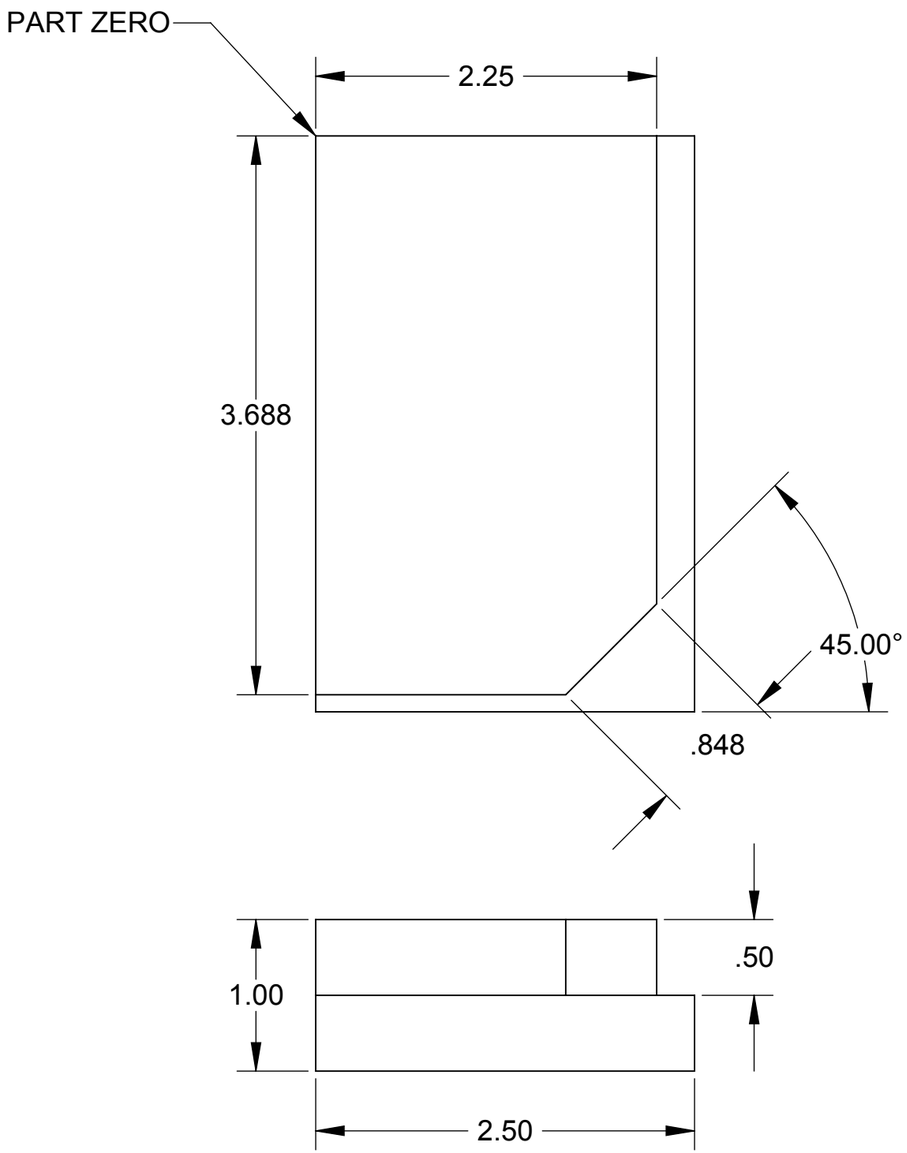
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

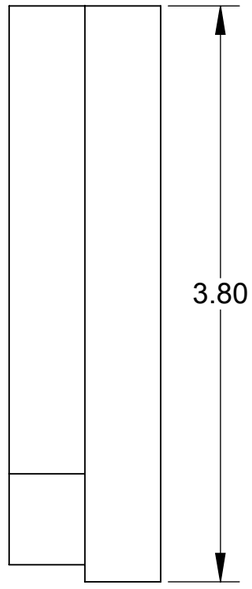
DESCRIPTION: **PLATE, CAM**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-15	1 OF 1	A

UNIT OF MEAS.: PC





TOOL LIST

3/4 END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.0x2.5x3.8 ASTM A36 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

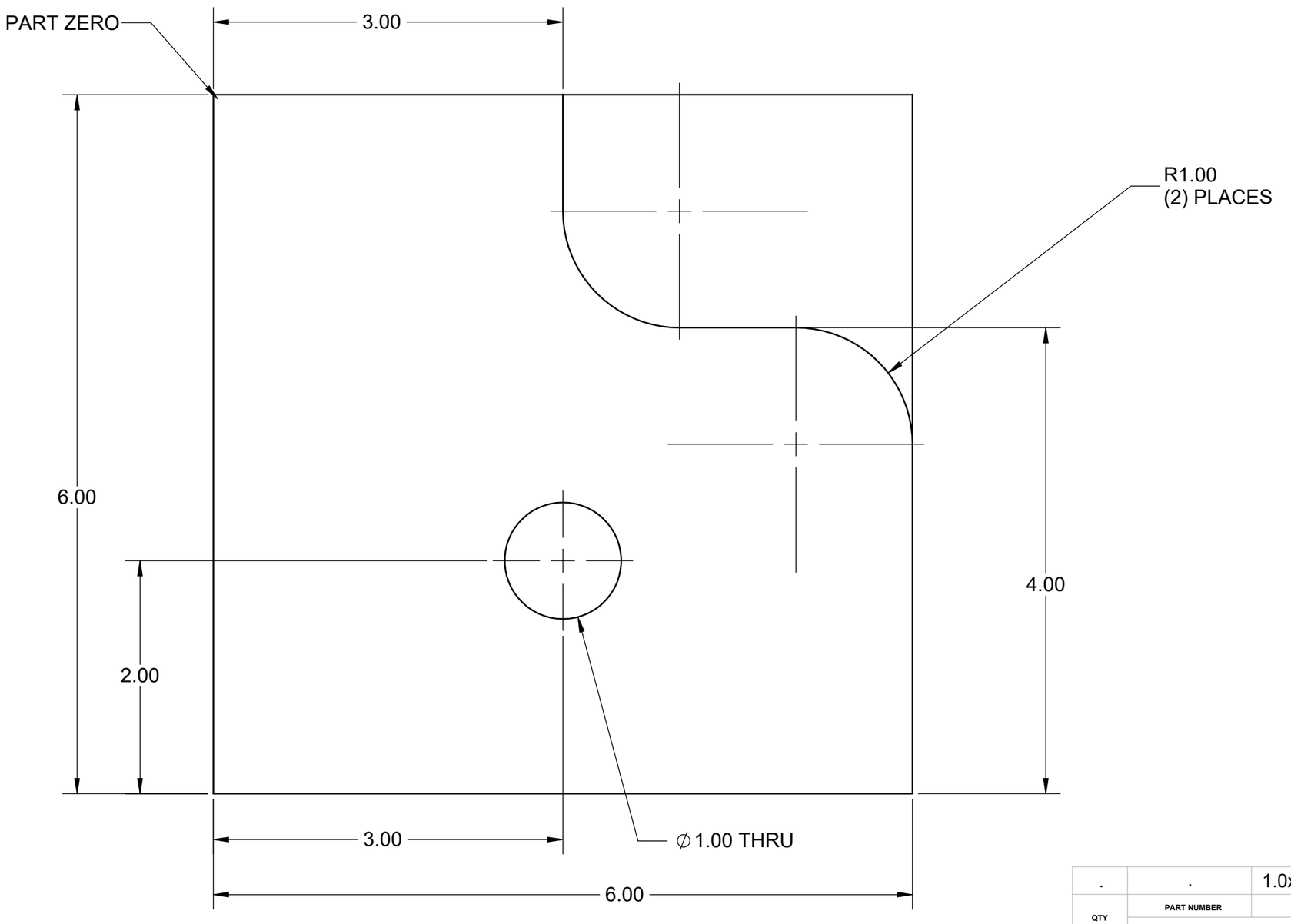
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

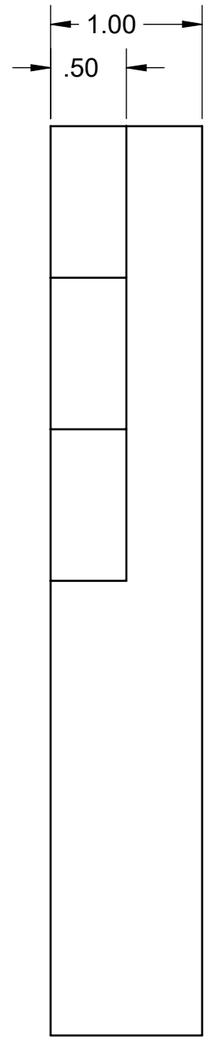
DESCRIPTION: **PLATE, EDGE**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-16	1 OF 1	A

UNIT OF MEAS. PC





TOOL LIST

3/4 END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.0x6.0x6.0 3003-0 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE	.	.	.	.	.	.

757-4006-034

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS:
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS: ±3

GENERAL TOLERANCES: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS IN METRIC

From 0.5 To 6	±0.1
Over 6 To 30	±0.2
Over 30 To 120	±0.3
Over 120 To 400	±0.5
Over 400 To 1000	±0.8
Over 1000 To 2000	±1.2
ANGULAR	±0°30'

HURCO®

HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **PLATE, LOWER CAM**

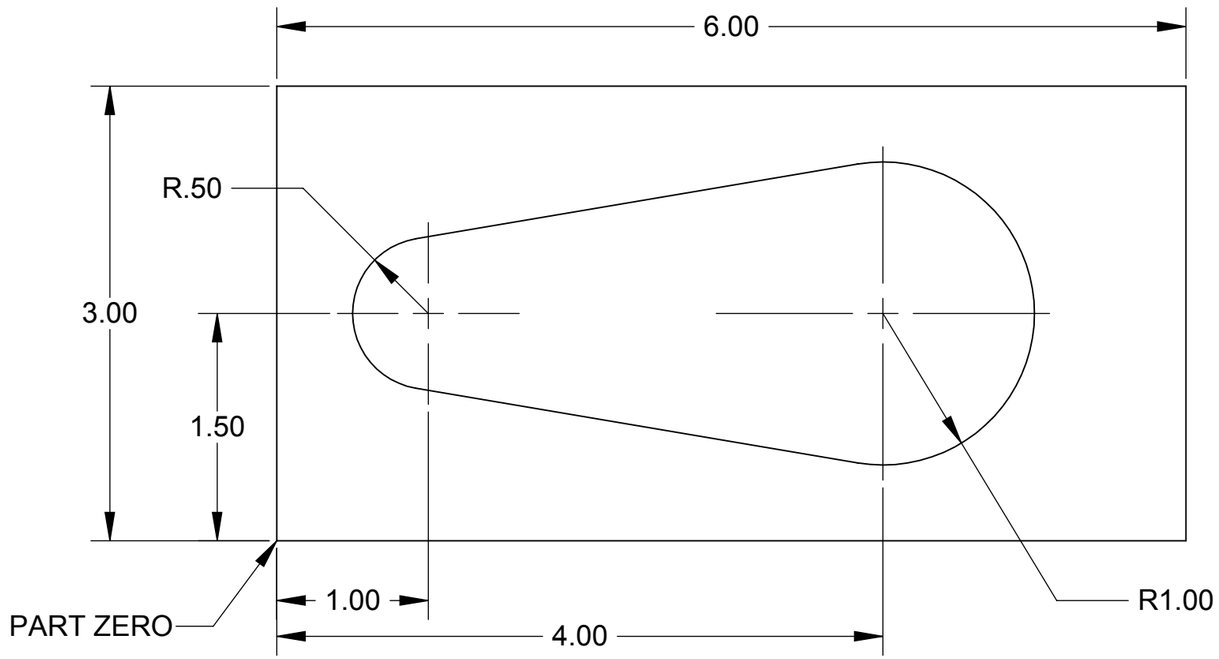
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

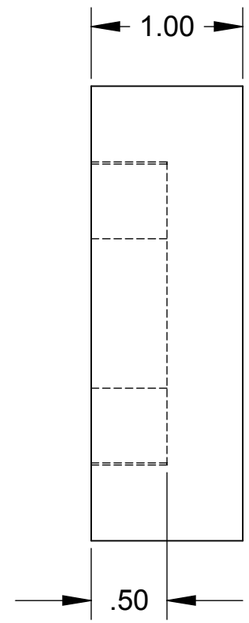
SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-17	1 OF 1	A

UNIT OF MEAS. PC

TOOL LIST

3/4 END MILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.0x3.0x6.0 ASTM A36 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **PLATE, LOWER LOCK**

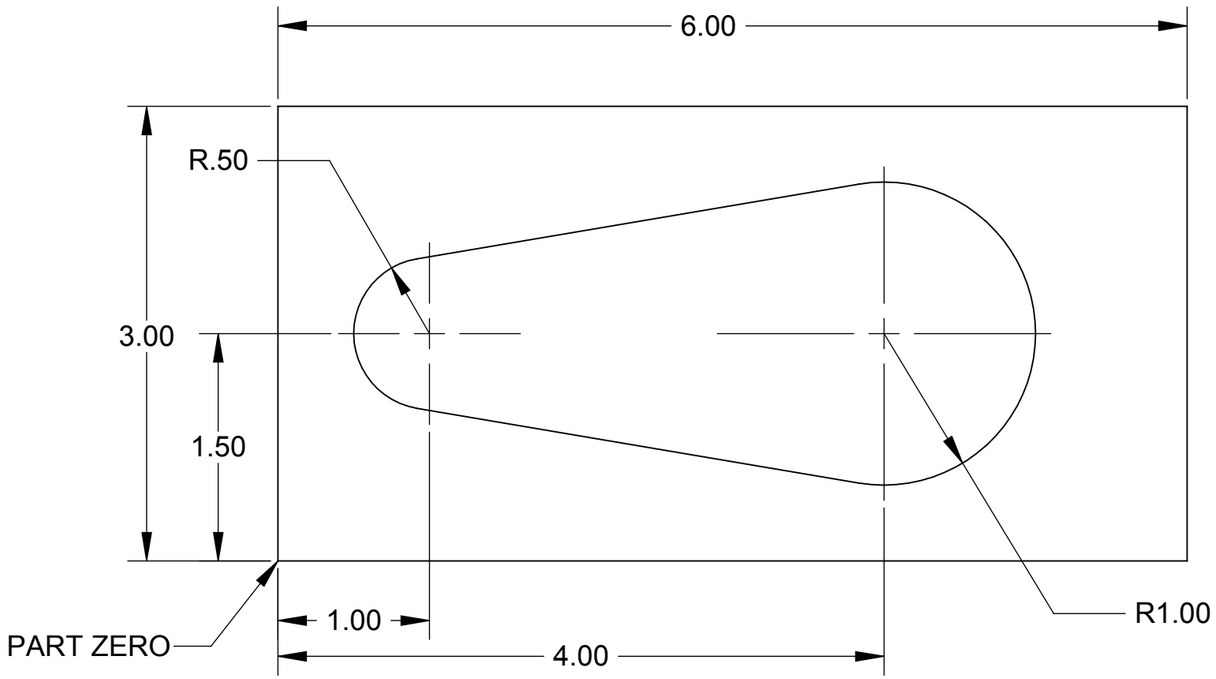
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

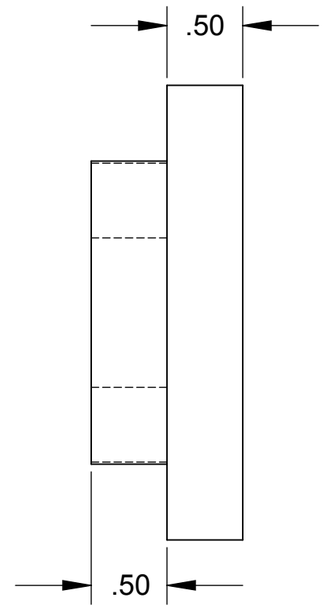
SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-18	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

3/4 END MILL





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.0x3.0x6.0 ASTM A36 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

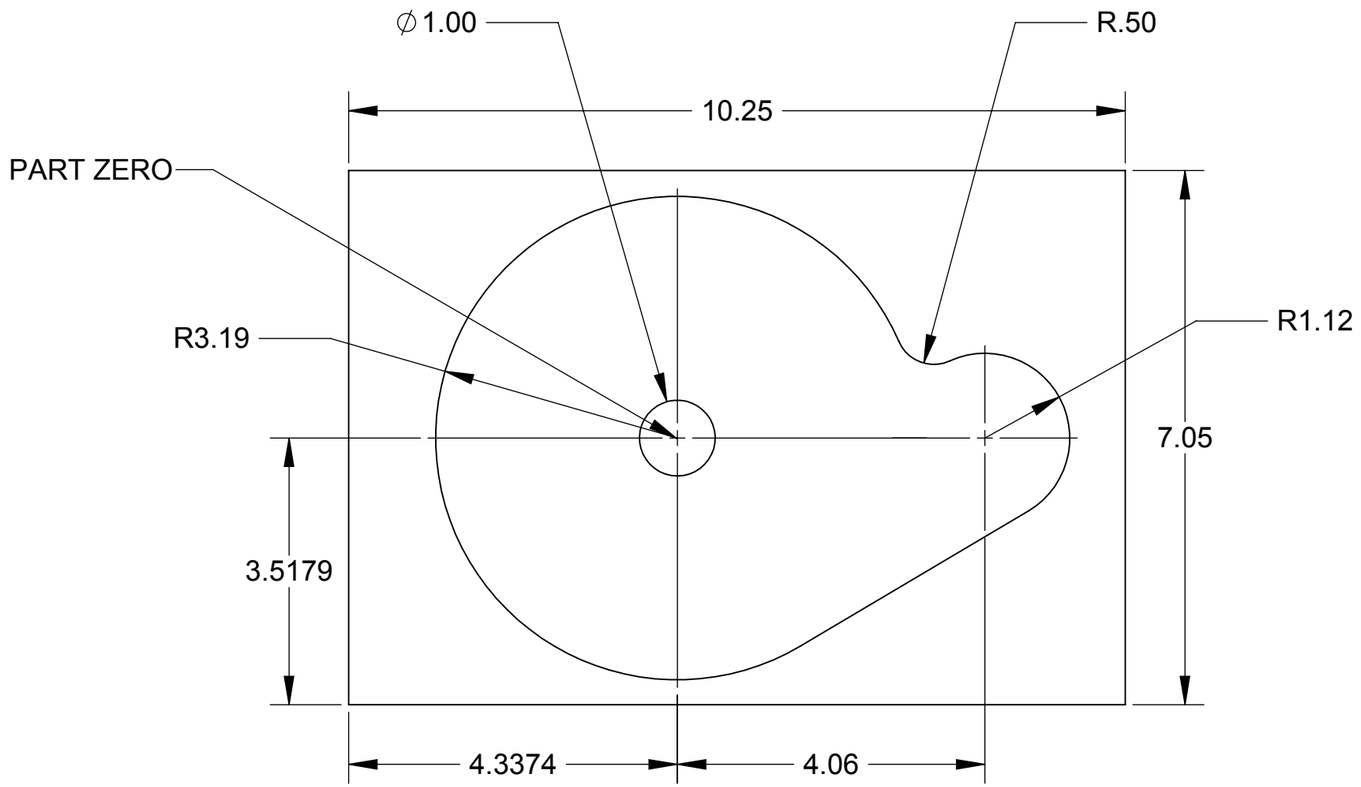
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

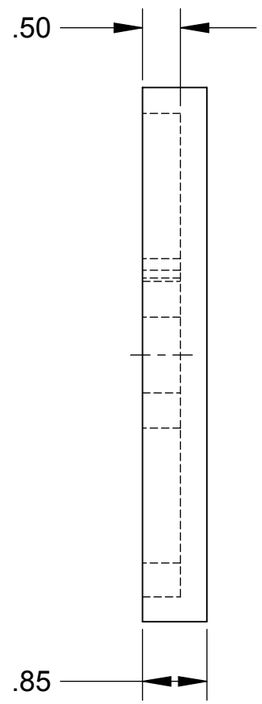
DESCRIPTION: **PLATE, UPPER LOCK**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-19	1 OF 1	A

UNIT OF MEAS.: PC





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.85x10.25x7.05 ASTM A36 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

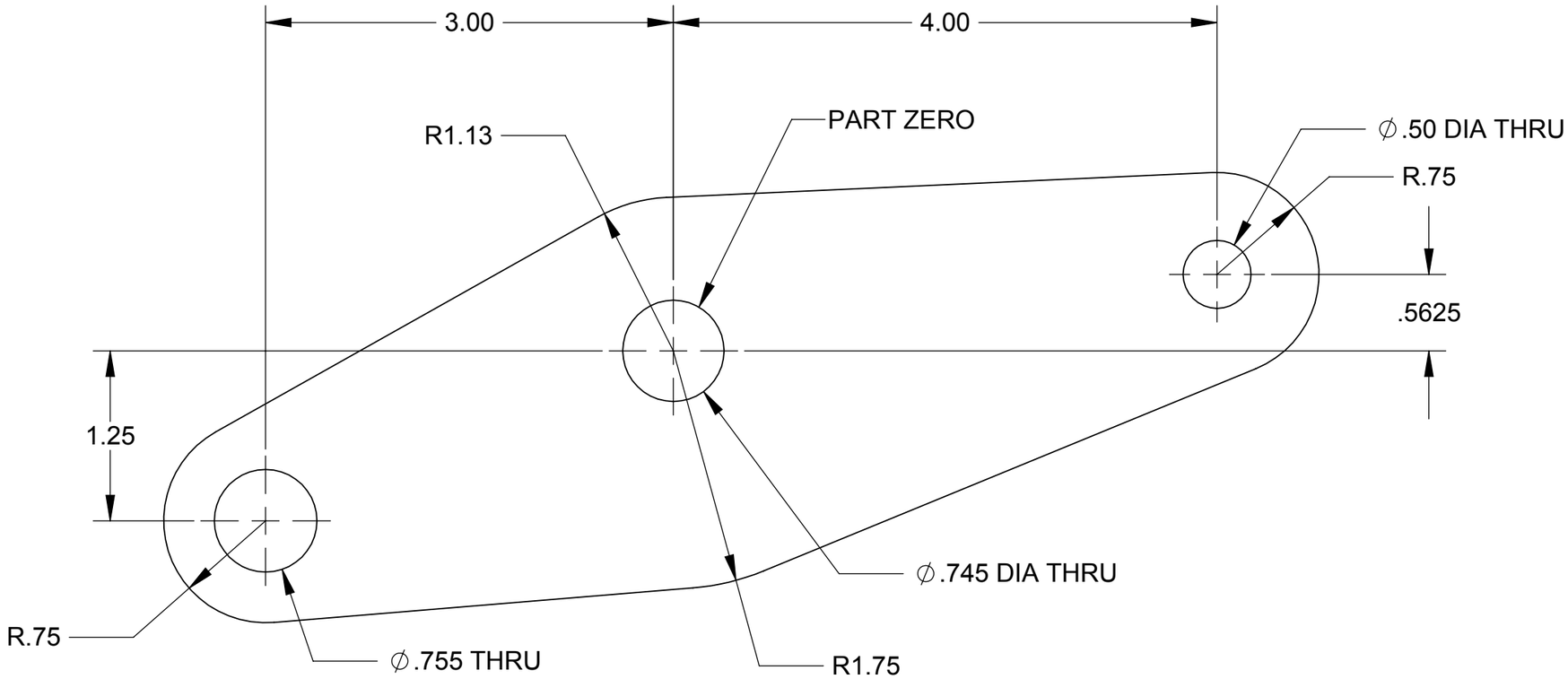
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **PLATE, SWITCH CAM**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

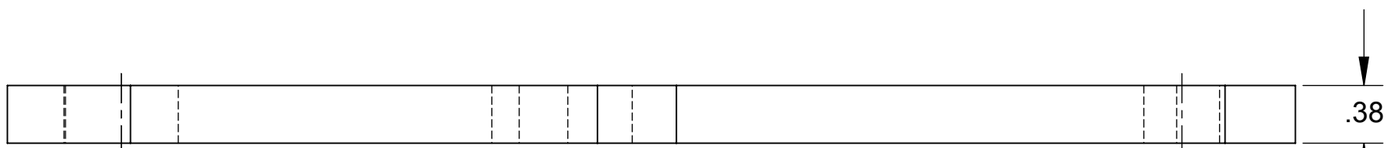
SCALE	SIZE	DRAWING	SHT	REV.
1:2	A3	INTRO-20	1 OF 1	A

UNIT OF MEAS.: PC



TOOL LIST

1/8" CENTER DRILL
1/2" DRILL
5/8" END MILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	3/8 THICK CLASS 45 CAST IRON	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

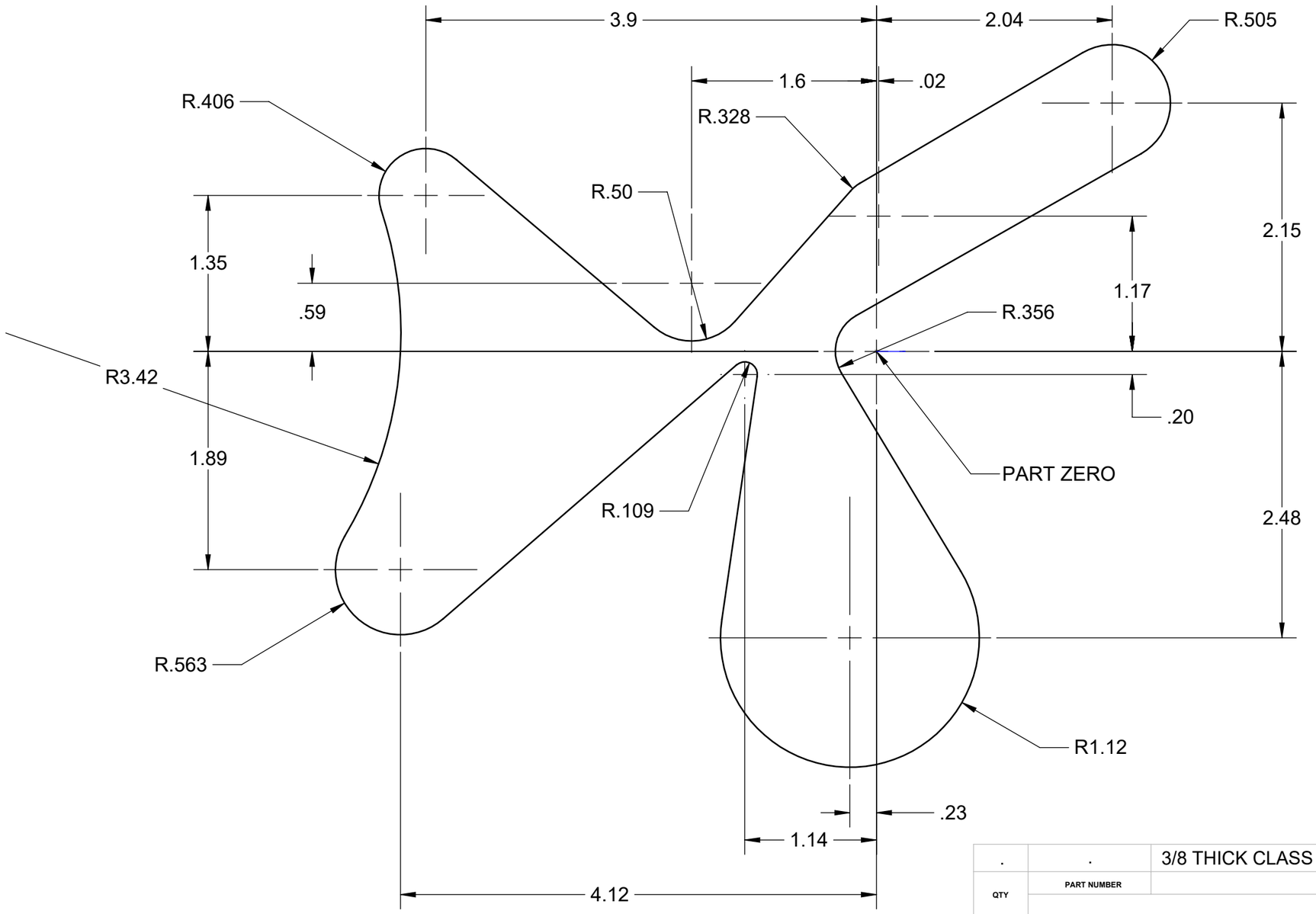
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **LEVER, SHIFT**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-21	1 OF 1	A

UNIT OF MEAS. PC



TOOL LIST

3/16" END ,MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	3/8 THICK CLASS 45 CAST IRON	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE	.	.	.	.	.	.

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS:
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS: ±3

GENERAL TOLERANCES: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS IN METRIC

From 0.5 To 6	±0.1
Over 6 To 30	±0.2
Over 30 To 120	±0.3
Over 120 To 400	±0.5
Over 400 To 1000	±0.8
Over 1000 To 2000	±1.2
ANGULAR	±0°30'

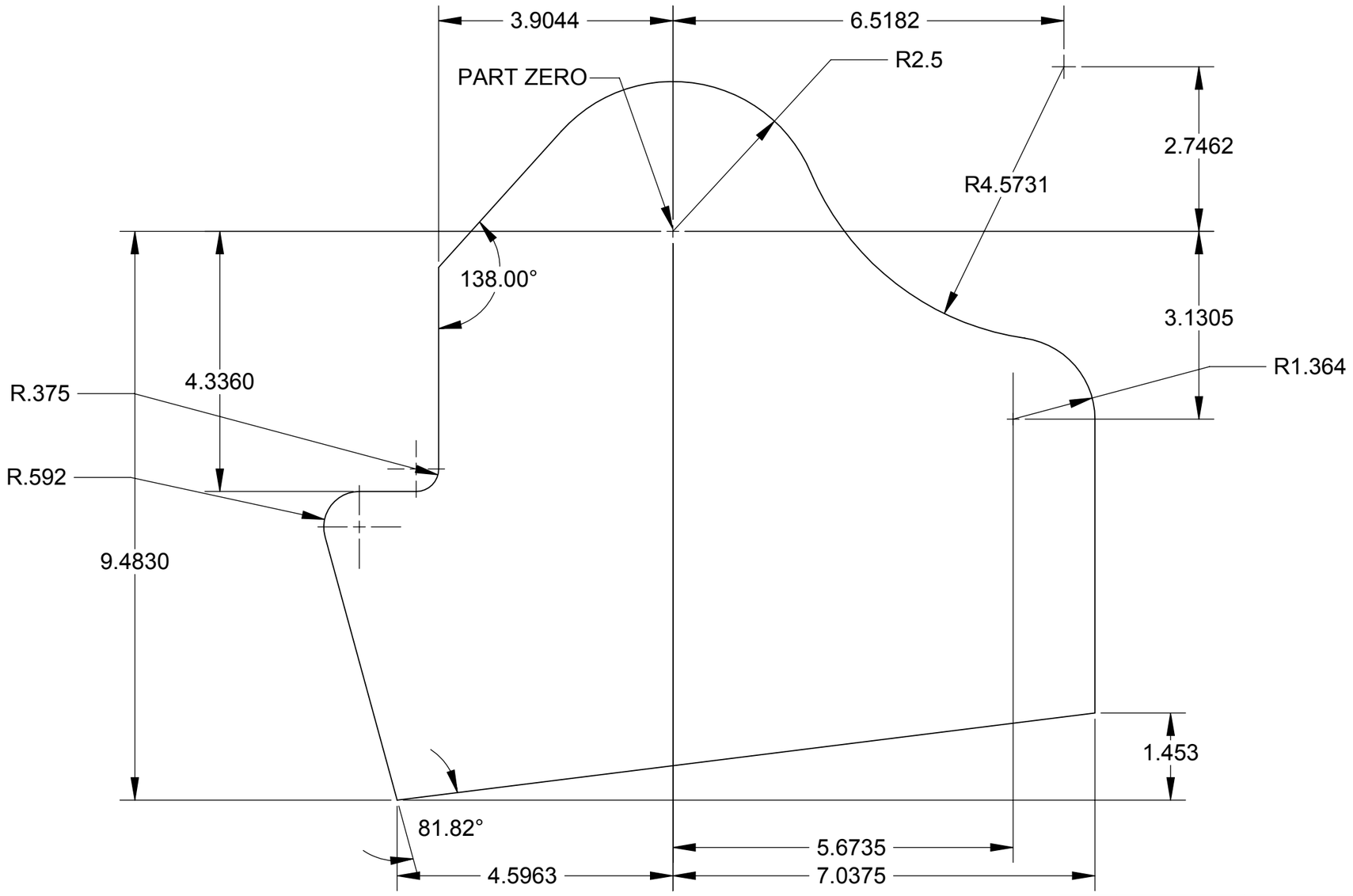
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **CAM, HIGH SPEED**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 1:1
UNIT OF MEAS.: PC
SIZE: A3
DRAWING: INTRO-22
SHT 1 OF 1
REV.: A

757-4006-034



TOOL LIST

5/8" END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	5/8x11.983x12.8562 1018 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

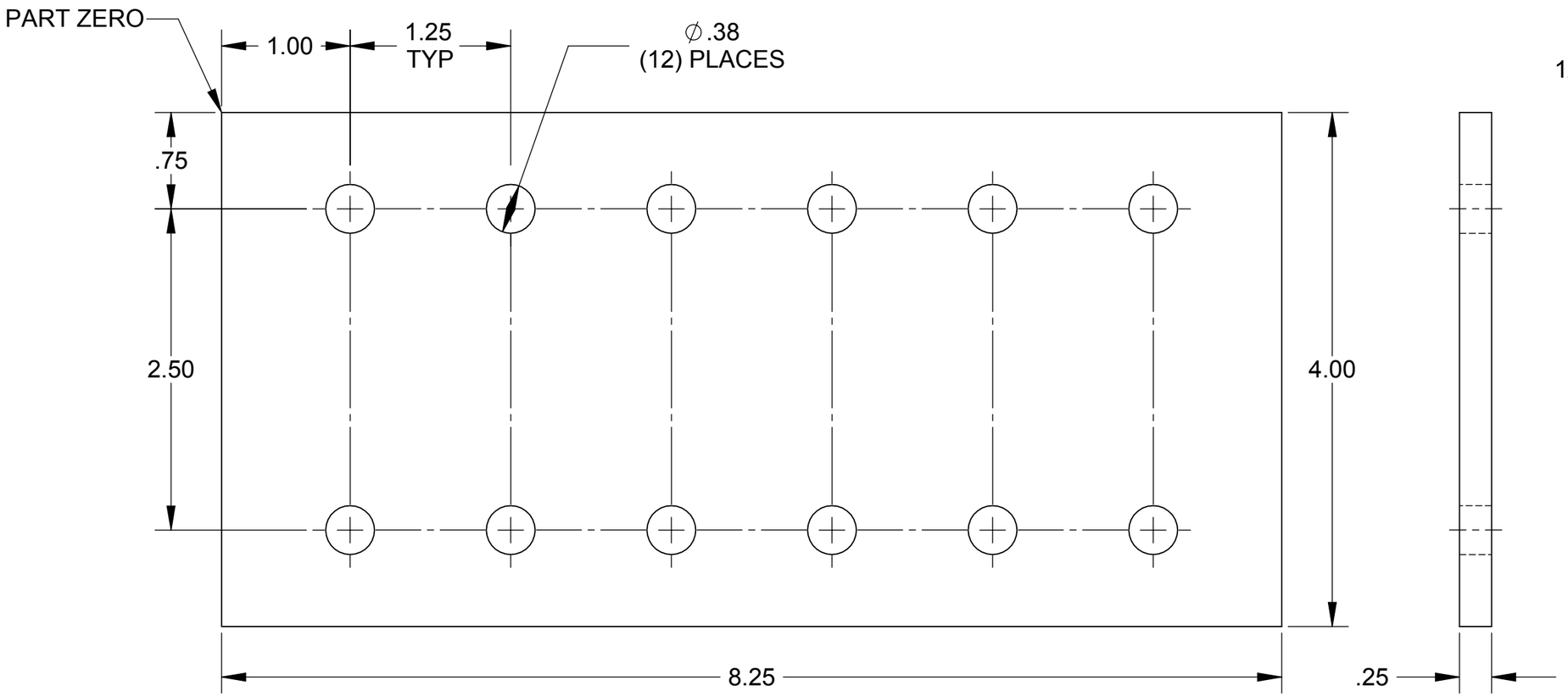
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **CAM, LOW SPEED**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:5	A3	INTRO-23	1 OF 1	A

UNIT OF MEAS. PC



TOOL LIST

1/8" CENTER DRILL
3/8" DRILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1/4x4.0x8.25 ASTM A36 HRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **PLATE, SPACER**

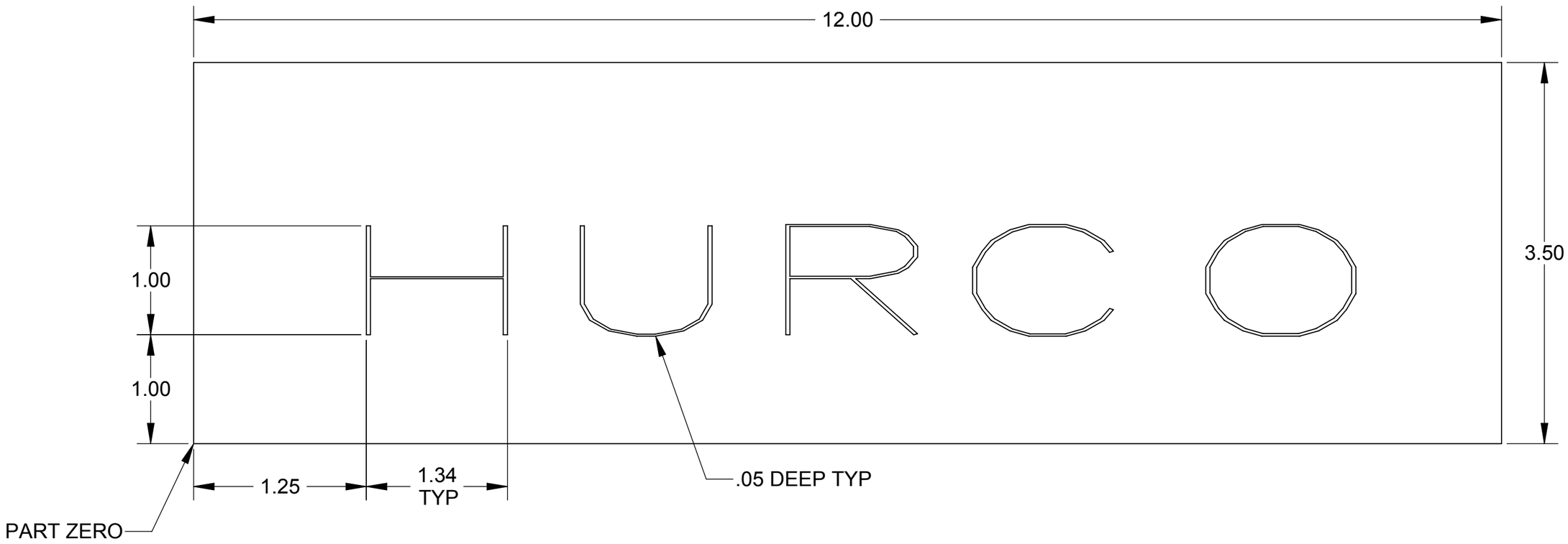
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-24	1 OF 1	A

UNIT OF MEAS. PC

TOOL LIST

45/64" SPOT DRILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1/2x3.5x12.0 2024 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: PLATE, HORIZ NAME

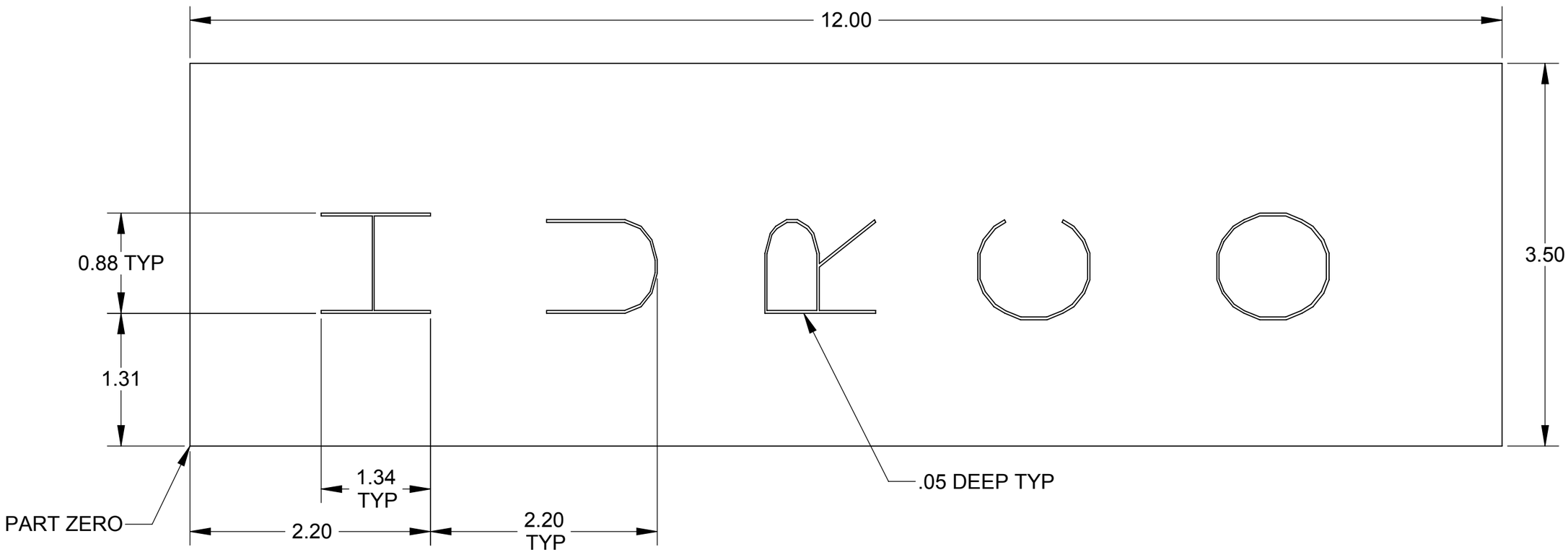
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-25	1 OF 1	A

UNIT OF MEAS.: PC

TOOL LIST

45/64" SPOT DRILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1/2x3.5x12.0 2024 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

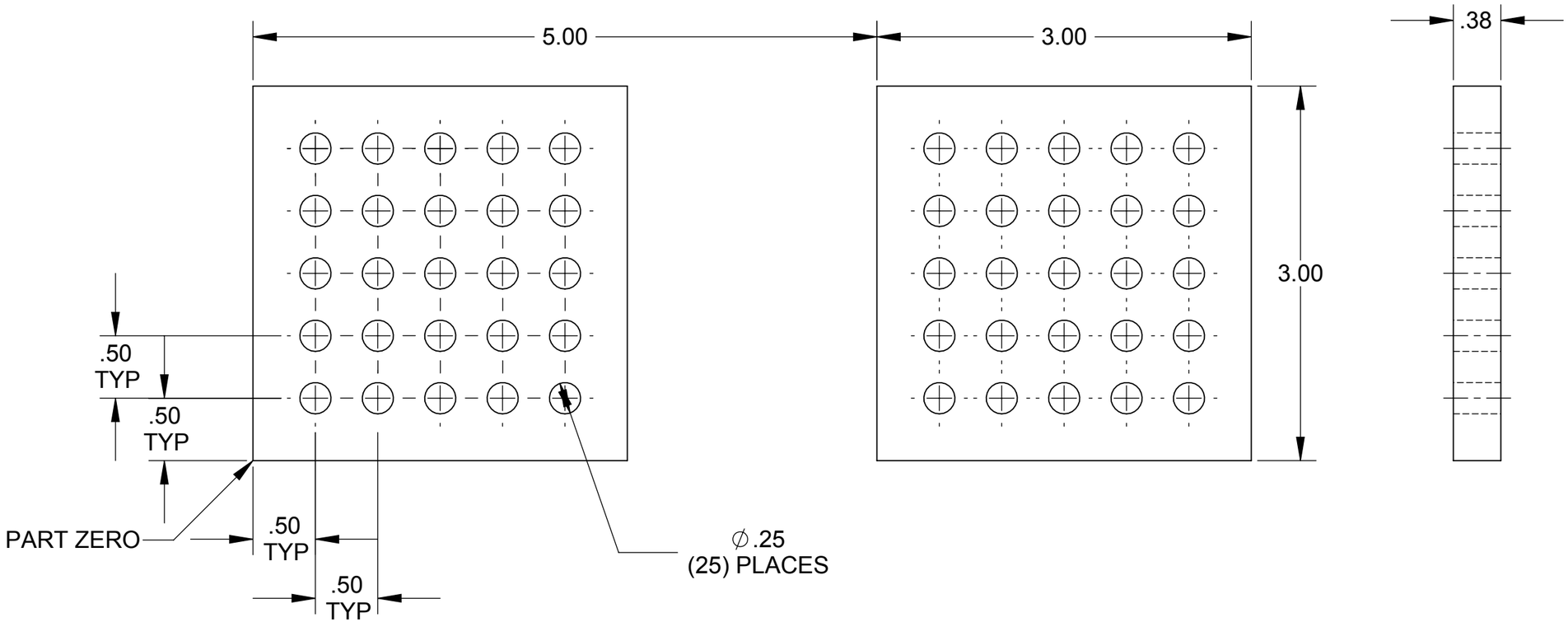
DESCRIPTION: **PLATE, VERTICAL NAME**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 1:1
UNIT OF MEAS.: PC
SIZE: A3
DRAWING: INTRO-26
SHT: 1 OF 1
REV.: A

TOOL LIST

1/8" CENTER DRILL
1/4" DRILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	3/8x3.0x3.0 6061-T6 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

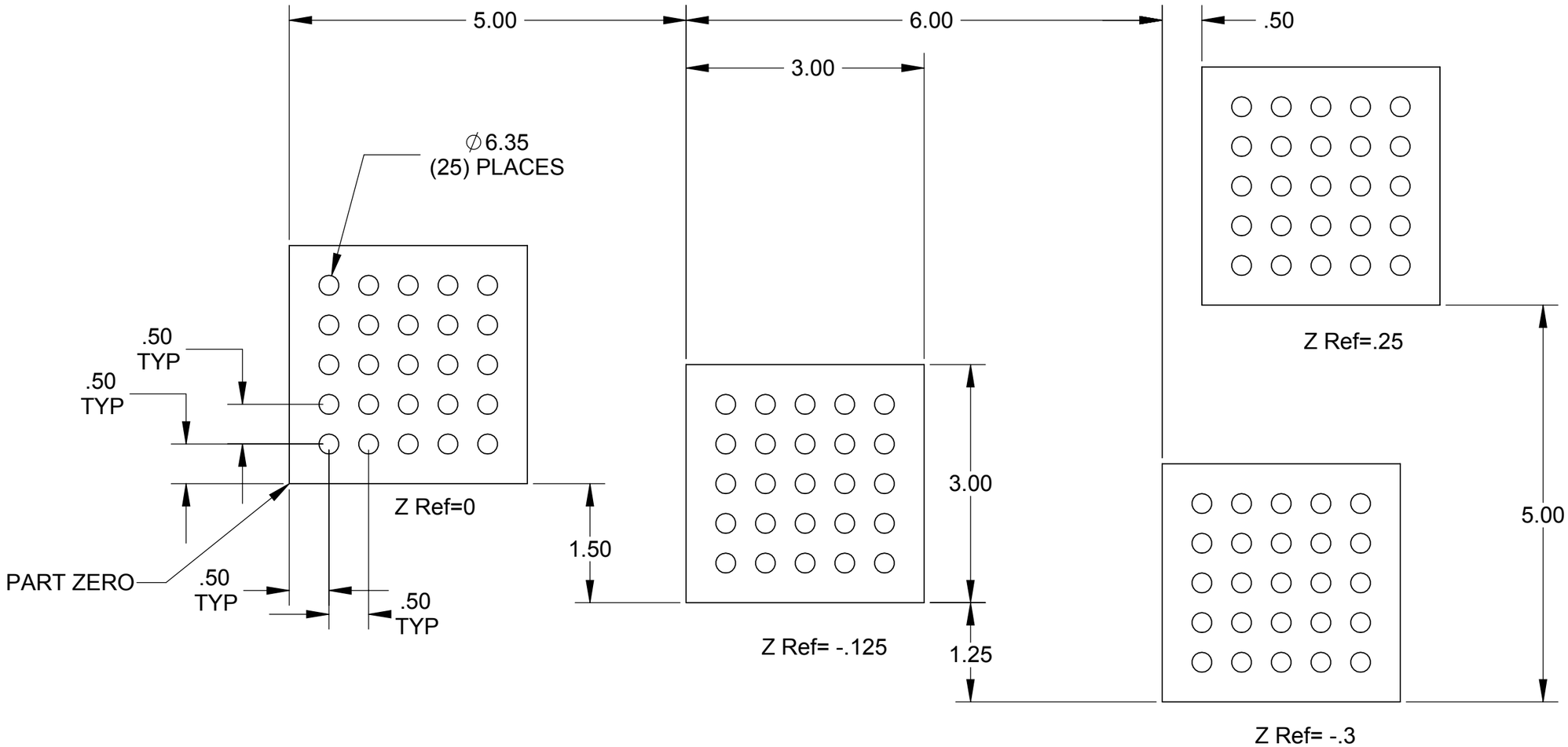
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **EXCHANGER, HEAT**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-27	1 OF 1	A

UNIT OF MEAS.: PC



TOOL LIST

1/8" CENTER DRILL
1/4 DRILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	3/8x3.0x3.0 6061-T6 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

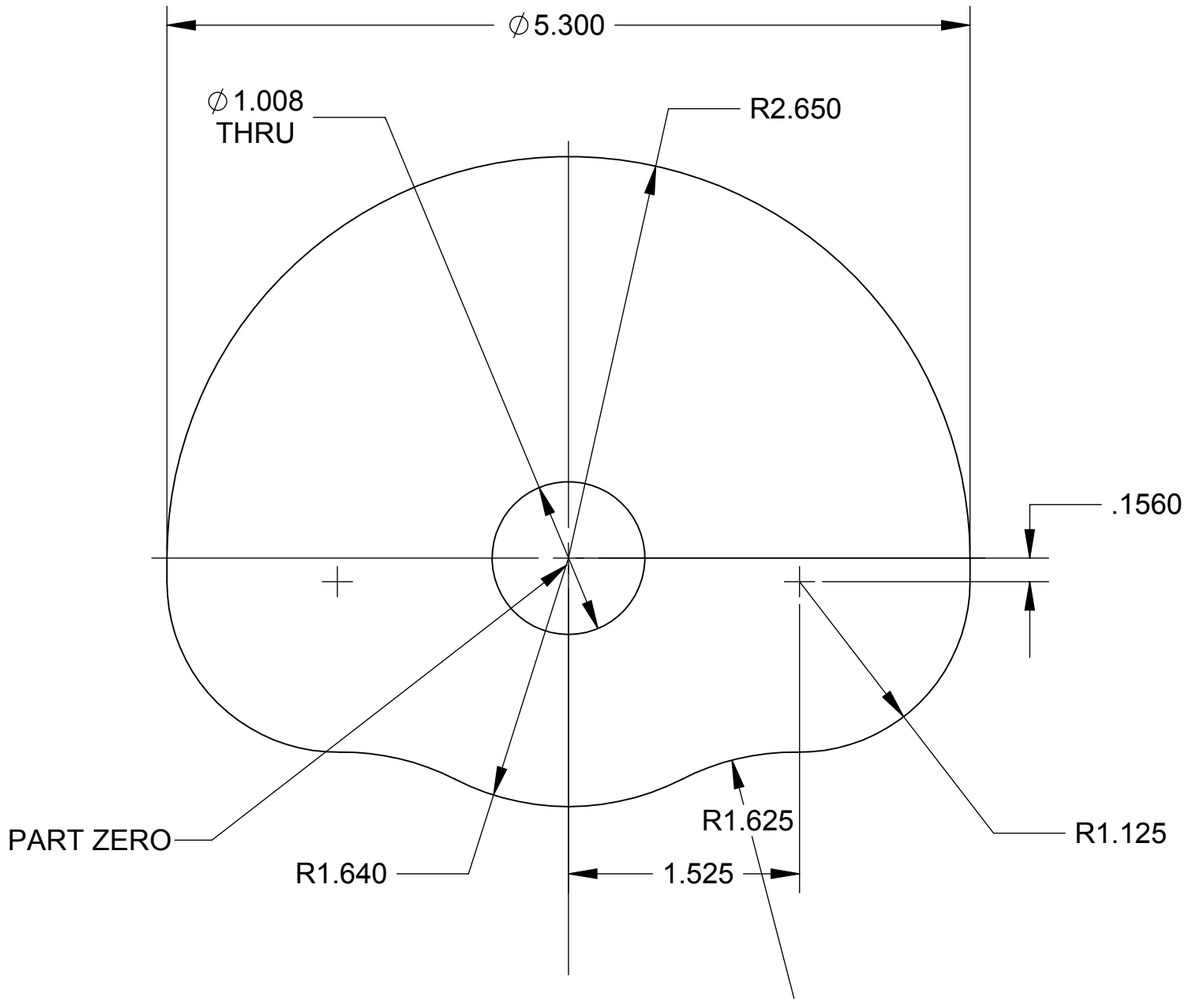
THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **EXCHANGER, MULTI HEAT**

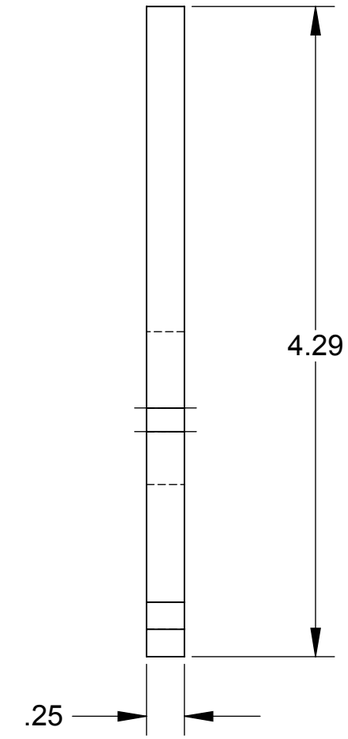
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 1:5
UNIT OF MEAS.: PC
SIZE: A3
DRAWING: INTRO-28
SHT: 1 OF 1
REV.: A



TOOL LIST

3/4" END MILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	3/8x3.0x3.0 6061-T6 ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

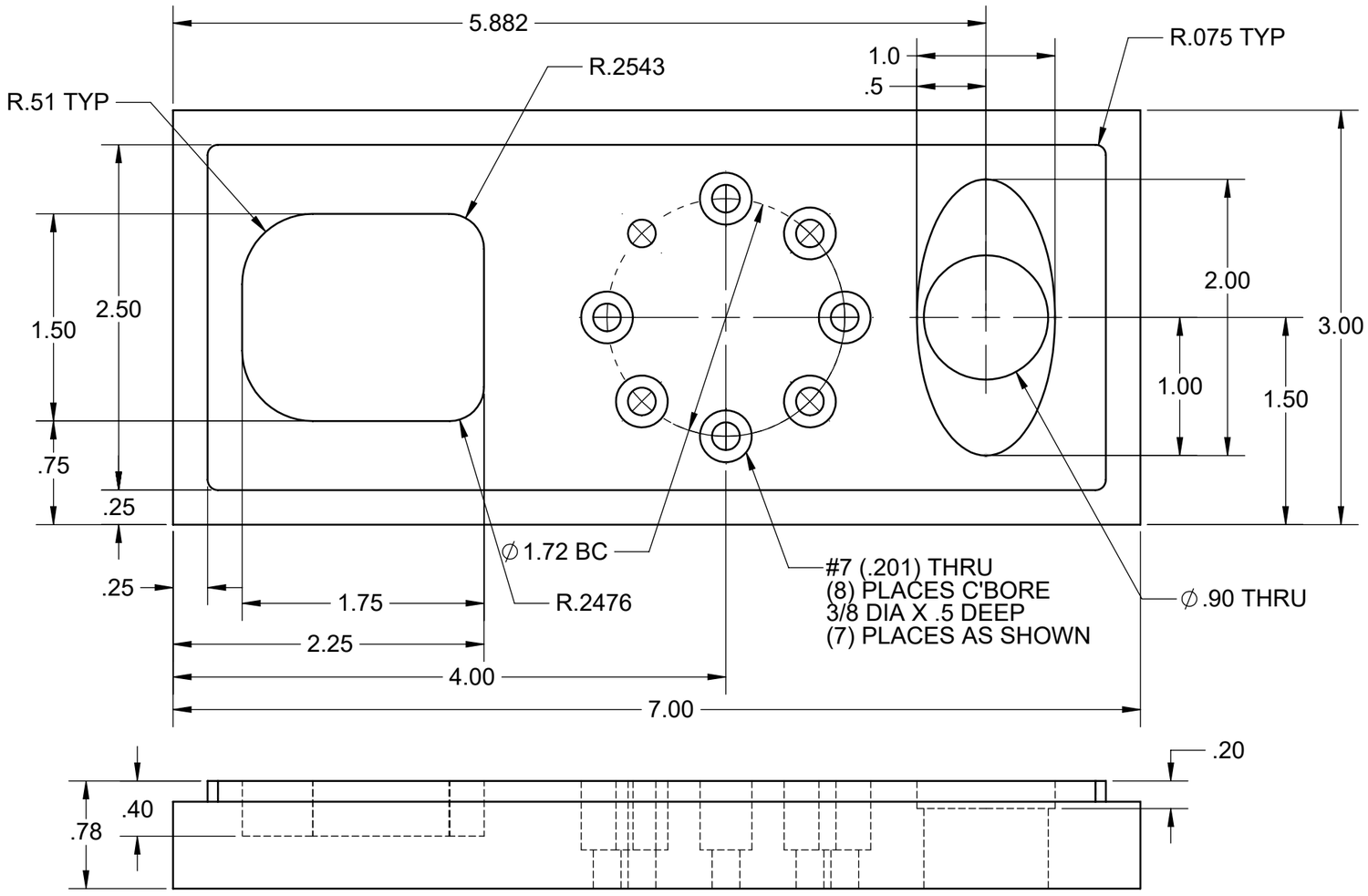
THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

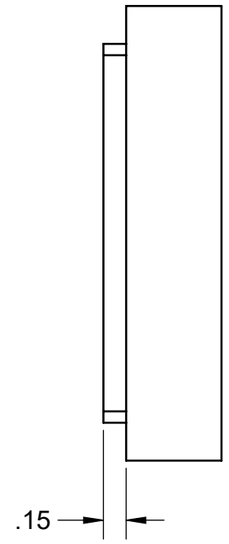
DESCRIPTION: **PLATE, HIGH SPEED CAM**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 1:1
UNIT OF MEAS.: PC
SIZE: A3
DRAWING: INTRO-29
SHT: 1 OF 1
REV.: A



TOOL LIST
0.201" DRILL
3/8" END MILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.78x3x7 WAX	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE	.	.	.	.	.	.

757-4006-034

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS:
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS: ±3

GENERAL TOLERANCES: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS IN METRIC

From	0.5	±0.1
To	6	
Over	6	±0.2
To	30	
Over	30	±0.3
To	120	
Over	120	±0.5
To	400	
Over	400	±0.8
To	1000	
Over	1000	±1.2
To	2000	
ANGULAR		±0°30'

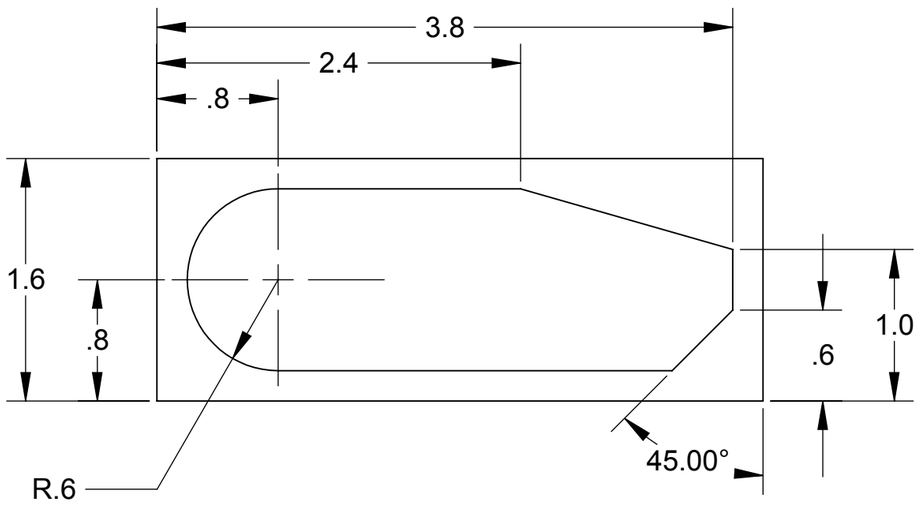
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

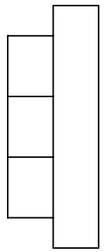
DESCRIPTION: **PLATE, RAM**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-30	1 OF 1	A

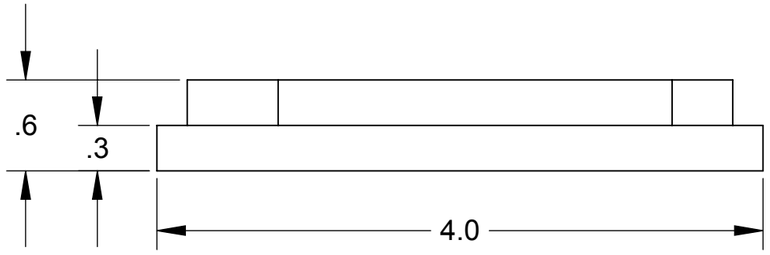
UNIT OF MEAS.: PC





TOOL LIST

3/4" END MILL



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.6x1.6x4.0 3003-F ALUMINUM	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

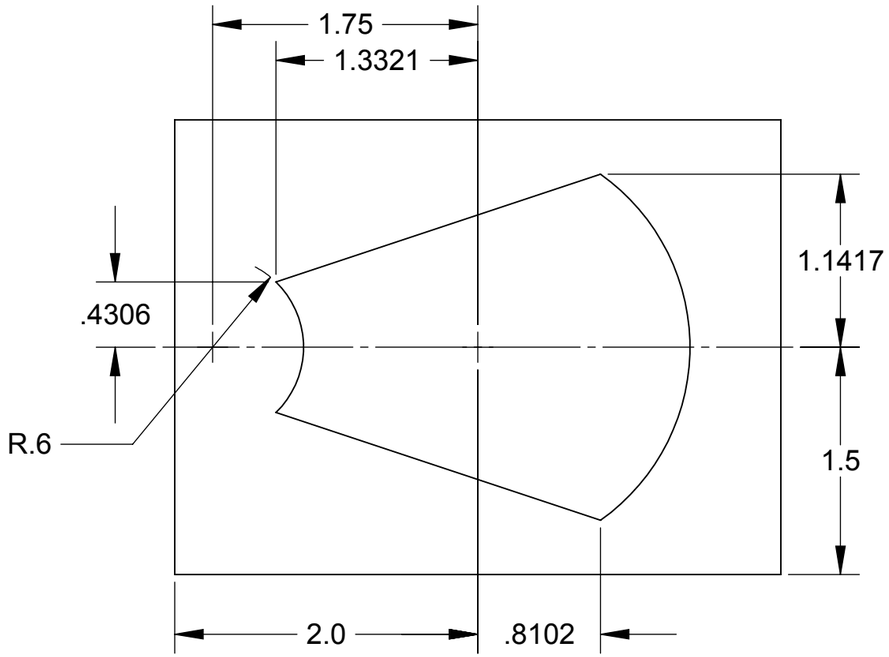
THIRD ANGLE PROJECTION

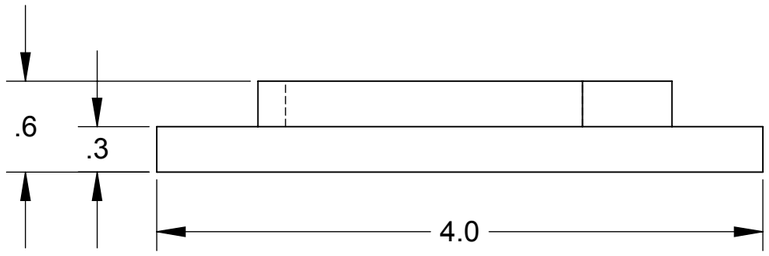
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: **LOCK, SLIDE**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE: 1:1
UNIT OF MEAS.: PC
SIZE: A3
DRAWING: INTRO-31
SHT: 1 OF 1
REV.: A





TOOL LIST

3/4" END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	.6x3.0x4.0 1045 CRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

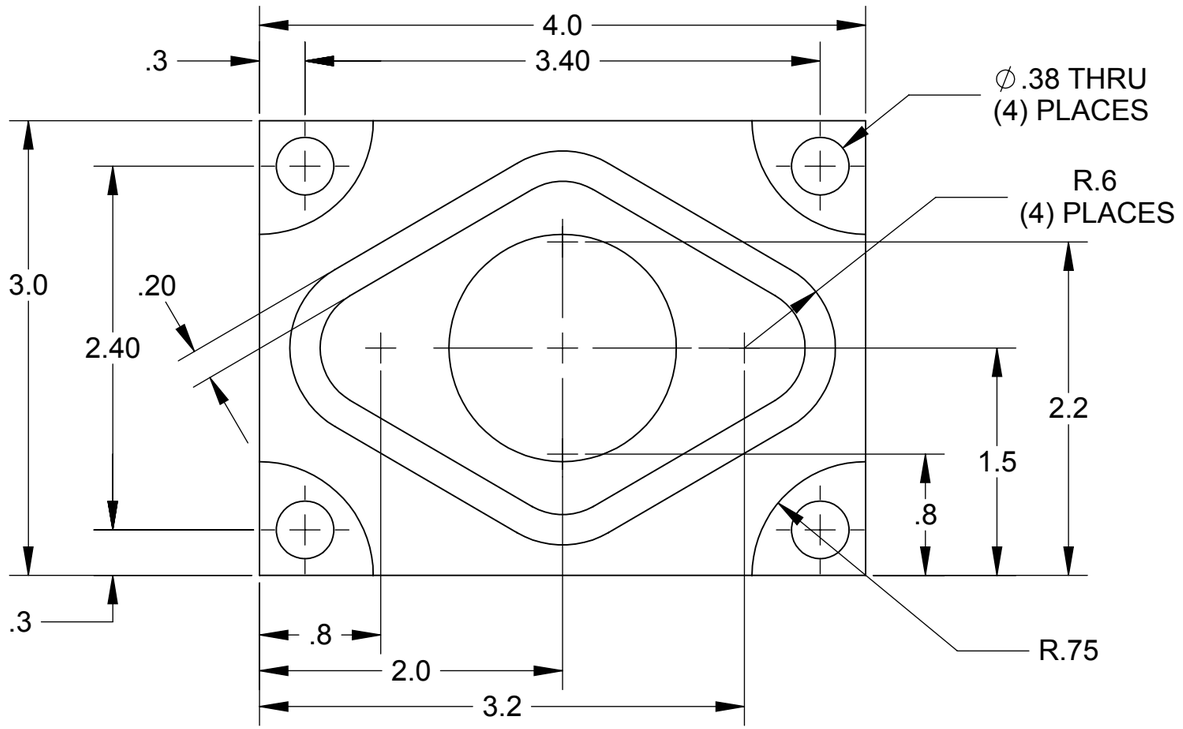
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

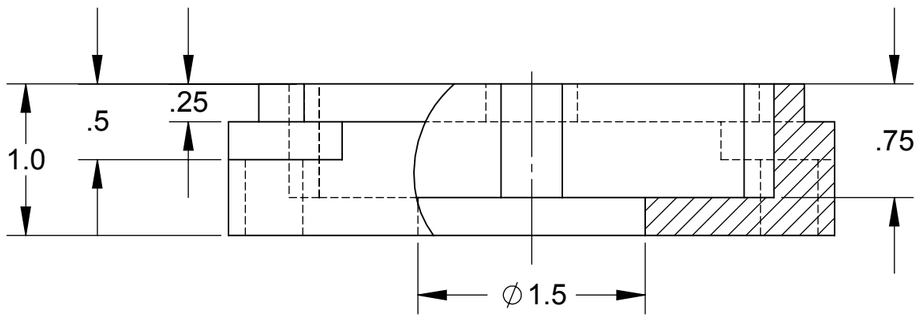
DESCRIPTION: **BLOCK, INJECTION**

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-32	1 OF 1	A

UNIT OF MEAS.: PC





TOOL LIST

3/4" END MILL
3/8" DRILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	1.0x3.0x4.0 1020 CRS	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
			.	.	.	.	.	.
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

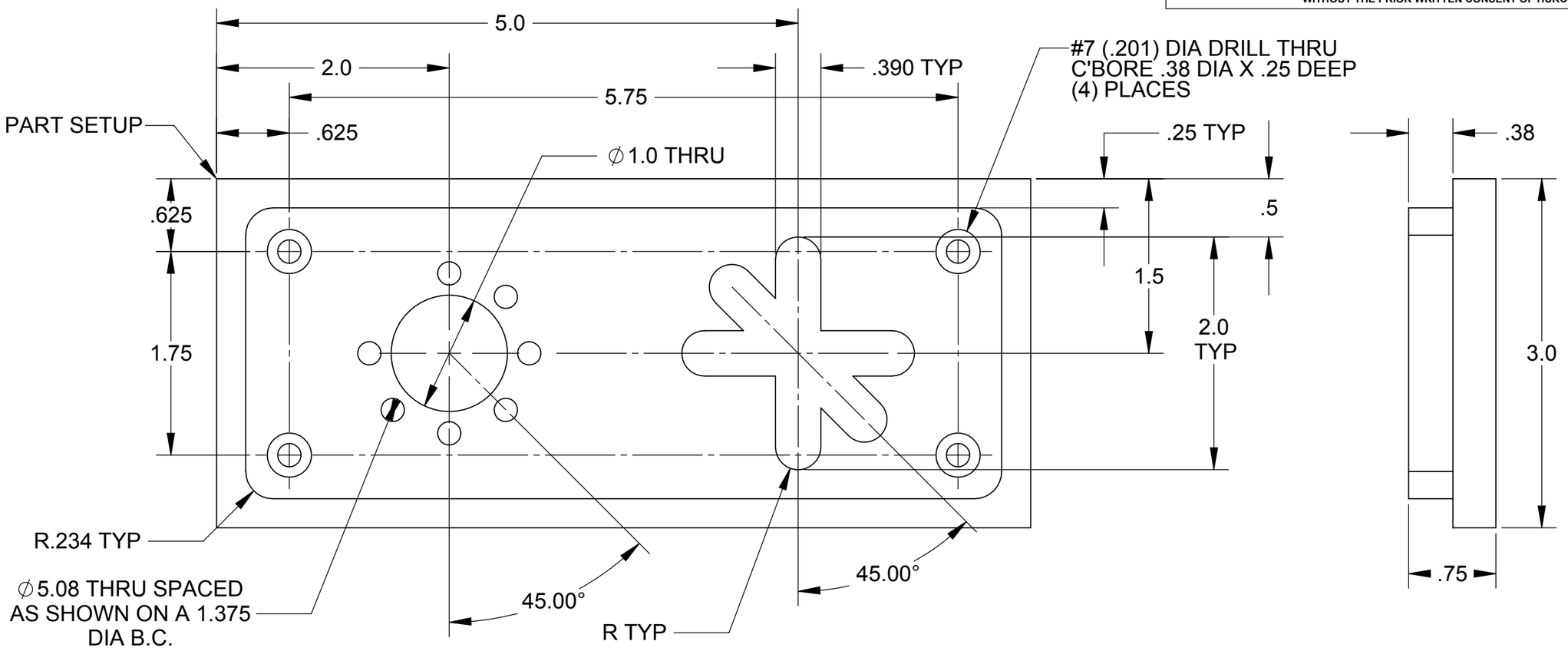
HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

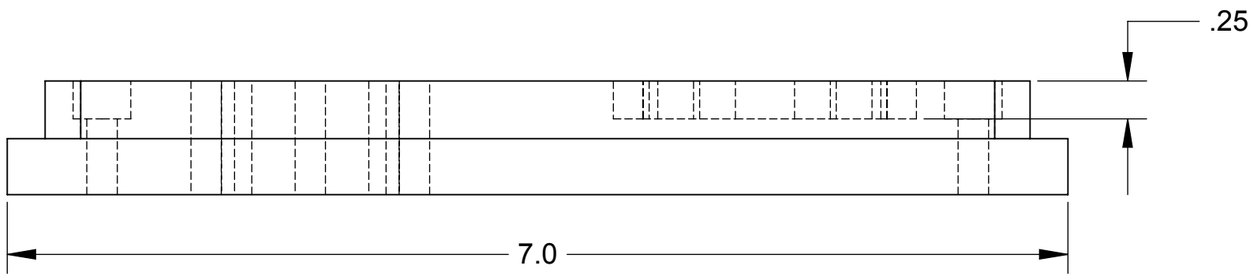
DESCRIPTION: COVER

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	12/16/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-33	1 OF 1	A

UNIT OF MEAS.: PC





TOOL LIST

#7 (.201) DRILL
.375" END MILL

QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	3/4x3.0x7.0 WAX	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: APPS

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

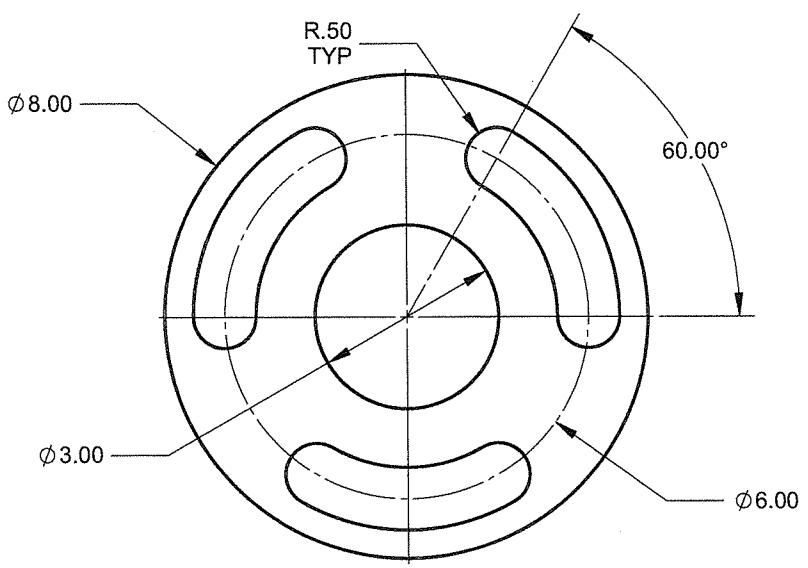
DESCRIPTION: **PLATE, HIGH SPEED SWITCH**

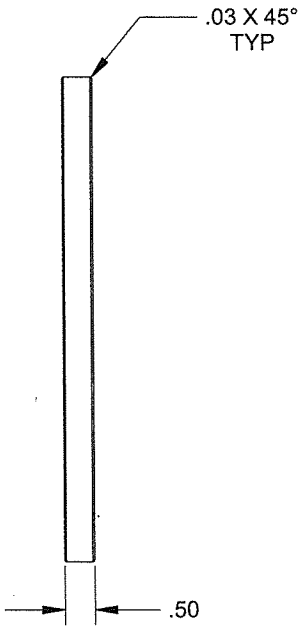
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	2/27/12	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:1	A3	INTRO-34	1 OF 1	A

UNIT OF MEAS.: PC

NOTE:
1. ALL CHAMFERS TO BE 0.030" X 45° UNLESS OTHERWISE NOTED
2. MATERIAL TO BE A36 HOT ROLLED STEEL BLANCHARD GROUND TO .500"±.025"





QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	A36 HOT ROLLED STEEL	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: BLACK OXIDE

FIRST USED ON: TRAINING

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®
HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: SLOT PLATE

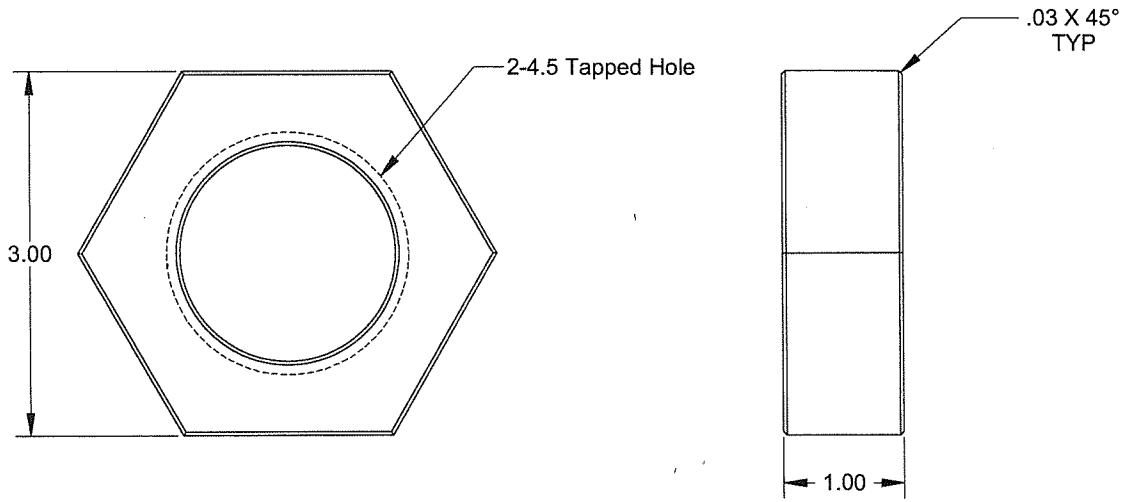
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	11/10/11	.	.	.	.

SCALE	SIZE	DRAWING	SHT	REV.
1:2	B	Slot Plate	1 OF 1	A

UNIT OF MEAS.: PC

NOTES:

1. PART TO BE MACHINED OUT OF SOLID BAR STOCK
2. ALL CHAMFERS TO BE .030" X 45° UNLESS OTHERWISE NOTED



QTY	PART NUMBER	ITEM DESCRIPTION	ITEM
.	.	316 STAINLESS STEEL BAR STOCK	.

PARTS LIST

REV	E.C.N. NO.	REVISION DESCRIPTION	REV BY	DATE	CHK BY	DATE	APPD BY	DATE
A	.	ORIGINAL RELEASE						

SURFACE TREATMENT: NONE

HEAT TREATMENT: NONE

FIRST USED ON: TRAINING

EXCEPT AS NOTED: ALL CORNERS MUST BE AS FOLLOWS
INSIDE: 1.3 X 45° OR 1.3 R MAX.
OUTSIDE: 0.8 X 45° OR 1.3 R

EXCEPT AS NOTED: WELDING TOLERANCE MUST BE AS FOLLOWS ±3

EXCEPT AS NOTED: ALL DIMENSIONS IN METRIC TOLERANCE
DECIMAL
.0 ±0.8
.00 ±0.4
.000 ±0.13
.0000 ±0.013
ANGULAR ±0°30'

THIRD ANGLE PROJECTION

HURCO®

HURCO COMPANIES, INC. INDIANAPOLIS, IN 46268 U.S.A.

DESCRIPTION: Hex Nut

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
BMK	11/10/11	.	.	.	.

SCALE: 1:1
UNIT OF MEAS.: PC
SIZE: B
DRAWING: Hex Nut
SHT 1 OF 1
REV.: A

Notes

Notes

Notes

Notes