POWER-FAB REFERENCE

Copyright ©1992,2016 Glass House Software, Ltd.
All Rights Reserved

TABLE OF CONTENTS

OVERVIEW OF POWER-FAB

The POWER-FAB (POWERSTATION OPTION) adds powerful capabilities to POWERSTATION for the programming of Punch / Plasma machines. With added support for common punching patterns, tool shapes, and automatic generation of multiple parts.

REQUIREMENTS

POWER-FAB is an add on option to the POWERSTATION CAD/CAM (PRO-VERSION) system, and requires it's presence, and will not function without it. Therefore it's hardware requirements are identical to the standard POWERSTATION product.

It is assumed that the user has a basic working knowledge of POWERSTATION with experience in milling or turning, or has completed one of the basic tutorials. If you have not done so, please read the "BASICS" section of the POWERSTATION REFERENCE manual.

It is also assumed that the user has experience in the operation and programming of the destination machine tool, as POWER-FAB does not determine how to make the part(s) but simply makes program generation much simpler.

GENERAL TERMINOLOGY

There are certain terms that will appear over and over throughout the operation of the system, and in this manual.

Cusp Height - This is a measurement of the surface roughness generated during nibbling operations. See figure 1-1.

Minimum Overlap - Generally used with square / rectangular tools, this is the minimum amount of tool overlay between hits. If set to zero, the hits (let's say along a line) will be right next to each other instead of overlapping. Note: This is the minimum amount, generally the amount will be greater than this as most all cycles automatically generate equally spaced hits.

Indexable Tool / -C- Axis - This refers to machines with Indexable "Rotary" tool capabilities, where a tool can be rotated under program control to any desired angle.

EXAMPLE

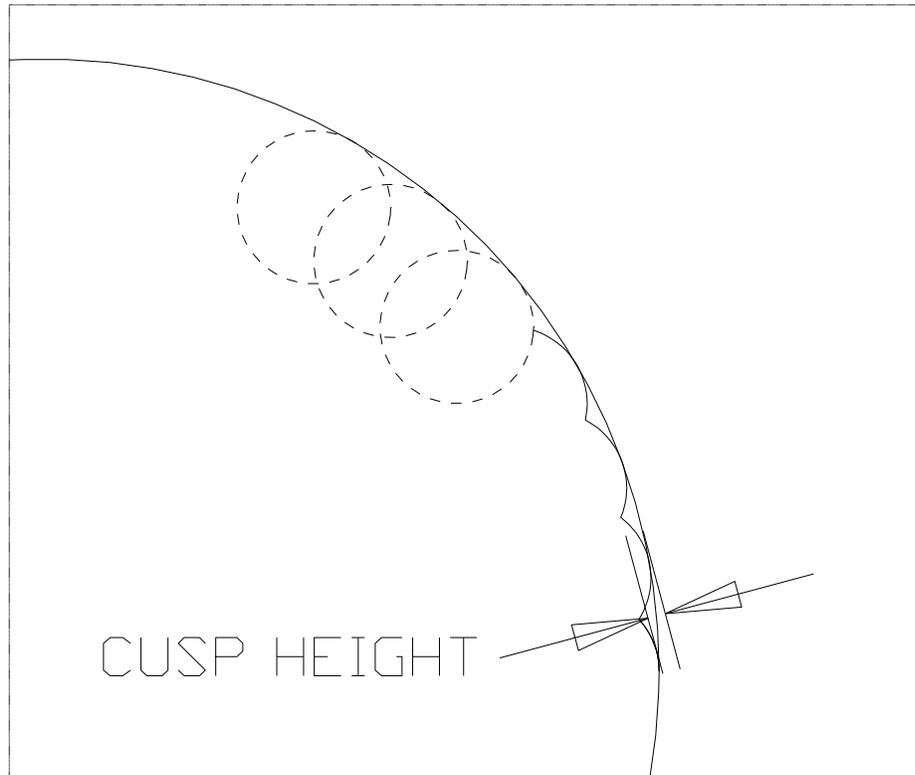See figure 1-2 for examples of several POWER-FAB features

CUSP HEIGHT

Figure 1-1 Cusp Height Example

SHEET DRAW COMMAND

GRID PATTERN

HOLE REMOVAL

CHAIN NIBBLING

RECTANGLE WITH SLUG

SPLINE NIBBLING

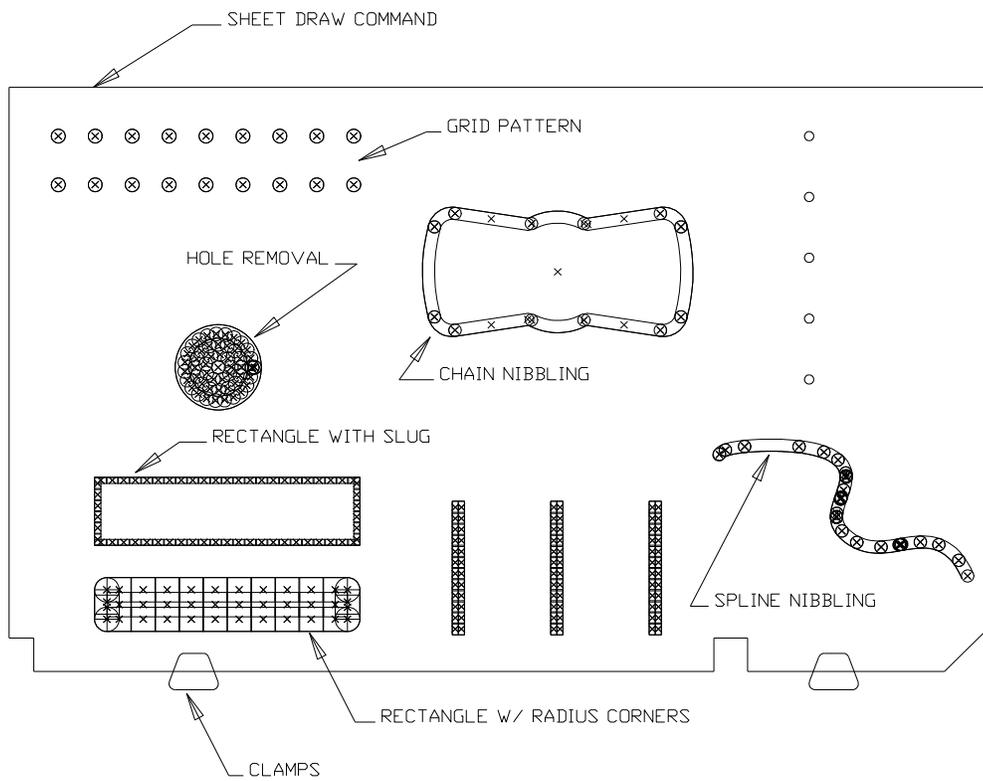RECTANGLE W/ RADIUS CORNERS

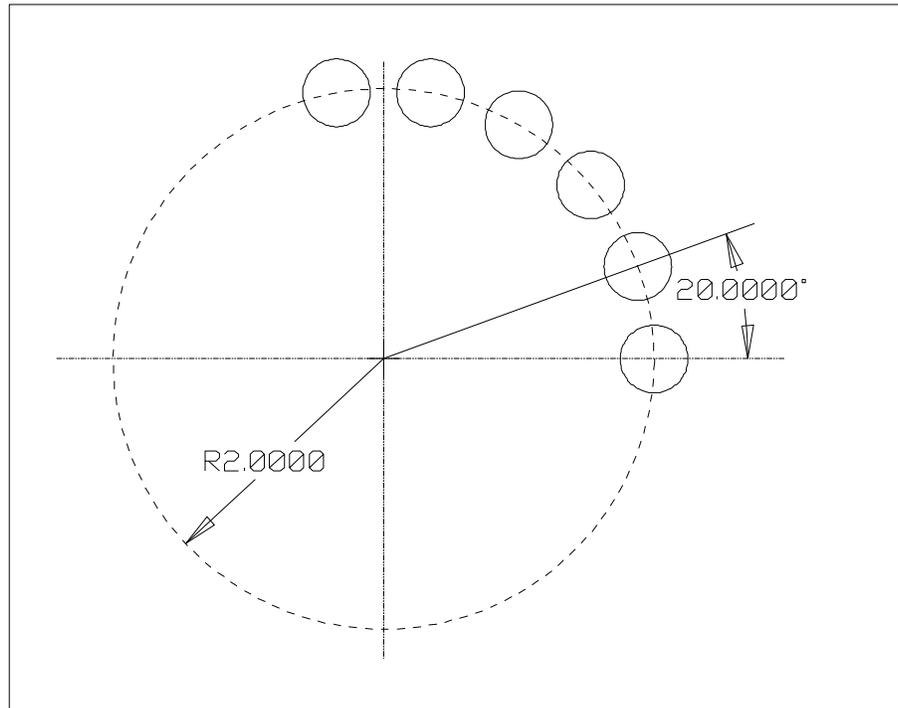CLAMPS

Figure 1-2 POWER-FAB Example

PUNCH MENU

Figure 1-3 Arc of Hits

ARC

The arc command is used to generate hits around a circle or arc. The output can be discreet hits, or canned cycle (see chapter 3). The questions are:

> **Center of the Bolt Circle   ("GET POINT" MENU)**
>
> **Number of Holes [8] ?**
>
> **Bolt Circle Diameter [1.00000] ?**
>
> **Angle of the First Hole [0.0000] ?**
>
> **Angle of the Last Hole [180.000] ?**
>
> **Clockwise Direction [Y/N] ?**
>
> **-C- Axis Rotation [0.00000] ?**
> This is the angle the tool is to index to before hitting all of the holes

In Figure 1-3 the angle of the first hole would be 0.0, the angle of the last hole would be 100, and "Clockwise Direction [Y/N] ?" would be answered "N".
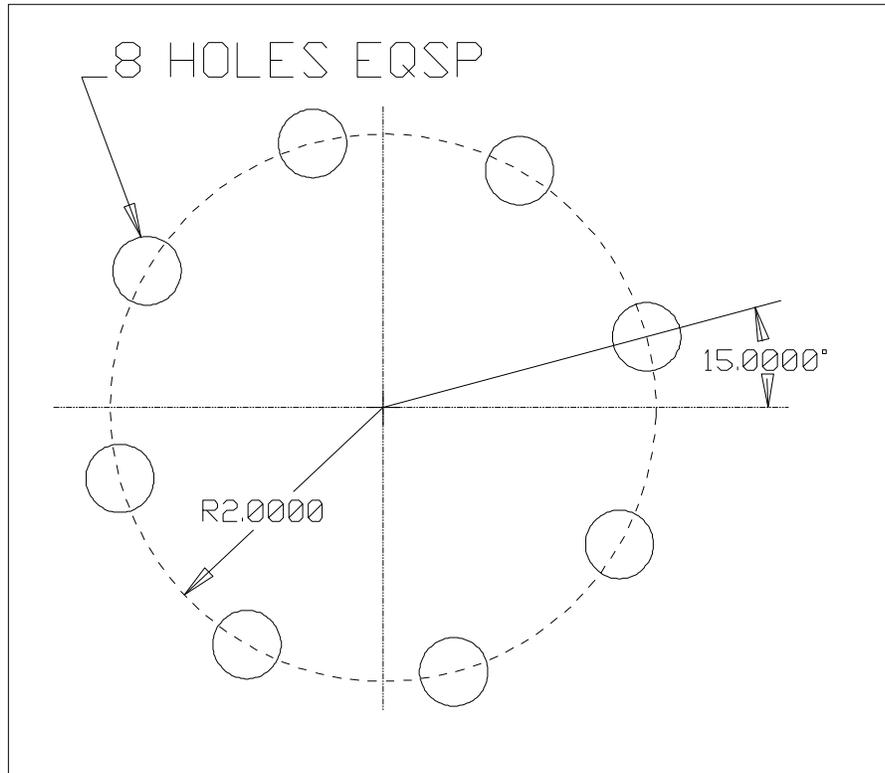
Tool Shapes Supported: Any

Figure 1-4 Bolt Hole Circle

BOLT-CIRCLE

The arc command is used to generate hits around a full circle. The output can be discreet hits, or canned cycle (see chapter 3). The questions are:

Center of the Bolt Circle ("GET POINT" MENU)

Number of Holes [8] ?

Bolt Circle Diameter [1.00000] ?

Angle of the First Hole [0.0000] ?

Clockwise Direction [Y/N] ?

-C- Axis Rotation [0.00000] ?
This is the angle the tool is to index to before hitting all of the holes

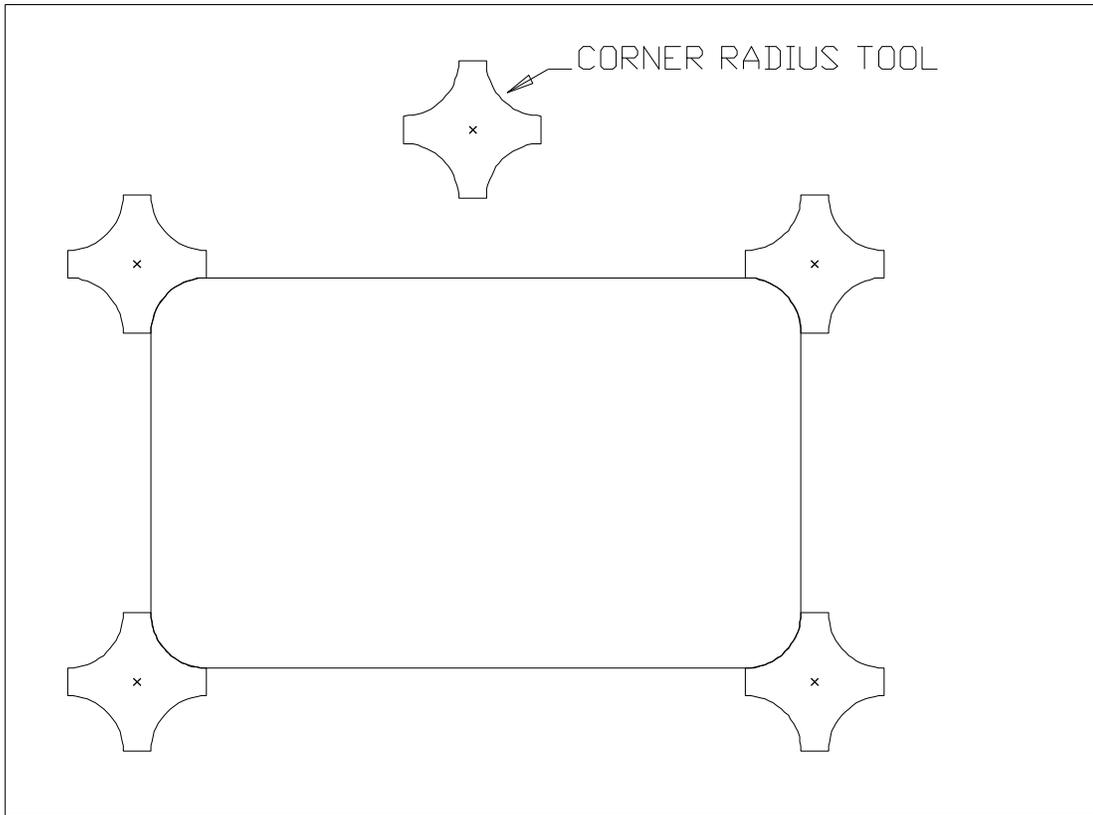In Figure 1-4 the angle of the first hole would be 15.0.

Tool Shapes Supported: Any

Figure 1-5 Corner-Radius Example

CNR-RAD

This command simplifies the rounding off of corners, using a radius (sometimes called a clover leaf) punch. There is only one prompt, that will be repeated until the <Esc> key or right mouse button is pressed.

Select an Arc

From the selected arc, the system will calculate a vector from the center of the arc, passing through the mid-point of the arc. This vector will be projected out to the calculated center of the tool, and a single hit will be output.

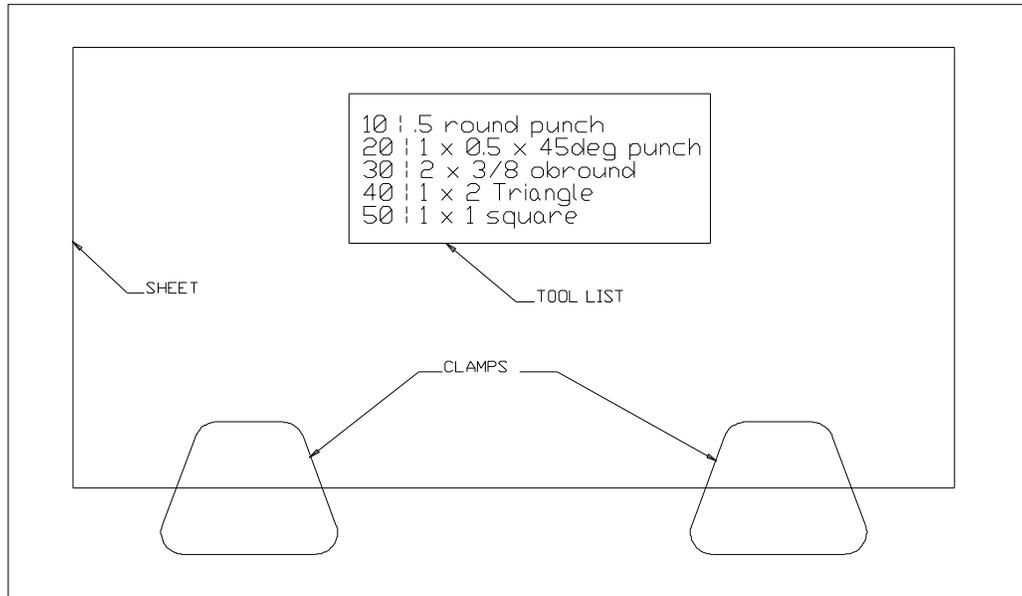**Tool Shapes Supported:** Corner Radius (type #4) only

Figure 1-6 Punch Drawing Commands

DRAWING (PUNCH DRAWING UTILITIES)

These commands simplifies the drawing of common shapes and information for sheet metal operations. See figure 1-6.

CLAMP - This command works in almost the exact same manner as the "GEOMETRY-BLOCKS-MERGE" command (See the POWERSTATION REFERENCE manual). Basically the clamps are drawn as any other POWERSTATION geometry, and stored as blocks using the "GEOMETRY-BLOCK-CREATE" command, and stored under the name "CLAMPn". Where the number "n" should be different for each clamp shape drawn. Note when asked for the "Block Origin", select a reference point on the clamp (generally the center & bottom).

After selecting the clamp name / number from the list you will be asked for the X & Y position to place the clamp in the current drawing. Note: Generally the -Y- value will be 0.0.

```
-X- Value for Clamp [4.0000] ?
-Y- Value for Clamp [0.0000] ?
```

SHEET - This command provides a simple means to draw a rectangle used to represents the blank sheet size. You will be asked:

```
Lower Left of Sheet in -X- [0.0000] ?
Lower Left of Sheet in -Y- [0.0000] ?
Width of Sheet in -X- [20.0000] ?
Height of Sheet in -Y- [20.0000] ?
```

Generally the lower left will be the default (0,0), and the width & height will be the actual sheet size.

DRAWING (PUNCH DRAWING UTILITIES) CONTINUED ...

TOOL-LST - This command draws a simple list of all defined operation numbers, and there descriptions. See figure 1-6. You will be asked:

```
Select the Top Left Corner for the List
List Text Height [0.15000] ?
```

The List text height will default to the current "Text Height" defined in the "DRAFTING-SETUP" command.

Note: Each line of the list will be drawn in the color defined with it's operation.
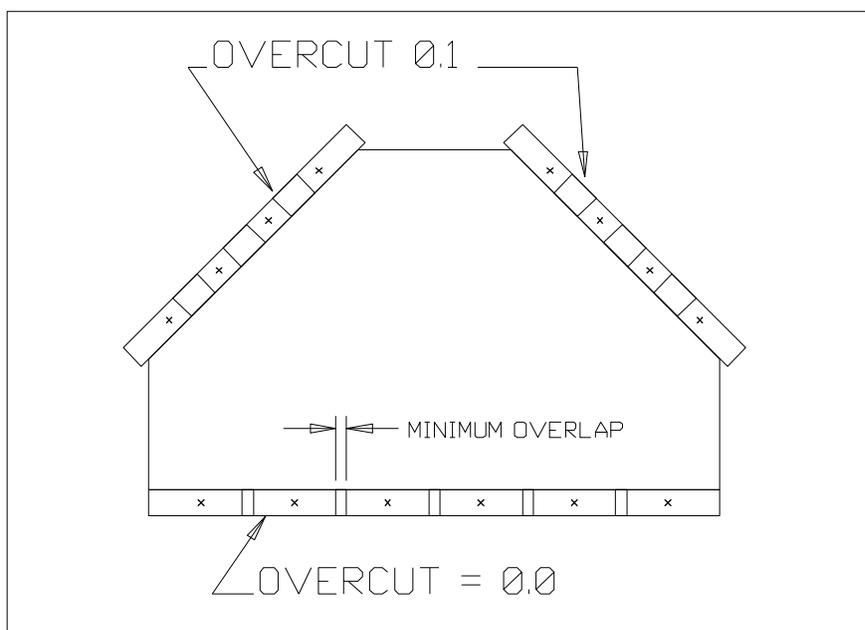
Figure 1-7 Edge command examples

EDGE

This command will generate hits along a line using a square / rectangular tool. Note: If the tool is indexable, lines at any angle may be cut, if the tool is fixed it must be set to the angle of the line or an error will result. The output may be discreet hits or a canned cycle. See figure 1-7. The questions are:

> **Over Cutting Distance [0.00000] ?**
> This is the extra distance the tool will position before the starting end of the line, and the distance the tool will cut past the end of the line
>
> **Minimum Overlap [0.05000] ?**
> See Chapter 1 for information on this
>
> **Number of Tabs to Leave [0] ?**
> The edge line to be punched will be divided into the specified number of equally spaced sections.
>
> **Width of Tabs [0.05000] ?**
>
> **Select a Line**
> **Indicate the Approximate point**
> These two prompts select the line to cut, the end to start on, and the side to offset to.

Notes: If the tool is longer than the selected line, a single hit will be generated in the middle of the line. If tabs are requested the tool must be shorter that the space between tabs, or an error will result: "Tool too wide for that many Tabs". You will then be returned to the original questions, so you can enter a different number of tabs.

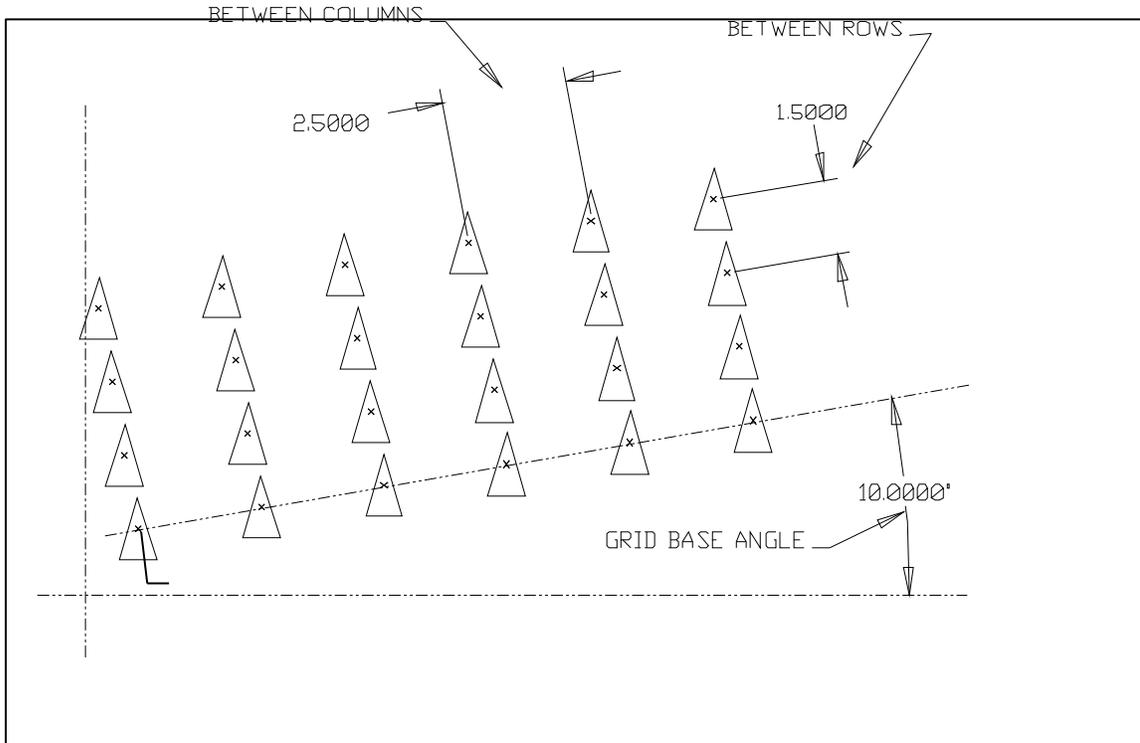**Tool Shapes Supported:** Square / Rectangle (type #2) only

Figure 1-7 Grid command example

GRID

This command generates a grid pattern of hits. The output may be discreet hits, or a canned cycle.

> **Select the Grid Origin ("GET POINT" MENU)**
>
> **Number of Columns <||||> [1] ?**
> **Number of Rows <-----> [1] ?**
>
> **Distance between Columns [1.0000] ?**
> **Distance between Rows [1.0000] ?**
>
> **Generate Hits in -X- or -Y- First [X/Y] ?**
> The Hits will be done by rows (-X-) first, or Columns (-Y-) first.
>
> **Grid Base Angle [0.0000] ?**
> The "Base Angle" is the angle between the horizontal axis, and the bottom row of holes.
>
> **-C- Axis Rotation [0.0000] ?**
> This is the angle the tool is to index to before hitting all of the holes

In Figure 1-7 the grid would have 6 columns and 4 rows.

Tool Shapes Supported: Any
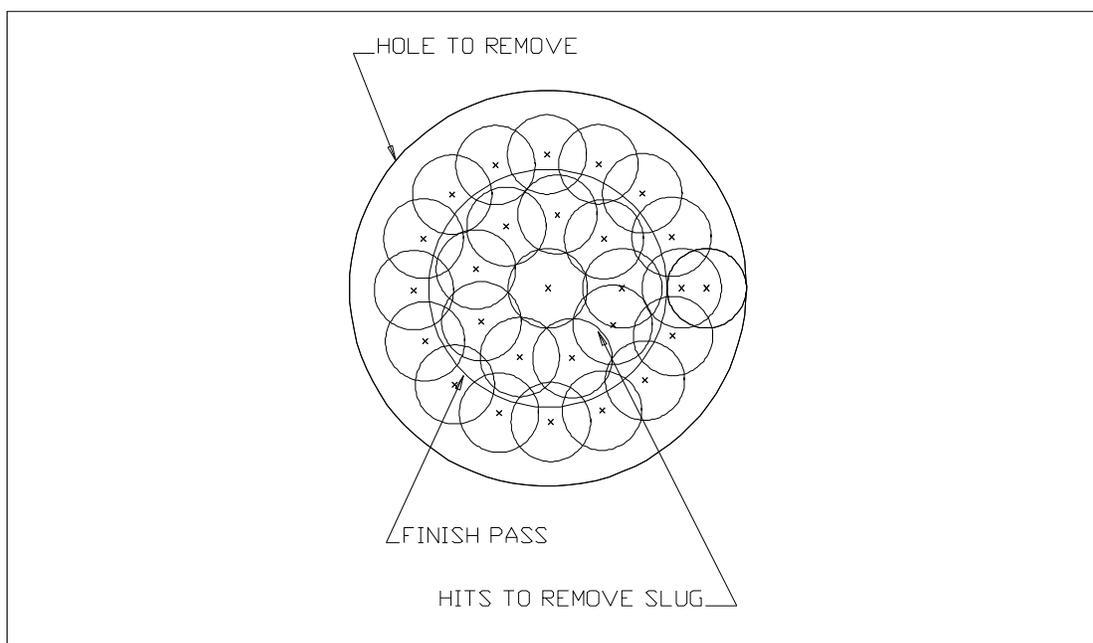
Figure 1-8 Hole command example

HOLE

This command will rough out (optional) and finish a hole. If removing the slug is selected it will always be output as discreet hits. The finishing of the hole will be done as a NIBBLE-ARC command and will be output as discreet hits or a canned cycle. The slug removal will start in the center of the selected circle, and move out approximately 7/8 of the tool diameter for each roughing circle.

Notes: If the punch diameter is equal to the diameter of the selected circle, a single hit will be generated. The punch diameter must be smaller than the circle selected (no kidding) or an error will be displayed.

Cusp Height [0.02500] ?
See chapter 1

Select An Arc

Remove Center Slug [Y/N] ?
If "Yes" the center slug will be removed as described above, If "no" then:

Generate Optional Stop After Last Hit [Y/N] ?
This will cause the output of an optional stop (typically M01) after the last hit.

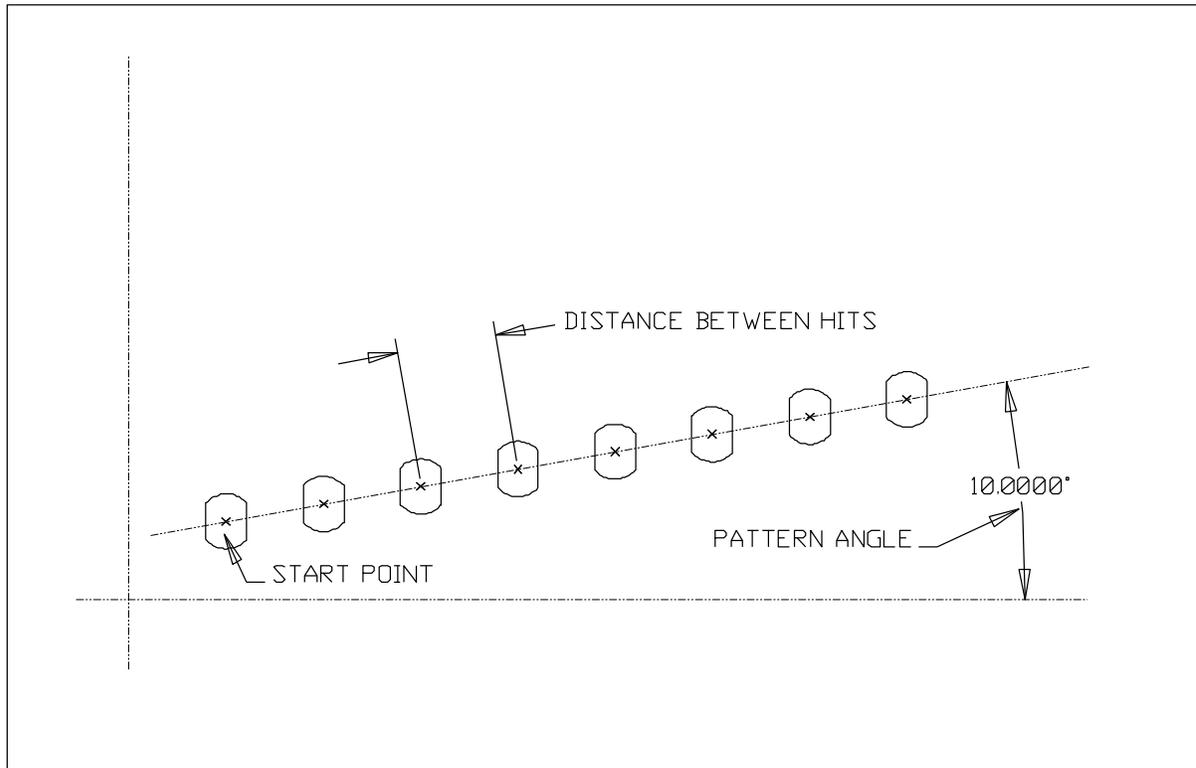**Tool Shapes Supported:** Round (type #1) only

Figure 1-9 Linear Example

LINEAR

This command generates a linear pattern of hits. The output may be discreet hits, or a canned cycle.

Number of Holes [8] ?
Start Point for Linear Pattern ("GET POINT" MENU)
Do You Know the Pattern End Point [N/Y] ?

If "yes" then:

End Point for Linear Pattern ("GET POINT" MENU)
If the end point is specified, the following information (angle & Distance) will be automatically calculated.

If "no" then:

Pattern Angle [0.0000] ?
Distance Between Holes [1.0000] ?

-C- Axis Rotation [0.0000] ?
This is the angle the tool is to index to before hitting all of the holes

Tool Shapes Supported: Any

Figure 1-10 Nibble-Arc Examples

NIBBLE MENU

NIB-ARC

This command will generate discreet hits, or a canned cycle to nibble an arc. The questions are:

> **Cusp Height [0.02500] ?**
> See chapter 1

> **Select An Arc**

> **Indicate The Approximate Point**
> This selects the side of the arc to nibble on, and the end of the arc to start at.

Note: The "Select Arc" and "Approximate Point" questions will repeat until the <Esc> key or right mouse button is pressed.

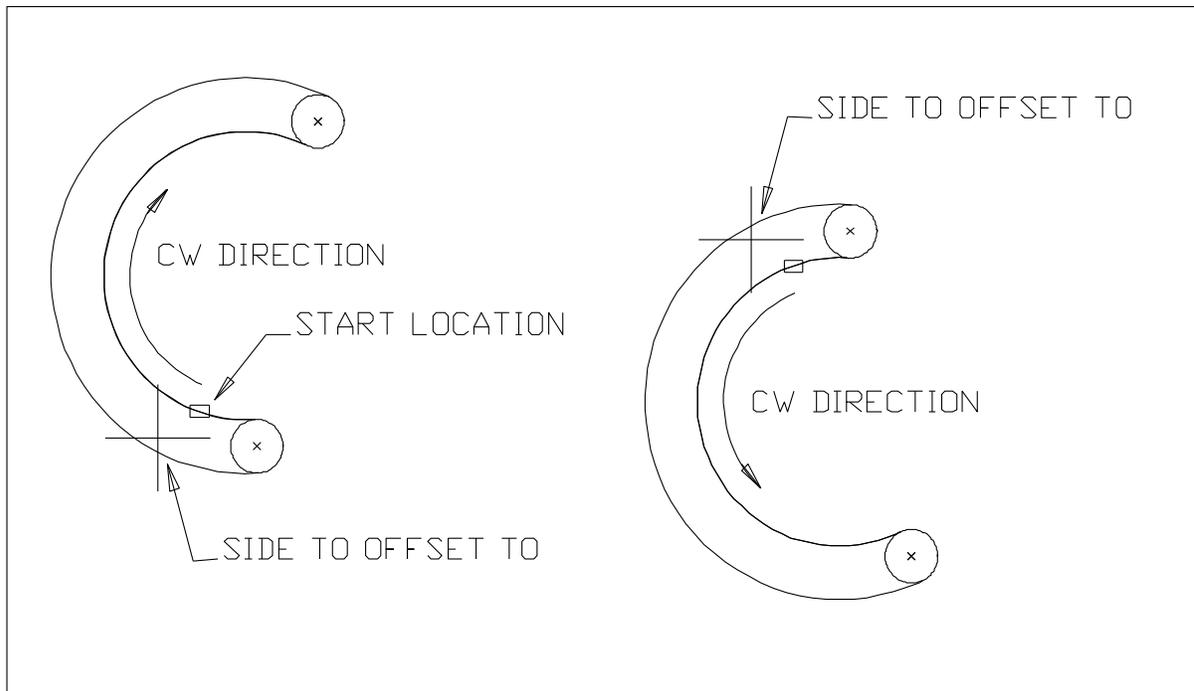**Tool Shapes Supported:** Round / Square (Indexable Only)

Figure 1-11 Nibble-Line Examples

NIBBLE

NIB-LINE

This command will generate discreet hits, or a canned cycle to nibble a line. The questions are:

Cusp Height [0.02500] ?
See chapter 1

Select A Line

Indicate The Approximate Point
This selects the side of the line to nibble on, and the end of the line to start at.

Note: The "Select Line" and "Approximate Point" questions will repeat until the <Esc> key or right mouse button is pressed.

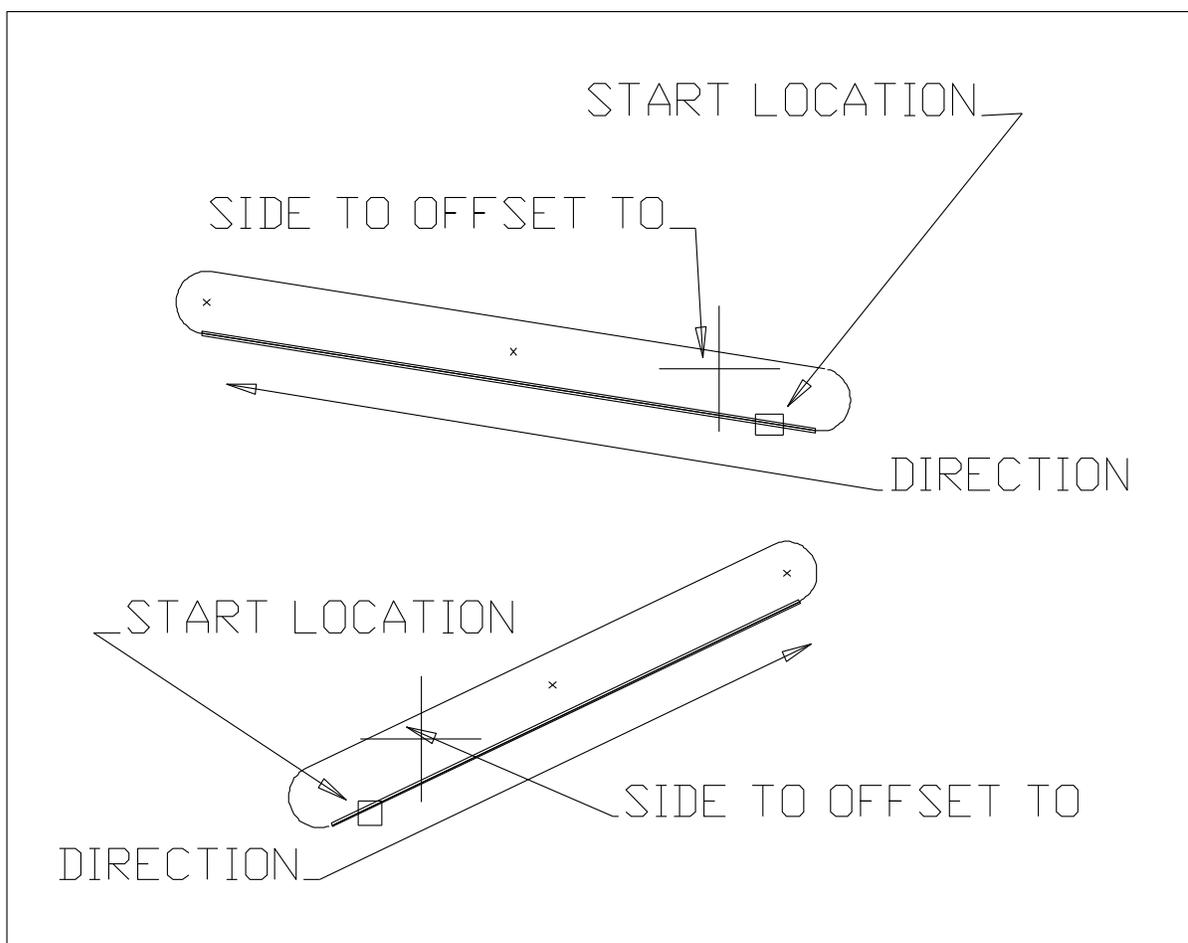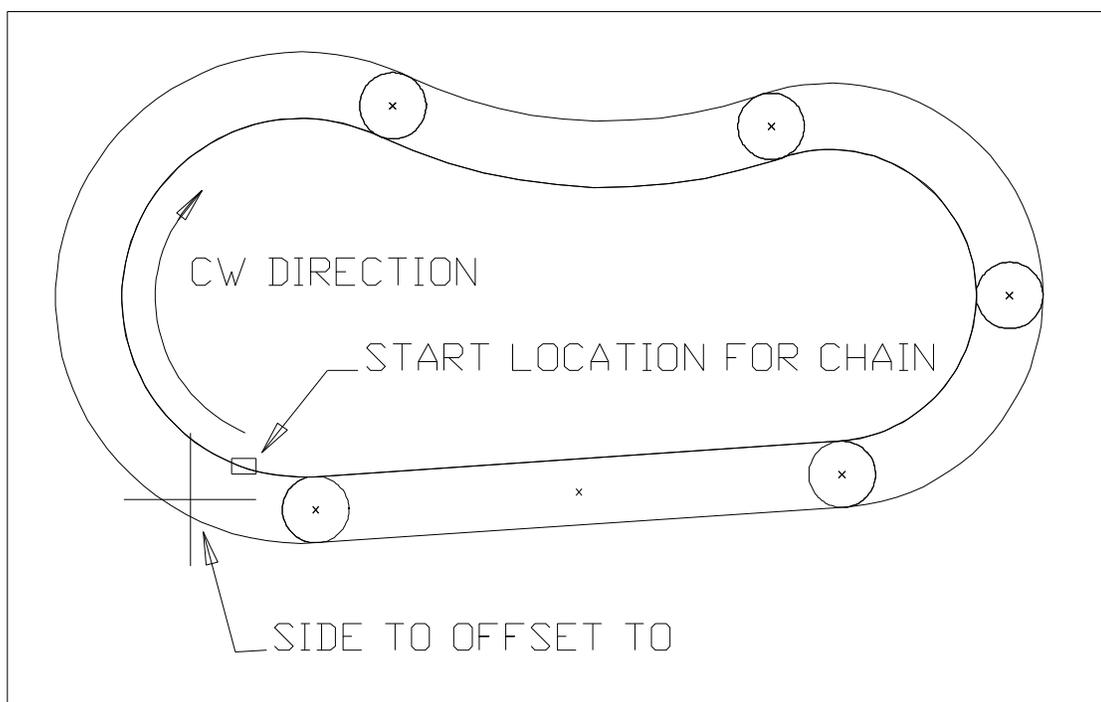**Tool Shapes Supported:** Round / Square (Indexable Only)

Figure 1-12 Nibble Chain Example

NIBBLE-CHAIN

This command will generate discreet hits, or a canned cycle to nibble a series of connected lines and arcs. The questions are:

Cusp Height [0.02500] ?
See chapter 1

Select The Starting Line or Arc

Indicate The Approximate Point
This selects the side of the line to nibble on, and the line of the arc to start at.

Note that lines and arcs are the only type of entities that can be chained. Chaining works in the following manner:

First you will be asked to select the starting line or arc. Second you will be asked to select the Line or Arc to stop before, or press <Esc> for none.

The chaining will start at the opposite end of the entity you select. If an entity is found who's beginning or ending point is near (less then 0.0005 away (this number can be changed in the "FILE-PROJECT" section)) from the end of the current entity, it will also be selected. A small arrow will be drawn to show which direction the chaining went in.

This procedure will continue until no entities are found near the end of the current entity, or the line or arc to stop before (if selected) is reached.

Tool Shapes Supported: Round / Square (Indexable Only)
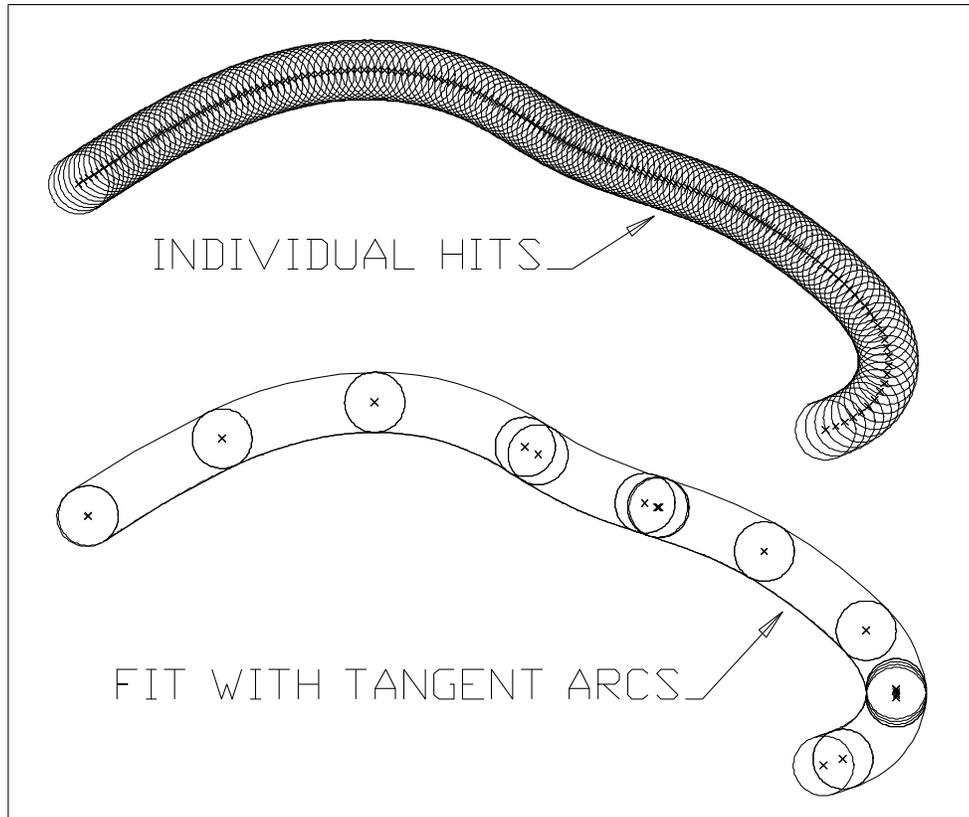
Figure 1-13 Nibble Spline Example

NIBBLE-SPLINE

This command will generate discreet hits, or a canned cycle to nibble a Spline curve. The questions are:

Cusp Height [0.02500] ?
See chapter 1

Select An End of the Spline to Nibble
You may pick the Spline by pressing the "S" key (Spline mask) and positioning the cursor over any of the spline's "control points").

Fit Spline With Tangent Arcs [N/Y] ?
A NO answer will generate simple point to point motion. If answered YES POWERSTATION will try to find a minimum number of ARCS to generate the curve.

Tolerance to Fit the Spline [0.01000] ?
This number controls the number of points output.

Starting End and Side to Nibble the Spline
Indicate The Approximate Point
This selects the side of the Spline to nibble on, and the end of the Spline to start at.

Tool Shapes Supported: Round / Square (Indexable Only)

Figure 1-14 Rectangle examples (leaving slugs)

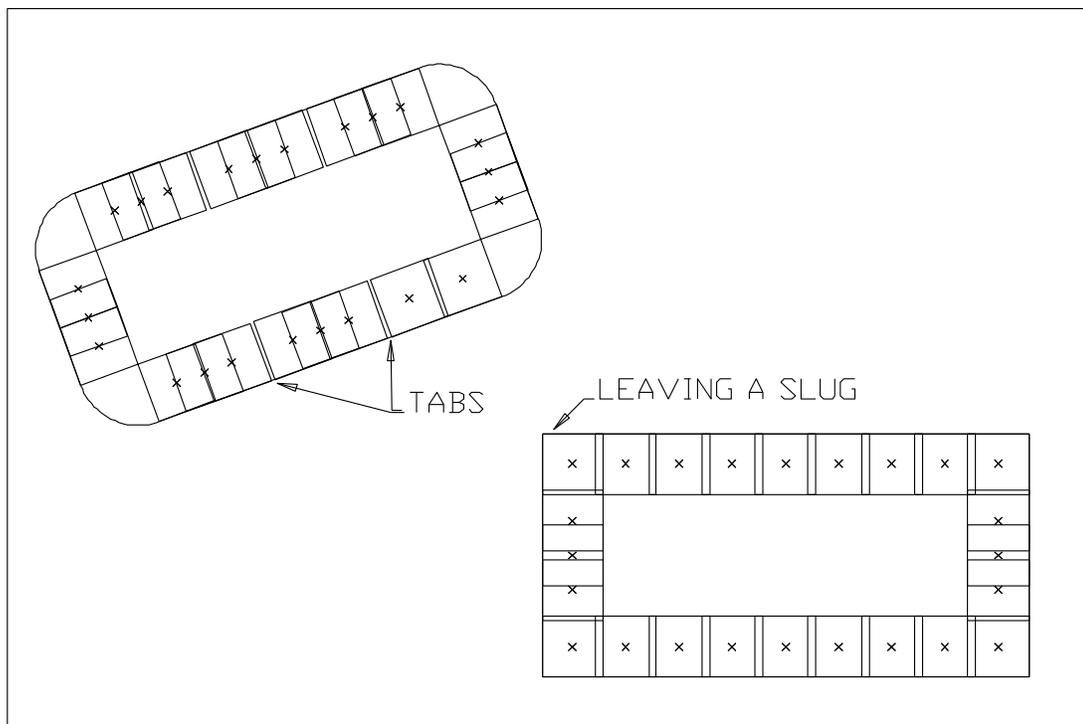## RECTANGLE

This command generate the necessary hits to remove a rectangular area from the part.

First the rectangle needs to be described. This is done in an identical manner to the standard "GEOMETRY-LINE-BOX" command. You will be prompted for the first corner, using the "GET POINT" menu. For the second corner there are two options, first you will be presented with the "GET DISTANCE" menu. If you desire an exact size box this is the method to use. If an approximate sized box is desired you may press <ESC> or the right mouse button, and the box will be "dragged" around the screen by the motion of the cursor. When the correct size box is displayed, press the left mouse button. Next you will be asked about the corner radius (if any) , and the base (or tilt) angle of the rectangle.

Errors:

After defining the rectangle to be punched, it will be checked for errors.

1.   Current tool is not a square / rectangle

2.   The tool is not indexable and the tool angle is not equal to the base angle

3.   Tool is larger than the rectangle to be punched.

RECTANGLE CONTINUED ...

Special Cases:

If the defined rectangle is exactly the punch size, a single hit is generated.

If a corner radius is defined, the tool will leave the corner in tact. These corners can be removed before or after the rectangle by using a round punch with the "MULTI" or "SINGLE" commands.

Next a series of questions will determine the tool path taken:

First a phantom rectangle is drawn to show where the punching will take place.

```
Minimum Overlap [0.05000] ?
```
See Chapter 1

```
Remove Center Slug [Y/N] ?
```
This is a key question. It determines the type of cycle and the questions that will follow.

If **NO** (Leaving the center Slug):

```
Hold Slug with Tabs [N/Y] ?
```
Sometimes called "shaker tabs" are used to hold the slug in place while the remaining punch hits are performed.

if Tabs are selected:

```
Number of Tabs in -X- [2] ?
Number of Tabs in -Y- [2] ?
Width of Tabs in -X- [0.05000] ?
Width of Tabs in -Y- [0.05000] ?
```

These set the number and width of tabs in each direction. Note: If the tool is too large to accommodate generating tabs in either direction, they will be automatically eliminated.

```
Generate Optional Stop after last hit [Y/N] ?
```
If answered "Y", a command to insert an "Optional Stop" (typically an "M01") will be added into the machining sequence.

At this point the hits will be generated. Note: At times if the tool is large and a small minimum overlap is requested, the punching may overrun the side(s) of the rectangle. If this occurs, press <F7> (Delete last), and try again with a different Minimum overlap, or a smaller tool. The punching will proceed as follows first the bottom is punched, then the right, the top, and then left side. See figure 1-14.

Note: If tool is indexable, and the width is less than the rectangle height, it is indexed 90 degrees for the right/left side.

<u>RECTANGLE CONTINUED ...</u>

<u>If removing the slug:</u>

`Punch in -X- or -Y- First [X/Y] ?`

The punching always starts in the lower left corner of the rectangle. If -X- is selected, the first hits will be in a row across the bottom of the rectangle. If -Y- first is selected the first hits will be in a column going up the left side of the rectangle. See Figure 1-15.
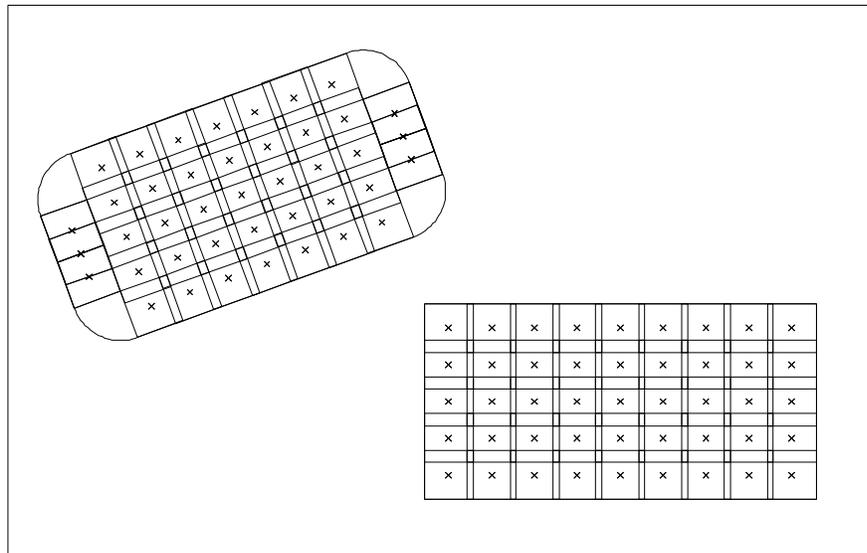
Tool Shapes Supported: Square

Figure 1-15 Rectangle examples (slugs removed)
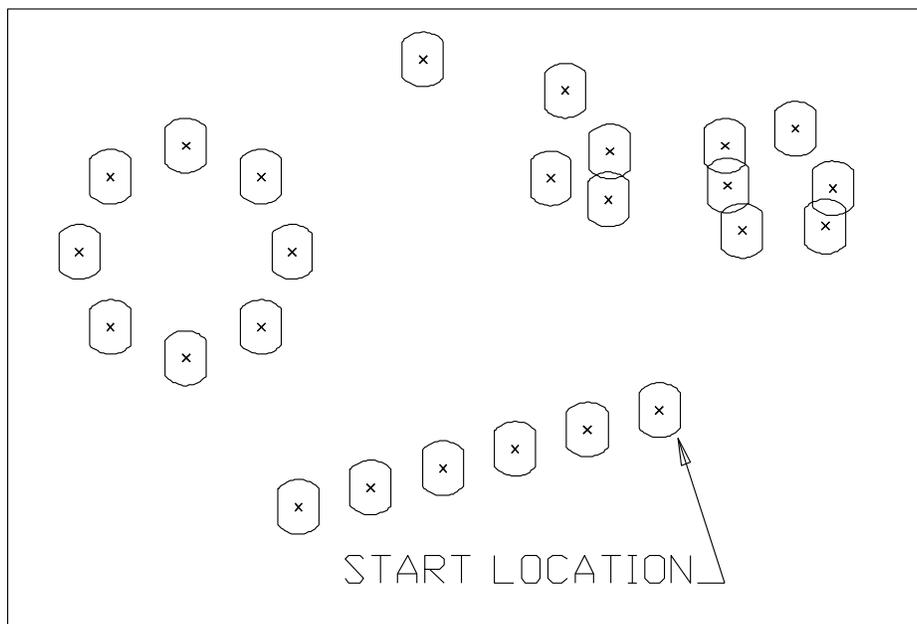

Figure 1-16 Punch-MULTI command example

SINGLE

This command is used to generate a single hit or hits. The questions are:

If the tool is indexable you will be asked for the tool rotation angle at which all hits will be performed.

-C- Axis Rotation [0.0000] ?

At this time the "GET-POINT" menu will be displayed (see tutorial chapter "Basics"). Use one of the standard methods to define the X,Y location where you want a hit. This process will repeat until the <Esc> key or the right mouse button is pressed.

Tool Shapes Supported: Any

MULTI

This command is designed to handle large numbers of random hit locations. After specifying the -C- axis location (See "SINGLE" above), you will be given the standard entity selection menu (Chapter BASICS). After selecting the desired geometry, you will be asked to indicate the approximate first location to be hit. At this time the selected entities will be scanned, and all points, and arc centers in the selection set will be considered as hit positions. Before hitting these locations however, POWERSTATION will do a simple optimization of the tool path (Finding the nearest hit to the last one). See Figure 1-16.
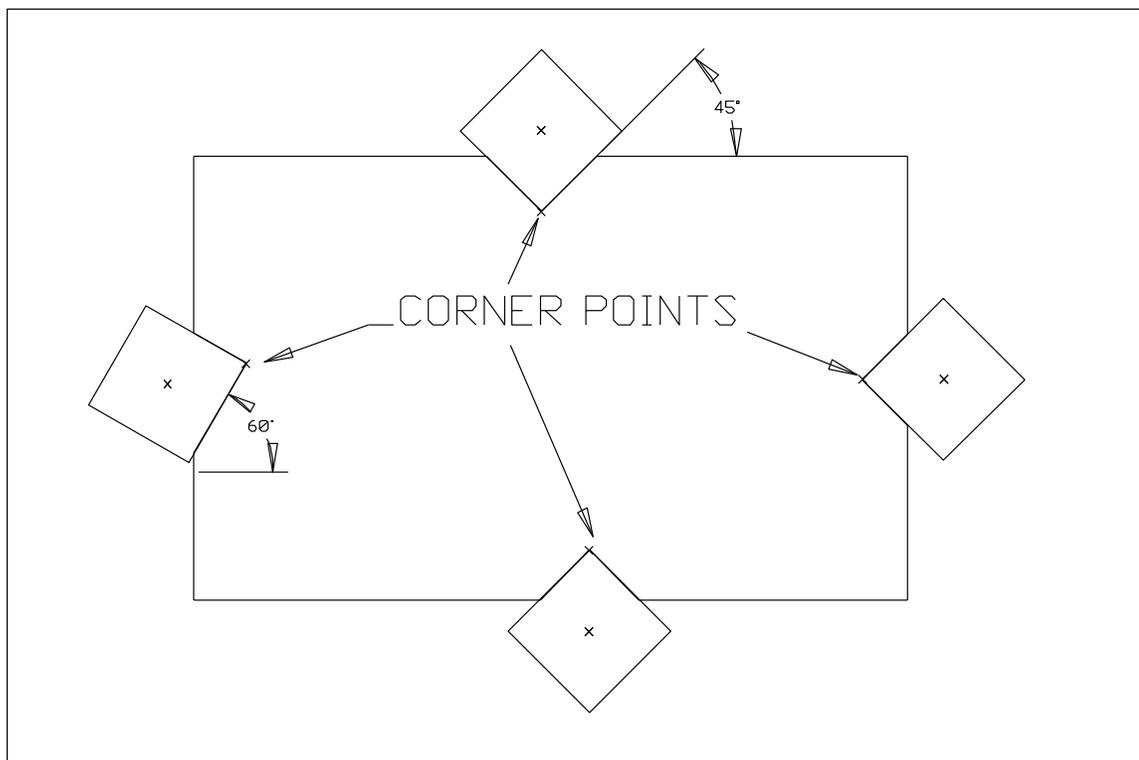
Tool Shapes Supported: Any

Figure 1-16A NOTCH command example

NOTCH

This command is designed to remove simple "V" shaped notches, using a square / rectangular punch. See figure 1-16A.

Corner Point for Notch
The standard "GET POINT" menu will be displayed.

Base angle for Notch [45.00000] ?
This angle will generally correspond to the angle of the lower edge of the punch (see example).

Indicate the Approximate Point
This will select which side of the corner point (left, right, up, or down) that the notch is located on.

Tool Shapes Supported: Square /Rectangle (Type #2)

UTILITY

This command brings up another sub-menu of punch "utilities".

UTILITY-NO-PUNCH

This command functions identically to the standard "SINGLE" command, except that instead of generating a single hit, it calls in the macro defined (in group 1 of the MACHINE SETUP) for "Position No-Punch". Typically this command is used to move around a clamp.

UTILITY-REPO

This command is used to activate a "repositioning" cycle. Most older machines do not have a built in repositioning cycle, but they can emulate it using several individual blocks. If a cycle exists or must be emulated, all output is generated by the post macro for repositioning (in group 1 of the MACHINE SETUP) . The questions are:

Reposition Distance in -X- [0.0000] ?
Reposition Distance in -Y- [0.0000] ?
(Typically 0.0)

Reposition Changes Tape Coordinates [N/Y] ?
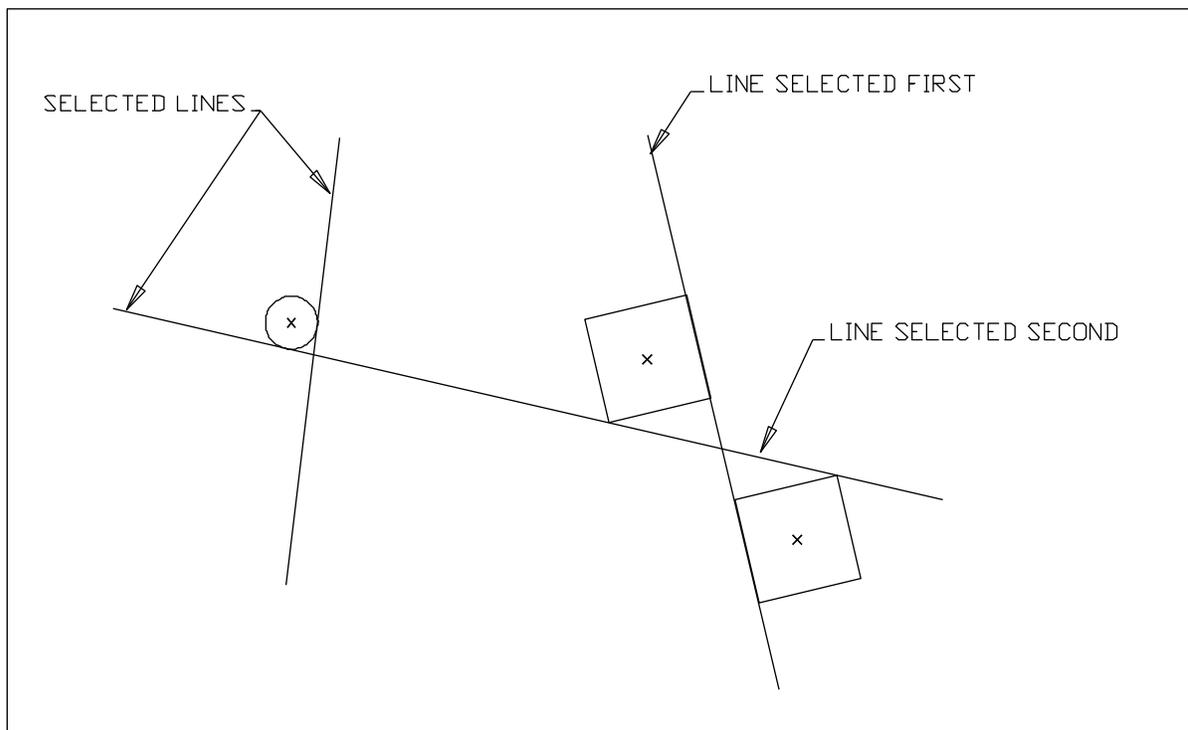If answered "Y" then all X & Y hits to follow will have the repositioning amount subtracted from them.

Figure 1-17 Utility-Tanto-2 Examples

UTILITY-TANTO-2

This command is used to position a round tool tangent to any combination of lines or arcs, or position a square tool tangent to two lines. After selecting the two entities to be tangent to, you will be asked to "indicate the Approximate Location", where the tool center will be. One special case is when using a square tool, the tool will be aligned with the first line selected, therefore the tool must be indexable or be set at the angle of the first line selected.

UTILITY-BURNING

This command can be used to output the proper codes to enter or leave a "burning" (Flame, Plasma, Laser, Etc.) mode. By itself it generates no specific output, but relies on a user created post macro for all output. See the chapter on "Post Setup" for more information on creating a macro. Generally once the burning mode is turned "ON" you will want to use the MOVE/CUT menu (Especially the "CHAIN" command).

Turn Burning ON [N/Y] ?

If "ON" is selected:

Select a Point to Pre-Position on to
The selected point will be output to the post macro. If this point is UN-necessary in your application, you may press <Esc> to skip.

GENERATING MULTIPLE PARTS
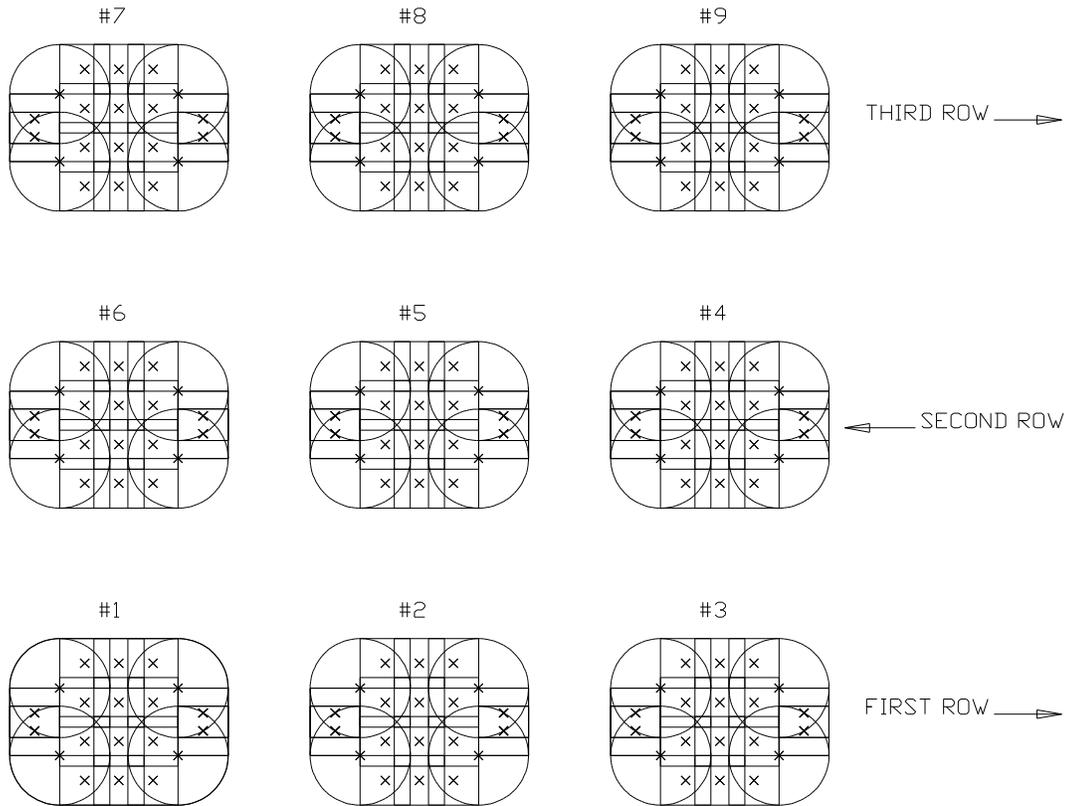
Figure 1-18 Multiple Parts Example

POWER-FAB makes the generation of multiple parts no more difficult than the creation on a single part.

Once the original part has been generated, (or before if you desire) generating multiple parts is simply a matter of specifying the number of parts in the X & Y directions, and the spacing between each.

To Set the number of parts, select "OPERATION-SET-PARTS", you will be asked the following questions:

```
Number of Parts in -X- [1] ?
Number of Parts in -Y- [1] ?
```

If the number of parts in -X- or -Y- is more than one, you will be asked:

Distance Between Parts in X & Y, <Esc> for Previous
The standard "Get DISTANCE" menu (See chapter "BASICS") will be displayed, and you may use any of these standard methods to define the X & Y space between parts. Pressing <Esc> will display the current values, and allow you to enter new ones if desired.

MULTIPLE PARTS CONTINUED ...

If <Esc> is pressed you will be asked:

```
Distance Between Parts in -X- [1.00000] ?
Distance Between Parts in -Y- [1.00000] ?
```

Notes:

1. The rows and columns of parts will be generated in a pattern as shown in figure 1-18. Starting at the first part, and proceeding along the -X- direction for one row, moving up (or down) the -Y- distance, and now generating parts in the opposite -X- direction as the last row.

2. The additional parts are drawn on the screen, but are not contained in the data base. Therefore they cannot be selected by any of the "PATH|EDIT" commands.

3. The information to actually hit the additional parts is not generated until the "POST" command is selected.

4. The number of parts in each direction, and the spacing between can be changed at anytime prior to issuing the "POST" command. Even if the drawing has been saved and loaded again at a latter date, the number of parts and the spacing may be changed.

5. The "Pre-Posting" (that takes place when the POST command is selected), WILL NOT MAKE ANY ATTEMPT TO UNDERSTAND ANY SPECIAL CONSIDERATIONS THAT MUST BE MADE WHEN MOVING FROM ONE PART TO ANOTHER. It will simply take everything that you did, in each operation and replay it at the next location. In other words, let's say the machine must first do a "Position-NO-Punch" to some safe location before beginning each new part (with each new tool). The NO-PUNCH move should then be the last thing entered into every operation.

6. The path taken is not optimized, except that the rows are punched in alternating directions.

MOVE/CUT MENU

With the POWER-FAB option, certain commands in the "MOVE/CUT" menu function some what differently than for Mills or Lathes. These modifications were made to support burning type machines (Laser, Plasma, Etc.).

CHAIN

In the CHAIN command if "Rapid to the Start Position" is answered "Yes", you will be asked for the clearance amounts in the X & Y axis.

```
Clearance Amount in -X- [0.1000] ?
Clearance Amount in -Y- [0.1000] ?
```

GENERAL

Most other MOVE/CUT commands will function identically to there "MILLING" mode. If any -Z- questions are asked, feel free to skip them.

OPERATION MENU

With the POWER-FAB option installed, the "OPERATION-Dialog" screen changes substantially.when an operation "type" of "Punching" is selected. After defining the operation number, The machining type selections will change:

Notes:

Offset Number
This number is typically not required on most Punching machines

Shape
Punch Shapes are: Round, Square/Rectangle, Obround, Cnr-rad, Triangle, "D", Double "D"

The questions that follow depend on the tool shape selected. (See Figure 1-19)

Round:

Punch Diameter [1.00000] ?

Square:

Punch Width [1.00000] ?
Punch Height [1.00000] ?
Orientation Angle [0.00000] ?

Obround:

Punch Width (Over Radii) [1.00000] ?
Punch Height (Over Flats) [1.00000] ?
Orientation Angle [0.00000] ?

Corner-Radius:

Punch Radius [0.50000] ?
Punch Web Thickness [1.00000] ?
Orientation Angle [0.00000] ?

Triangle:

Punch Base Width [1.00000] ?
Punch Height [1.00000] ?
Orientation Angle [0.00000] ?

"D":
Punch Diameter [1.00000] ?
Measurement over flat [0.750000] ?
(Must be smaller than punch diameter)
Orientation Angle [0.00000] ?

Double "D":
Punch Diameter [1.00000] ?
Measurement over flats [0.750000] ?
(Must be smaller than punch diameter)
Orientation Angle [0.00000] ?

The following questions apply to all tool shapes:

[ ] Sheer Proof Tool

[ ] Indexable Tool
This defines a tool that can be rotated in place under machine control. Generally referred to as a -C- axis.

Feedrate [1.00000] ?
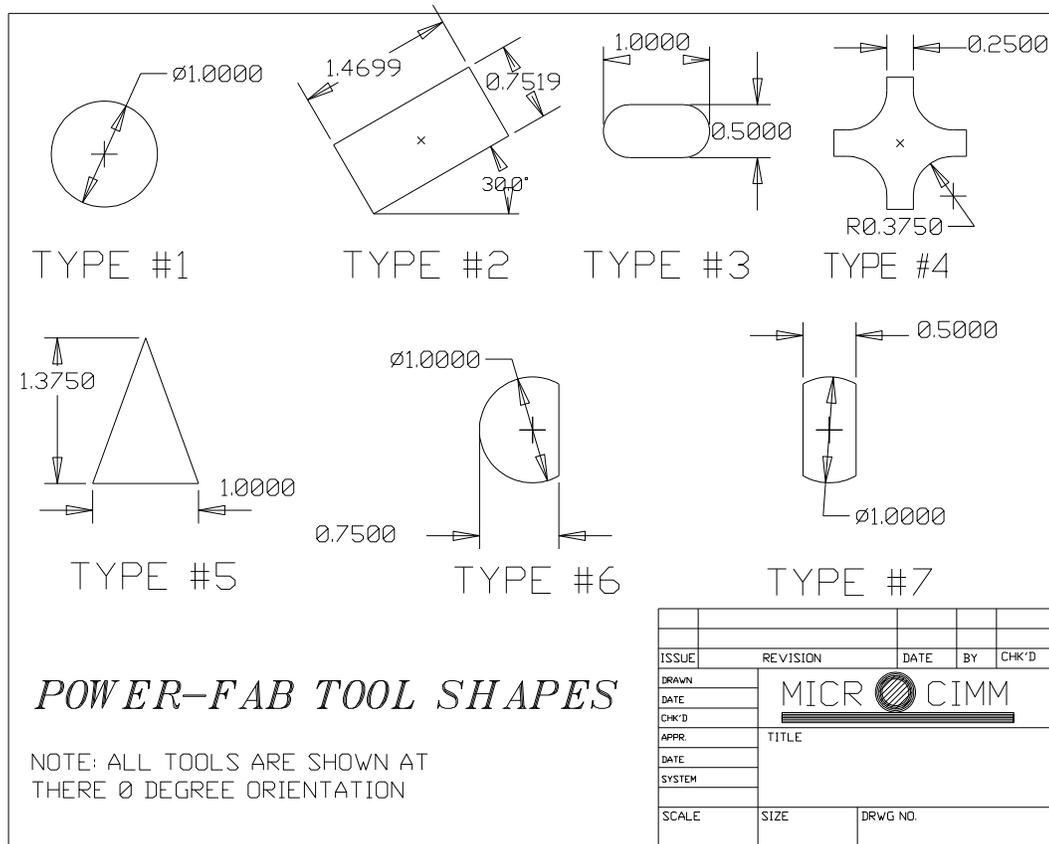Generally not used in Punching mode, usually required only if burning is selected.

Figure 1-19 Standard POWER-FAB Tool Shapes

POWER-FAB ERROR MESSAGES

The POWER-FAB option adds a few new error messages:

Punch Hole cycle supports Round Punch Only -- The "PUNCH-HOLE" command supports round punches only. Change the punch shape to round, or select a different operation that was defined with a round punch.

Corner Radius Not Equal to Punch Radius -- In the "PUNCH-CNR-RAD" command the radius of the selected arc, does not equal the radius on the punch.

Command is for Rectangular Tools Only -- Many commands (Such as the "RECTANGLE" command) support square punches only.

Tool Angle not equal to Edge/Base Angle -- In the "EDGE" , "RECTANGLE", & "NOTCH" commands, the tool must be indexable or be preset to the angle of the line being punched.

Command Uses Round or Square Tools Only -- TheTANTO-2 command can only calculate positions using round or square tools.

Square Tool must be indexable to Nibble -- The NIBBLE command always support round tools, and *if the tool is indexable:* square tools.

This Cycle supports a Corner Radius (type #4) Punch Only -- The "CNR-RAD" command was designed for one punch style only.

Tool Too wide for that many Tabs -- In the "EDGE" command, the punch width (relative to the length of the line being punched) cannot generate the requested number of tabs. After this error is displayed, you will be given a chance to change the requested number of tabs.

POST SETUP

Setting up a post for a punch, is identical to setting up for any other machine (Please see the Applications Cookbook under "Post Building'/Machine Setup" for a tutorial on post setup. The first thing to try is under "Sample Posts", install the sample post named "Power-FAB Posts".

The most important area to be setup are the post macros. They are used for the generation of canned cycles, and even such common operations as positioning without punching, and re-positioning. For the purpose of example we have chosen to create sample macros for a typical modern machine manufactured by USA AMADA Corp.

The POWER-FAB option, add a few new and very important questions to the "MACHINE-SETUP".

IN GROUP #1 (MACHINE TYPE):

After setting the machine type to a number 3 (punch) there are several new questions:

```
Punch Has Indexable Tools 0 = No, 1 = Yes          [0] ?
```
This determines if the machine has rotating tool (-C- axis) capability.

```
************* Punch Macros ***************
```
These macros will each be documented in the pages that follow.

```
Macro name for Single Punch Hit               [NONE] ?
Macro name for Bolt Hole Circle/Arc of Holes  [amdbhc] ?
Macro name for Linear Pattern of Holes        [amdlin] ?
Macro name for Grid pattern of hits           [amdgrid] ?
Macro name for Position / NO Punch            [amdnopch] ?
Macro name for NIBBLING a LINE                [amdnibl] ?
Macro name for NIBBLING an ARC                [amdniba] ?
Macro name for EDGE Command                   [amdshr] ?
Macro name for Repositioning                  [amdrepo] ?
Macro name for Burning ON/OFF                 [NONE] ?
```

GROUP 2 (AXIS NAMES)

```
Alpha Character for Rotating Tool Axis [C] ?
```

GROUP 3 (-G- CODES)

```
-G- Code for Single Punch Hit      [NONE] ?
```
This code is generally not required by most machines

SAMPLE MACROS

Each time a cycle command is selected, the post looks for a user defined macro to generate the proper canned cycle output. If none is found (defined in group #1), then discreet hits will be output in place of the canned cycle.

Prior to calling in the macros that you define, POWER-FAB will output several variables (generally within 1..10) that describe the parameters of the desired cycle. The variables and there values will be documented in the following example macros.

As mentioned above, an AMADA machine will be used for the following examples.

FILE: AMDBHC.MAC

Purpose:

Bolt Hole Circle / Arc of Holes MACRO

Variables:

1 = -X- Center of arc
2 = -Y- Center of arc
3 = -R- Radius of arc
4 = Start Angle
5 = Angle between hits
6 = Number of hits
7 = Direction FLAG CW = -1 CCW = 1
8 = Flag indicating the type of cycle: ARC = 1, BHC = 2

Example:

```
(AMADA PUNCH SAMPLE BHC MACRO)
INS/ G72 X#1 Y#2
IF/ #8 EQ 1 INS/ G29 I#3 J#4 P#5*#7*-1.0 K#6 T#20
IF/ #8 EQ 2 INS/ G26 I#3 J#4 K#6 T#20
```

FILE: AMDLIN.MAC

Purpose:

Linear Pattern of Hits

Variables:

1 = -X- start location
2 = -Y- start location
3 = Distance between holes
4 = Angle of pattern
5 = Number of hits

FILE: AMDLIN.MAC CONTINUED ...

Example:

```
(AMADA LINEAR PATTERN MACRO)
INS/ G72 X#1 Y#2
INS/ G28 I#3 J#4 K#5 T#20
```

FILE: AMDGRID.MAC

Purpose:

Grid Pattern of Hits

Variables:

1 = -X- start location
2 = -Y- start location
3 = Hits in -X- direction
4 = Distance between in -X- direction
5 = Hits in -Y- direction
6 = Distance between in -Y- direction
7 = Base Angle of grid

Example:
This example has something special: Since the AMADA cycle supports Grid's who's base is 0 degrees only, so first variable #7 is checked. If it is not zero, the body of the macro is jumped over, and a special flag is set to tell the POST that the MACRO read has failed, and the discreet hits need to be output.

```
(AMADA GRID CYCLES)
( IF GRID BASE ANGLE <> 0 DEGREES, HITS MUST BE OUTPUT)
IF/ #7 NE 0.0 GOTO/ BAD
INS/ G72 X#1 Y#2
( CHECK FOR WHICH DIRECTION HAS MORE HITS )
IF/ #5*#6 GT #3*#4 GOTO/ GRIDY
( GRID IN THE -X- DIRECTION )
INS/ G36 I#4 P#3-1 J#6 K#5-1
GOTO/ END
GRIDY:
INS/ G37 I#4 P#3-1 J#6 K#5-1
GOTO/ END
BAD:
( THIS FORCES THE HITS THAT FOLLOW TO BE USED, NOT SKIPPED )
V / 74 0
END:
```

FILE: AMDNOPCH.MAC

Purpose:

Position tool without punching

Variables:

1 = -X- to position to
2 = -Y- to position to
3 = -C- axis (Current)

Example:

```
(AMADA PUNCH, NO-PUNCH MACRO)
INS/ G72 X#1 Y#2
```

FILE: AMDNIBL.MAC

Purpose:

Nibbling a line

Variables:

1 = Start -X- of line
2 = Start -Y- of line
3 = End -X- of line
4 = End -Y- of line
5 = Length line
6 = Angle of line
7 = Distance between hits
8 = -C- Axis (current)

Example:

```
(AMADA NIBBLE A LINE)
INS/ G72 X#1 Y#2
INS/ G69 I#5 J#6 P#76 Q#7 T#20
```

FILE: AMDNIBA.MAC

Purpose:

Nibbling an Arc

Variables:

1 = -X- Center of arc
2 = -Y- Center of arc
3 = Radius of arc
4 = Start Angle
5 = End Angle
6 = DIRECTION FLAG CW = -1 CCW = 1
7 = Included angle to travel
8 = Angle between hits
9 = -C- Axis (current)

Example:

```
(AMADA NIBBLE AN ARC)
INS/ G72 X#1 Y#2
INS/ G68 I#3-(#76/2.0) J#4 K#7*#6 P#76 Q#8 T#20
```

FILE: AMDSHR.MAC

Purpose:

Punching along a line, uses AMADA "-G66- Shear proof" cycle.

Variables:

1 = -X- Start of line
2 = -Y- Start of line
3 = length of line (between first & last punch centers)
4 = Angle of line
5 = Side of line Flag, 1 = Tool left, -1 = Tool right
6 = Distance between hits
7 = Number of hits
8 = Over cutting distance
9 = Minimum overlap

Example:

```
(AMADA SHEAR PROOF CYCLE)
INS/ G72 X#1 Y#2
INS/ G66 I#3 J#4 P#76 Q0 D#8 T#20
```

FILE: NONE

Purpose:

Punching a single hit. No macro required for AMADA, the default output is all that is required. (This will be the case for most machines).

Variables:

1 = -X- of hit
2 = -Y- of hit
3 = -C- of hit
4 = -X- of last hit
5 = -Y- of last hit
6 = -C- of last hit
7 = AXIS OF MOTION (0=NOMOVE, 1=X, 2=Y, 3=C, 4=XY, 5=XC, 6=YC, 7=XYC)

FILE: AMDREPO.MAC

Purpose:

Repositioning macro.

Variables:

1 = -X- Amount of Reposition
2 = -Y- Amount of Reposition

Example:

```
(AMADA REPOSITIONING)
INS/ G25 X#1
```

FILE: NONE

Purpose:

Macro to turn burning mode on / off.

Variables:

1 = FLAG 0 = OFF, 1 = ON
2 = -X- OF PRE-POSITION POINT
3 = -Y- OF PRE-POSITION POINT