

SECTION "D"- TEMPLATE DESIGN

Following are design guidelines for Magna Die® and Magna Die ® 2000 template sets. There are many ways and opinions on how to design templates. Depending on customer requirements, tooling cost considerations, job complexity and delivery demands, templates can be designed to produce parts in (1) setup, (1) hit, or in multiple setups, with multiple hits. Templates can also be designed for production from strip stock or even from coil-fed material.

Magna Die® template design involves the following (5) steps:

- Step 1 Determine the number of hits and setups to complete a part.
- Step 2 Determine locations of tool components to produce the part.
- Step 3 Determine the quantity and location of gages, pushers, pilots, support buttons
- Step 5 Verify press support area and material flow for template size.
- Step 6 Produce coordinate data and other information needed for template manufacture.

If you have questions about designing Magna Die® templates, please consult our Engineering Department. They will be happy to review the project with you and help determine the best way to punch and notch your product.

The back cover on our Magna Die® Reorder Guide has 1/2 scale retainer layout templates to help you in your template design. Whistler also offers retainer templates in DXF format, downloadable from the technical area of our website at www.sbwhistler.com, to use for designing your own templates.

CALCULATING DIE CLEARANCE: Die clearance is related to the thickness and type of material being punched. For mild steel (AISI 1010/1020) we recommend a total of 10% of material thickness (5% each side) added to the punch size. Clearance should be doubled for stainless steels. Use a total of 8% for light gage softer materials, like aluminum or copper.

Example: To punch a .500" (12.7mm) diameter hole in 11 gage (.120") mild steel, the die size will be .512" (13mm). ($10\% \times .120 = .012 + .500 = .512$).

To determine the size of the guide, add .03 (0.8 mm) to the size of the punch.

CALCULATING TONNAGE:

To calculate punching tonnage use the following shear strength value chart with either the Inch or Metric formulas. To ensure safe operation, it is recommended that any questionable tonnage conditions be reviewed thoroughly with your press manufacturer.

Shear Strength Values

MATERIAL	TONS PER SQ INCH	METRIC TONS PER SQ CM
Aluminum 1100-0 3003-0,6061-0	5.0	0.71
Aluminum 2024-0 3004-H36, 5052-H32	10.0	1.41
Brass & Aluminum 2025-T6, 6152-T6	17.5	2.46
Mild Steel & Bronze	27.5	3.87
Stainless Steel	55.0	7.74

Formula - Inches

Linear inches X Material thickness in inches X Tons per square inch = Tonnage Required

Formula - Metric

Linear centimeters X Material thickness in centimeters X Metric tons per square centimeters = Metric Tonnage Required

NOTE: Add an additional 10% for stripping pressure (multiply by 1.1).

EXAMPLE: How many tons are required to punch fifteen 0.375" (9.52 mm) diameter hole in 16 gage 0.06" (1.52 mm) mild steel ?

Inch

Using the formula of Circumference = 3.1416 X Diameter, determine the linear inches of one 0.375" diameter hole ($0.375 \times 3.1416 = 1.178$ "). Multiply by 15 to calculate total linear inches ($15 \times 1.178 = 17.672$ "). Select the proper Shear Strength value from the above chart (Mild Steel = 27.5 tons per square inch) and calculate the total tonnage using the below formula.

$$17.672" \times 0.06" \times 27.5 = 29.2 \text{ Total Tons}$$

Add 10% for Stripping pressure

$$29.2 \times 1.1 = 32.1 \text{ Tons}$$

Metric

Using the formula of Circumference = 3.1416 X Diameter, determine the linear centimeters of one 9.52 mm diameter hole ($9.52 \times 3.1416 = 29.91$ mm, or 2.99 cm). Multiply by 15 to calculate total linear centimeters

($15 \times 2.99 = 44.85$ cm). Select the proper Shear Strength value from the above chart (Mild Steel = 3.87

metric tons per square centimeters) and calculate the total tonnage using the below formula.

$$44.85 \text{ cm} \times .152 \text{ cm} \times 3.87 = 26.38 \text{ Metric Tons}$$

Add 10% for Stripping pressure

$$26.38 \times 1.1 = 29.0 \text{ Metric Tons}$$

SECTION "E"- TEMPLATE MATERIAL

Magna Die® templates are manufactured in pairs (2 pieces). One template becomes the punch (upper) template and the other becomes the die (lower) template. The only difference is in the way that they will be stamped with setup information.

The primary function of the templates is to provide the X - Y (i.e. coordinate) location of the various tool components in the setup. The punch template must also support the weight of the punch tooling between the Locator Posts mounted in the Master Die Set; therefore, it must be adequately rigid. Accessory items such as Hex posts and AMTS-50 Auxiliary Template Supports can aid in this situation. See page 15 in the Magna Die® Reorder guide (MRG-00).

Template holes are machined to precision diameters and accurate locations. Since vertical alignment of the two templates is critical during operation, template material must remain dimensionally stable within the expected ranges of ambient shop temperature.

It would be simple enough to dismiss anything but steel for Magna Die® templates. However, other materials such as aluminum, masonite, hardboard and plastics are occasionally used. For general sheet metal stamping, Whistler recommends the use of low carbon AISI-1008 steel templates.

Plastics can save on the weight factor, but they can be very expensive, less precise, unavailable in the required thickness, may crack and are more difficult to mark with the required information.

Whatever material you choose, its coefficient of thermal expansion and rigidity (modulus of elasticity) must be considered relative to the positioning and weight bearing functions described above.

The template thickness specification for Magna Die® templates is .154"/.162" (3.91/4.11mm). The standard Whistler template stock is AISI 1008, 8 gage hot rolled, pickled and oiled (HRP&O) steel. Mill sheets are put through a rolling process to produce very flat sheets. After the leveling process, the sheets are then sheared to final size.

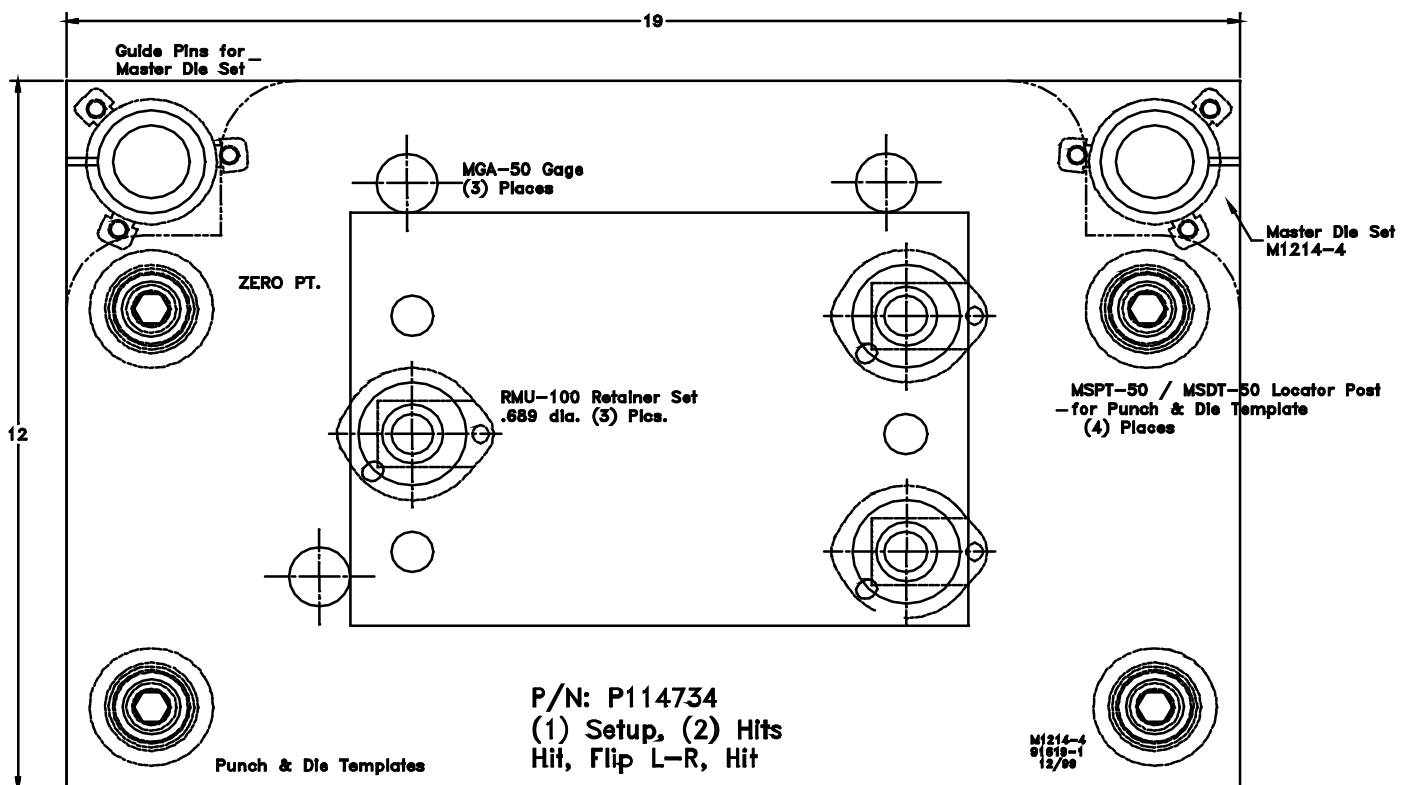
The steel mill hot rolling process sets up stresses in the steel's micro structure. Steel material used for Magna Die® templates which has not gone through the leveling process may "kink", "oil can" or warp out of flatness, when numerous holes are subsequently machined into it. Leveling the steel to the elastic limit relieves stress, insuring that the finished templates remain dead flat and dimensionally true.

Templates that are not flat can cause misalignment of punches and dies, which will shorten tool life. In addition, a warped template may elevate die retainers, allowing slugs underneath. This may cause damage not only to the Magna Die® system, but may cause damage to the press itself.

SECTION "F"- TEMPLATE MANUFACTURING

There is no one best method for machining templates. Templates are a major component of the Magna Die® system and it is critical that the templates be correct. We recommend that Whistler make the first set of templates for you. This is important because it gives you, the user, a chance to see what the templates should look like, how Whistler identifies and finishes each specific hole, and permits Whistler to warrantee the final product.

If you would like to make your own templates, Whistler will be more than happy to work with you. Just give Whistler a call and we will assist you in any way possible. From advice on how to machine the templates, doing actual layouts or utilizing the DXF disk to aid in design and manufacturing, we can help.



- CAUTIONS:
- 1) Verify slug chute orientation for adequate scrap discharge area.
 - 2) Check job tonnage versus press capacity
 - 3) Design layout for balanced tonnage load
 - 4) Contact Whistler for additional design data on coil or strip-feed applications
 - 5) Multiple station applications should be gauged from the first station edges. Pilots can also be provided if preferred.