Forming simple winding checks from flat sheet material

A discussion of the methods and tools employed

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For over 60 years from the beginning of the volume manufacture of the fishing rod, to well into the 1950's, many manufacturers used stylishly formed winding checks from the simple pattern to the flamboyant. That this variety of form was prevalent was due to the flexibility of the process employed, which was easily altered to fit the need of the fishing rod product. Low cost rods used a simple form of part or none at all. Medium priced rods had a bit of detail and form. High-end rods frequently employed larger, longer, more ornate designs.

Before the advent of the modern lathe turned winding check, these parts were made using basic blank and form press-forming techniques. This process was automated by joining the several steps required into a single tool and run progressively in a punch press or a transfer press. The result was good parts produced at a volume to suite the rod makers needs and some flexibility of style as may be available by the changing of tool components in the die.

During the classic period of rod building, the cost of materials and direct labor were carefully considered. Investment in tooling having a high value was practical due to the very high run rates and modest labor costs and lower cost of equipment and operating environment. Today, this manufacturing environment no longer exists. The cost of labor, specialized tooling and equipment is very high as is the cost of power, facilities, taxes and a host of other issues that never existed 50+ years ago. Today the most economical calculation is found where time on machine is very low and direct labor does not exist. This has evolved into a process where equipment like the automatic lathe, screw machine or CNC lathe produces parts and is not constantly served by an operator. Well suited to the limited volumes required.

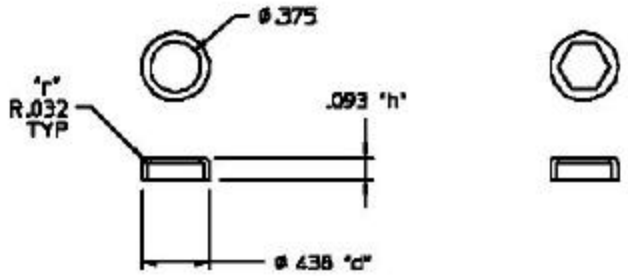
The lathe is capable of producing economical parts having a constant radial section. Automatic lathes may be programmed to produce a profile or ornate section from bar stock or tube. The bar stock being more readily available, manufacturers use it to produce winding checks. The raw material bar is not a particularly rare commodity permitting minimal quantities of material to be purchased. This contrasts sharply with the press-forming of parts during the Classic period, where the strip or coil material employed was made to order and where economical ordering practices obliged the manufacturer to commit to large amounts of material.

So here we are today, producing a high-end fishing rod from commercial components designed to be produced at the lowest possible cost resulting with a style directly attributable to the process and at the user level, having no flexibility of form. This environment can only hamper the ability of the craftsman-rod maker to express himself thru his work and differentiate his work from that of all the others.

It is possible to fabricate simple winding checks after the image of those made during the Classic period using simply made tools in our shops today. The material cost associated with such a fabrication is minimal as sheet material and commercially available discs are available at low cost. Should a certain size be desired that is not available commercially, these can be made on a simple punch and die made in our shop. These disks are the raw material for the simple winding check.

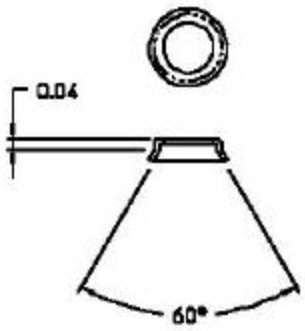
Turned winding checks

Classic winding checks

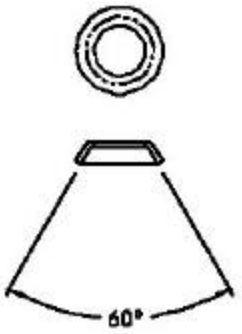


SIMPLE WINDING CHECK
ROUND PERFORATION

SIMPLE WINDING CHECK
HEX PERFORATION

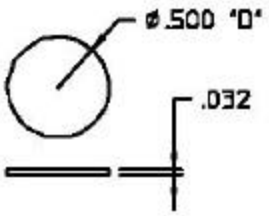


SIMPLE WINDING CHECK
ROUND PERFORATION
AND 60 ° SKIRT



SIMPLE WINDING CHECK
ROUND PERFORATION
60 ° CONIC

VARY HEIGHT AND DIAMETERS TO SUIT



PURCHASED BLANK

MATERIAL: .032 THICK 18% NICKEL SILVER

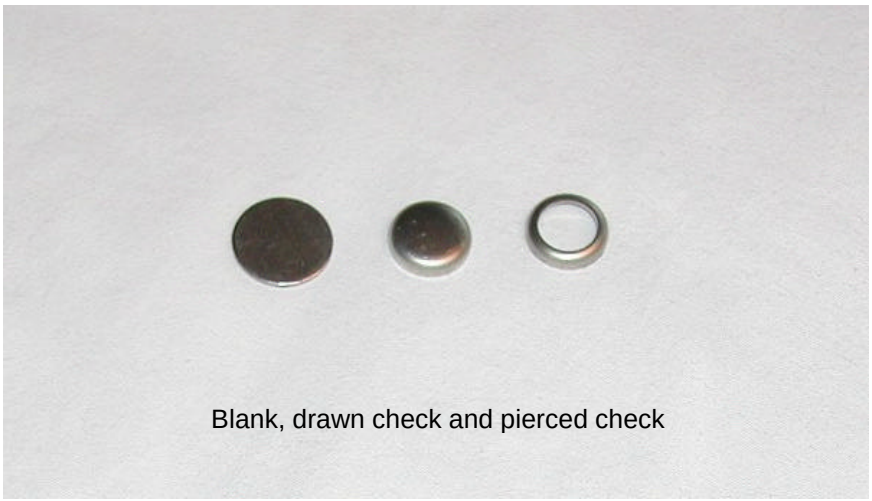
$D = \sqrt{d2 + 4dh - r}$ = BLANK DIAMETER

ROUND UP TO NEAREST FRACTIONAL DIAMETER

SIMPLE WINDING CHECKS

Part design

The simple winding check is a shallow cup formed from a disk of nickel silver. The height of this cup should be about 20% of the (outside) diameter. The result is a form that is easily producible on simple tools with little or no distortion. Modest accommodation to this ratio may be made in order to achieve a visually pleasing part shape. Be careful to keep the check design as short or shallow as possible as distortion will begin to occur or will become more evident as the height of the cup increases. With the increase in height comes a greater surface area and contact with the draw die surface. The friction and contact, not being controllable, results with a distorted cup mouth perimeter requiring machining after forming to establish a plane. While this machining may not be difficult, one can avoid it with careful part design. Deeper parts are possible. I have successfully formed checks 3/16 in. deep for subsequent decorative re-forming.



Blank, drawn check and pierced check

Any reasonable size check may be produced using this method. The only necessary detail is the need to keep the material used as thick as possible. I use .032 inch thick material (20 gauge) as a standard. At this thickness, forming is not a problem and the finished part will have sufficient rigidity to permit some machining if desired or engraving and polishing. The illustration on the adjacent page entitled Simple Winding Checks, illustrates a check having an outside diameter of 7/16 (28/64) inch and a height of 3/32 inch. This part is the basis of this discussion. One can vary the outside diameter and height to suit.

While the cylindrical part is the easiest to fabricate, tool components may be made that will alter this cylinder into other shapes having more style. Style options include a modest conical skirt and a full conical profile. Other shapes are limited only by the craftsman's imagination and ability to make tools.

Material

Bamboo rod hardware is made from 18% nickel silver. It has traditionally been the material used for many of the metal components of the quality bamboo fly rod for many years. The choice of this metal is rooted in its material characteristics and performance. Nickel silver 65-18 is an alloy of copper (65%), Nickel (18%) and Zinc (17%). Its technical designation is SAE J463, Copper Alloy C75200. It is supplied to the manufacturing trades in various forms including sheet, strip, plate, rods, bars, tube, shapes and wire. It is generally used to produce parts such as rivets, screws, table flatware, wire, zippers, mechanical parts for optical assemblies, base for silver plated goods such as cutlery, jewelry and others. Its' copper base make it well suited to cold forming methods including blanking, bending, drawing, spinning and swaging. The alloy has a pleasing silver-blue-white color when buffed. Ease of formability, color and good corrosion resistance to organic products, air and water are the characteristics

that have made its use in the crafting of quality fishing rod components so prevalent. Alloys of nickel silver having less nickel do not have the bright silver-blue-white color or strength of the 18% alloy.

Tools

In order to fabricate this simple winding check, a set of tools will need to be constructed. Using some common components, these tools will first form and then pierce our checks. Construct your tools using a good grade of steel. The use of tool steel will result in tools having a good service life provided they are properly heat treated. Alloy steels such as AISI 4140 will also make good tools but cannot be easily heat treated in the small shop. Low carbon freely machining steels will serve but are susceptible to injury due to their softness and will not keep their form and finish for long unless case or surface hardened. This can be successfully done in the small shop using a commercially available product. I use O-1 steel for lathe turned tools of this type. It is readily available, easy to machine and easily heat treated in the small shop. The heat treated tool will serve well for some time, considering the number of parts we make and use each year. O-1 steel may be heat treated in a temporary setup of fire bricks using a propane torch having high heat output as a heat source. Once heated to proper temperature and held there for a bit it is quickly transferred into a heat-proof vessel containing the appropriate quench and agitated. One should refer to standard references on this subject for details.

Locating Collar

Shop made tools

Start tool construction by turning the locating collar. The outside diameter and height may be larger to suit material you may have on hand and to limit time on machine. However you make it, be sure to provide at least two inches of height in order to support the punch and dies. When boring the inside diameter, allow a couple thousands of stock to remain in order to permit polishing the bore to the finished diameter. Keep the bore square to the bottom. In order for these tools to work well and consistently, a close fit is required. The aim is to obtain a fit of .0015 clearance or less. The idea is to minimize the opportunity for the several components stacked up in the locating collar to be eccentric to the center of the punch. If this eccentricity become too much, beyond .006 or so, it will begin to become noticeable on the finished parts. Cups will not be even around their perimeter, a portion of the perimeter may be scuffed or the hole pierced for the rod shaft may not be in the center of the part.

When machining parts that are to be bored in the lathe, measure progress using telescoping bore gauges and a micrometer previously checked to a standard. Calipers are fine for coarse measurements but not for precision work especially when checking holes. Hand position and

the relationship of the tool to the work may affect the dimension. Telescoping gauges are not affected by this.

Punches

Punches may be of solid construction and heat treated or may be of assembled construction. The assembled construction method requires more care and time on machine but results in a better tool. It is the method I have used here. Turn the outside diameter to within a couple thousands of the I.D. of the locating collar. Polish the remaining material off with aluminum oxide abrasive paper strips until a close sliding fit is obtained. Measure frequently and at several places along the cylinder being turned. If you elect to make assembled punches, take care to assure that your center drill stays on center. When drilling, use a couple intermediate diameters of drills to minimize wandering. Carefully ream or bore the final pass to get a proper press fit or interference fit of about .0010 to .0015. The working portions of assembled punches may be economically made from “gauge pins” available at nearly any size from industrial suppliers. These pins are sufficiently long enough to yield two sections. One to use and one for a spare. They are adequately hard enough for use either for drawing or piercing. Cutting is best done with a thin abrasive cutoff disk run at high speed. After assembly, the bottom of the hardened gage pin “punch” should be carefully altered to a small radius.

Draw dies

Draw dies are best made from heat threat-able steel or may be made from low carbon steel and case hardened. As before, soft tools will work but only for a short period of time as they will soon begin to gall and scratch the part being formed. Turn the outside diameter to fit the locating collar in the same way you fit the punches. Carefully bore or ream the inside diameter or draw diameter of the die, allowing adequate material to polish after turning and again after heat treating. Make the die mouth radius per the drawing, polishing the same as the bore. The notches on the sides of the die are intended to facilitate getting a firm hand hold on the die and facilitate stripping the die (or part) off the punch by hand. Allow a clearance between the draw punch and draw die equal to twice the material thickness of your blank. Any error in size should be made on the larger side opening up the clearance, not reducing it.

Piercing dies

These may be made in the same manner as the draw dies. To get a clean shear in the blank, make the clearance between the punch and die about .002 to .003. The desire for a clean and minimal shear (no ragged edges) on the blank reflects the need for close fits between the pierce punch and the locating collar and the pierce dies and the locating collar. If your clearances exceed that specified then the clearance between your punch and dies must be made proportionally larger. The larger the clearance, the greater the likelihood a burr will be formed.

Locating rings

A ring will be required to centrally locate the flat blank over the draw die when forming the part and the formed part over the pierce die when piercing the hole. These rings should be made and fit to the locating collar in the same manner as the punches and dies as they control the location of the parts being formed. Each size blank and formed part will require a separate locator. Bore the holes to be part size plus .002 so that they will just fall in and have minimal clearance. It is helpful to have a finished drawn check to measure before making the locator for piercing the hole.

Spacer

A short spacer is required in order to allow the parts to be pushed thru the draw dies and to keep the punches and the formed parts away from the press surface when forming or piercing a part. The spacer is turned to the same size as the dies and about 3/8 of an inch high. Provide it with a thru hole larger than the O.D. of your largest part. In use, it will support the draw die or pierce die.

Tooling for the conic (60 degree) skirt

In order to form the conic skirt or full section, another punch/die group is required. The die side of this group would receive the previously formed cylindrical part and would have a conic relief into which the part would be formed by the punch. The drawing entitled “Simple winding check tools to form 60’ skirt”, shows the details. Alternatively, a kind of conic skirt may be formed by using a spherical steel ball in lieu of a machined punch. The ball would be placed on the part when in the forming die and a rod would be used to apply press force to the ball.

Fig. 1. 20 ton bench hydraulic press

Equipment

The tools described above can be made on any capable engine lathe. If you plan to ream your holes be careful to verify that your tailstock is precisely set to center. Further, consider the use of a floating tool holder in the tailstock. Such an accessory will permit your reamers to follow the bore of your drilled holes and reduce any potential for eccentric, oversize or off axis holes. Surface finishes are important in this project. If your lathe cannot yield a smooth finish cut, take the time to ascertain why and make corrections before you start the construction of tools.

I form my parts using a 20 ton bench style hydraulic press. See figure 1. This press provides good and constant control of the application of force to the tools. It may be possible to use a hand lever style arbor press but I would be concerned about keeping the tools parallel to the force direction and the rate at which the force is applied. Without good control of the force applied to your tools, you may ruin them quickly. The hand arbor press usually requires three hands for safe operation of the press and control of your tools. Avoid the use of screw vices or hammers as they will certainly ruin your tools and injure you.

Tools in press

Making or purchasing flat blanks

Before you may form a check, you must purchase or make round flat blanks. Flat nickel silver discs may be purchased from any of numerous suppliers to the jewelry trade. Costs for purchased blanks are reasonable considering that you do not have to make tools. Not all necessary sizes are available commercially. These may be made in the shop. Tools may be made to permit making these blanks following the layout of the piercing tools, punch and die; described earlier. To make your own blanks you would first cut an oversized piece of material using a hand shear, place it onto the die, insert the punch into the locating ring and apply force using your hydraulic press.

Figure 2 shows an alternate type of shop made tool for forming blanks. The two plates are first screwed and doweled together. They are then squared up and holes are drilled and reamed to the diameters required. The plates are separated, the upper plate milled to provide a material thickness clearance, the lower plate is heat treated and finish ground flat.

Hand cut blanks may not form successfully into useful cups. Any lack of perfect roundness will cause that portion of the perimeter not having sufficient material to be drawn into the die before the remainder of the perimeter. This would result with a shorter wall on that portion of the cup. Some hand shears leave serrations in the material that they cut. These serrations would cause inconsistent flow of material thru the die and would be plainly evident on the formed parts as a surface blemish. Hand shears do not always cut perpendicular through the sheet. Any angularity will result with the short wall effect noted above.

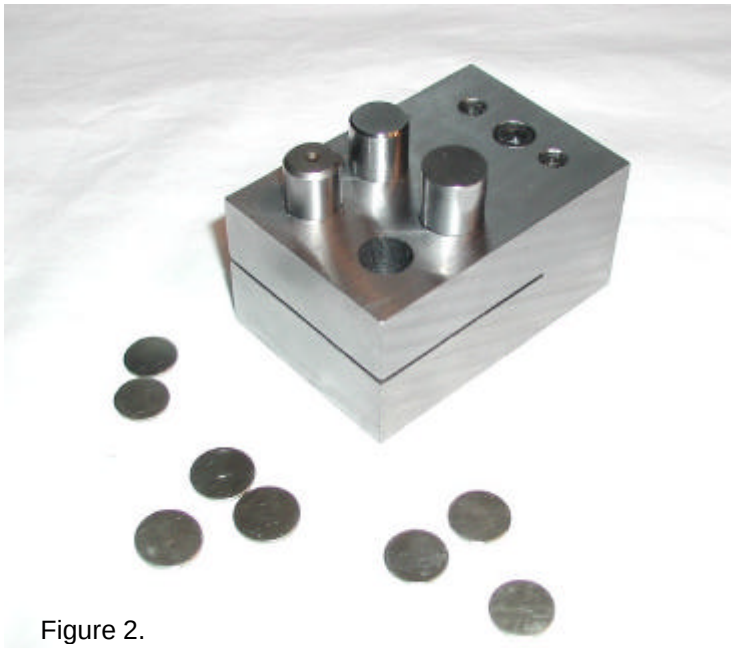


Figure 2.

The simple winding check described on the drawing is produced from a

blank, .500 inch diameter and .032 inch thick. If your part differs in size you will have to calculate the blank to suit. The part drawing shows a short calculation that will yield a useful blank. After calculating, round your result up to the nearest available purchased blank diameter or the nearest larger fractional dimension if you plan to make your own blank tools. Choosing a fraction will simplify obtaining reamers to finish holes to size.

Forming the part

To make a part, first make a supply of flat round blanks. To draw a check, place the appropriate diameter locator into the bottom of the locating collar, followed by the draw die and then the spacer. Place this group onto the press plate. Insert a flat blank from the top being sure to place it into the locating ring and onto the top of the draw die. Insert the draw punch and assure that the punch is in contact with the top surface of the blank. Apply press force slowly until a part if formed. Once the part is formed, remove the tools from the press. Carefully separate the components until the punch-spacer-die group remains. They will be kept together by the formed part still on the punch. The formed part my be removed from the punch by grasping the notches in the die or by sing a pair of needle nosed pliers to get leverage against the part and the top of the punch handle. Carefully leverage the part off using ever so little force. Move around the perimeter of the part to minimize distortion.

The hole for the rod shaft is made with the pierce punch and die. Choose the locating ring the same diameter as the O.D. of the drawn check. Insert it into the locating collar as before followed by the pierce die and the spacer. Put this group onto the press plate. Insert the formed check hollow side up and into the locating ring and onto the pierce die. Insert the pierce punch and assure that the punch is in contact with the top surface of the blank. Apply press force slowly until the hole is pierced. Once the part is pierced, remove the tools from the press. Carefully separate the components until the punch-spacer-die group remains. The part may be striped off of the punch using the methods described above.

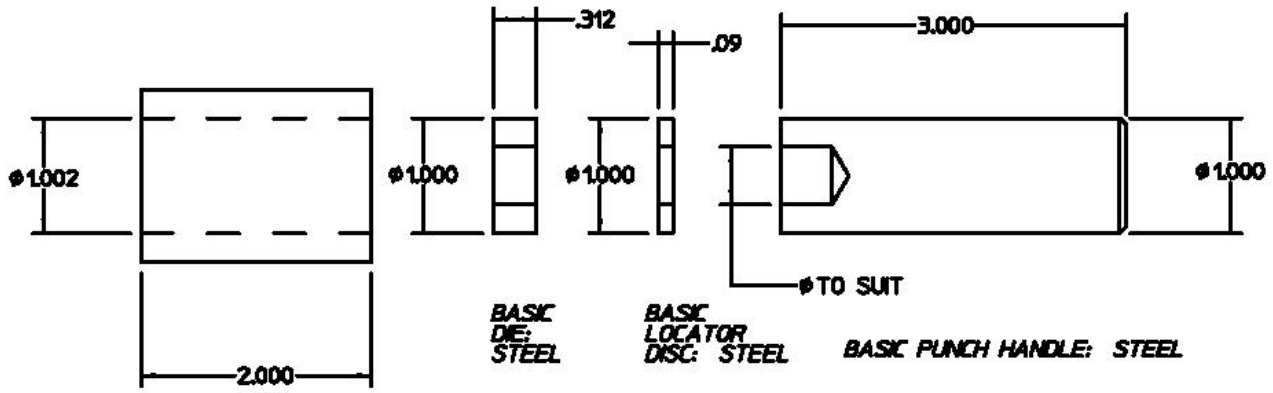
Finishing

After forming it may be necessary to touch up the bottom of the check to assure that it is flat. If you wish, it my be rung onto a pin and turned in the lathe for polishing or held on the pin for buffing against the fabric wheel. If carefully done one may mandrill or arbor mount it and turn an inscribed line or a shoulder in the lathe. The small size of the part requires a good understanding of work-holding tools.

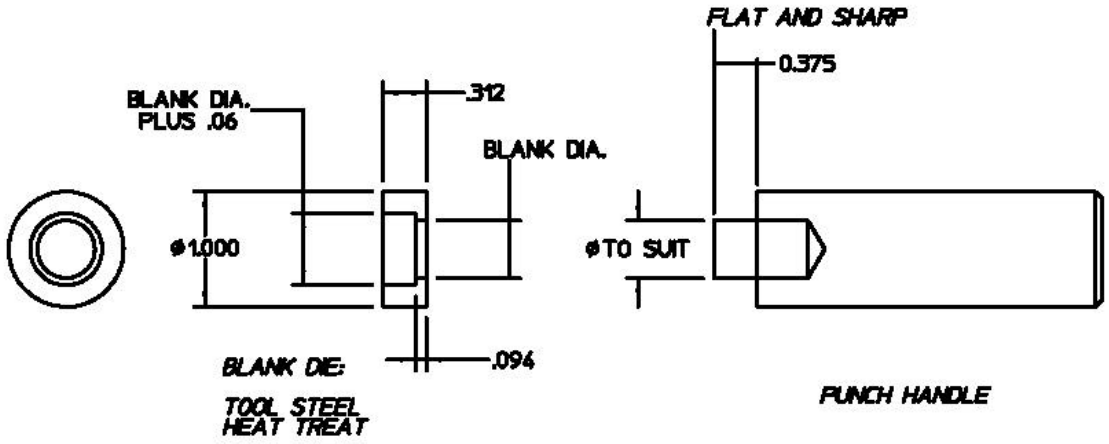
Sources

Material:	Nickel silver sheet.	T. B. Hagstoz and Son.	Telephone (215) 922-1627
	http://www.hagstoz.com/contact_us.htm		
Tooling:	Gauge pins.	MSC industrial supply.	Telephone (800) 645-7270
	Steel		

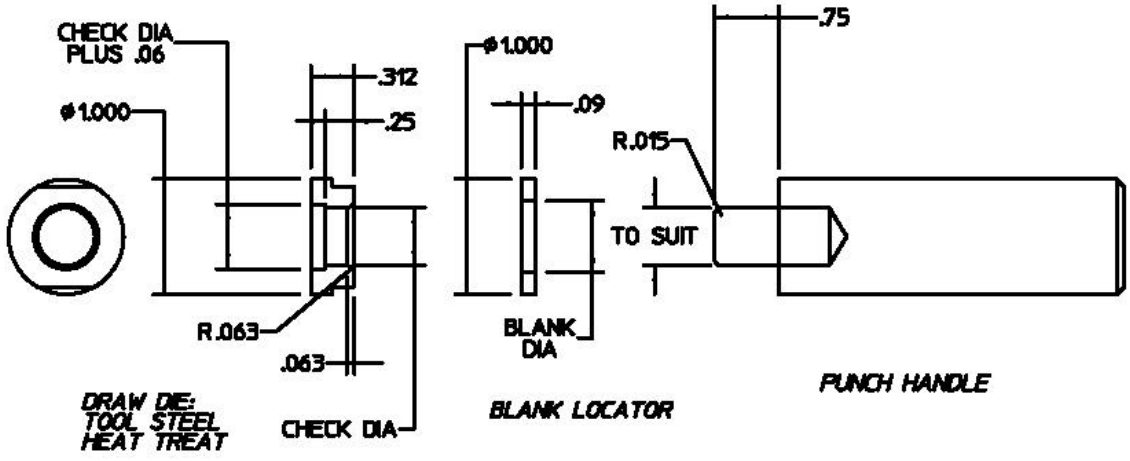
I'd be happy to discuss these tools and methods with anyone with questions. E-mail me at: gdabrowski@yahoo.com or look for additional articles on my site: http://brooksiderod.trpod.com/components.htm



BASIC LAYOUT



BLANK (DISC) AND CHECK PIERCE PUNCH LAYOUT



BASIC DRAW DIE LAYOUT

TOOLS: DRAW AND PIERCE WINDING CHECKS