



ENGINEERING SPECIFICATION

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Any deviation from these Die Building Requirements & Specifications will require a written request from vendor to Key Safety Systems Corporation Tooling Engineer.

I. Purpose

- A. The purpose of this metal stamping die standard is to eliminate misunderstanding, promote



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thought and generate discussion on key tool development, design and build issues. The information given here is not to be construed as limiting or the only way but rather a guideline to prevent indecision and represent best die design and build practice. The following criteria are intended to promote team development atmosphere to produce the best tool possible for the application.

1. Dies are required to produce finished parts that conform to:
 - a. The part drawing.
 - b. Including geometric dimensioning and tolerancing.
 - c. Requirements for first parts approval process.
2. This standard and the specifications referenced herein are issued to:
 - a. Define the general classifications of metal stamping dies for Key Safety Systems.
 - b. Reduce the dies design and build costs by:
 - (1) Standardization of design, which will decrease review time and expense.
 - (2) Using commercially available die components.
 - c. Assure the safety of the operating personnel.
 - d. Promote superior tool design and consistent die making practices.

II. Scope

A. All metal stamping dies supplied to Key Safety Systems will comply with the requirem specified herein and as stated in the die design and construction data sheets.

III. Die Classifications

A. All dies will be constructed for inter-changeability of perishable die blocks, punches, retainers, die buttons, pilots, etc..

IV. Initial Tryout Requirements

A. Tryout parts are to be run on production simulated equipment from coil fed presses at the die shop. At this time any necessary adjustments will be made to enhance the productivity of the tool before the final run off at the stamping facility.

Intent: During die run off at the die shop parts are not falling off of the die, scrap shedding, pads sticking etc. must be fixed before the die ships to the production facility.

No tool will be shipped or approved if it cannot meet estimated SPM (strokes per minute) specified due to die problems.

V. Metal Stamping Dies - General Requirements:

A. Tryout Materials



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Are to be supplied to the Tooling source by the supplier three weeks prior to the Tooling completion date.

B. Die design approval:

1. A strip layout is required on all parts and must be approved by the Key Safety Systems tool Engineer, before actual design of the die can begin and before formal design is started. The strip layout is to reflect the stock width, the progression, and the tonnage required to produce the stamping. Strip layouts should be developed so that scrap pieces are not left in the die.

2. A preliminary design of the die (plan of die, plan of punch, and longitudinal cross sections) must be submitted for approval, before the design can be completed and the detailing started.

All designs are to be one-hundred percent detailed (excluding the die set and standard commercial die components)

3. To conserve material, the edge of the part may be the edge of the coil material wherever the part design will permit. Using edge of coil as part entity will require written approval from the tool Engineer.

4. The strip should be developed to maintain maximum strip strength for the greatest possible distance through the die.

5. A die should be designed to minimize any strip distortion which would tend to change the distance between pilot holes (alter the progression).

6. All die drawing numbers plus special die drawings will be supplied at preliminary review.

7. Provision for loading and unloading of raw materials for all dies, as well as part ejection and scrap removal will be covered during the die design review.

8. Designs will avoid excessive use of lubrication to produce stampings.

9. If stock does not start against a pitch notch (positive stop) a start mark for the first hit will be necessary (1/16 inch groove ground into the die sections) so as to avoid partial piercing, trimming or forming which could cause die damage. Use spring loaded start fingers when a starting line is not visible because of a solid (dog house) stripper.

10. One full scale set of die drawings will be submitted to the Tooling Engineer for approval prior to the start of construction.

11. The die supplier will furnish in writing the developed blank size along with the preliminary Tool drawing(s).



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12. All die designs are to be originated and dimensioned using inch standards.
13. Dies are to be designed so they can be maintained in the press using inserts in forms and cut off sections. All forming inserts must be adjustable to accommodate stock thickness variance minimum.
14. Wear points of the die sections must be inserted for economical maintenance, replacement cost, and adjustability for stock variance.
15. If the part tolerancing indicates that more stations may be needed in the future a die should have a minimum of two idle stations wherever press size permits.
16. The position of the ball seat and key flats must be noted on the stock list when not in the standard position, on oblong and rectangular punches and buttons.
17. In addition the die design drawing will show:
 - a. Strip layout (full scale if possible).
 - b. Plan view (top and bottom section assembly).
 - c. Sectional views (right and left and or front and back as required to show construction).
 - d. Cross-sectional views (for timing, punch length, and travel of springs).
 - e. Detail drawing(s) of all perishable special punches and or buttons with material identified. Detail drawing(s) will be on 24" x 36" paper with Key Safety Systems title block.
 - f. When several die components are drawn on one sheet, all related views should be separated from the other details by dividing lines.
 - g. All perishable die sections, punches & buttons, and alignment dowels will be referenced to the center line of the die set.
 - h. Use the 0-0 work line method to detail all components.
 - i. All designs must have a complete bill of materials, including standard commercial components.
 - j. All designs must be ballooned with split indicators containing the detail number and the sheet number that it is dimensioned on.
 - k. Each sheet of a design must contain a Key Safety Systems title block in the lower right hand corner.
 - l. Symmetrically opposite die sections must be assigned different detail numbers.
 - m. Die prints are to include data on cylinders as follows:
 1. Work stroke of cylinder
 2. Rebuild Kit number
 3. Cylinder replacement number
 - n. All non-standard perishable die component parts and critical die sections will be detailed on paper with Key Safety Systems Title block and border.
 - o. All detail prints will be reduced in size to fit on 8.5" x 11" paper and provided in a



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binder, to Key Safety Systems and the manufacturer for shop floor quick reference.
p. All wire edm sections are to be 100 % detailed and the wire burn data is to be sent on a 3 1/2" diskette with the designs.

18. Die progress reports are to be submitted once a week to the Key Safety Systems Tooling Engineer.

19. If roll sized drawings are supplied they will be folded to 24"x 36" size with the title block located in the lower right hand corner.

20. Completed die designs are to be reviewed and approved before die construction begins.

C. Die design ownership:

1. The die designs supplied to Key Safety Systems are under a design and build purchase agreement and will become the property of Key Safety Systems. Therefore, no restrictions will be place on the design drawings and diskettes by the vendor.

D. Die Noise and Reverse Tonnage :

1. During the die design and build, consideration will be given to the following:
 - a. Cutting shear.
 - b. Stagger punch entry levels
 - c. Balanced stripper and pad pressures

E. Die design responsibility:

1. The die design, construction, function, and ability of the die to produce acceptable repetitive production parts will be the sole responsibility of the die supplier.
 - a. Any errors found in the dies during tryout and final acceptance run off will be corrected by the die supplier at no additional cost to Key Safety Systems.

2. All tools must comply with OSHA Federal Safety Standards. It will be the vendors responsibility to keep themselves informed to the revisions in federal safety standards.

F. Die performance:

1. All new dies will produce Key Safety Systems production parts to meet first parts approval and part run rate before final acceptance.

G. Die material requirements:

<u>Die Component Description</u>	<u>Die Material Type</u>
Die Steel	D2 or better
Filler steel	HRS/CRS
Buttons	M-2 or better
Pilots	M-2 or better



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Punches	M-2 or better
Buttons & punch retainers	A2, 6150 & 4140 steel-hardened
Pressure pads	A2, 6150 & 4140 steel-hardened
Stripper windows	6150, 01, CRS CARB. & hardened
-	4140 steel case hardened
Form steel	D2 or better
Coining Steels	06 or better

In any application where we are stamping a high strength or high carbon material the use of CPM - M4, CPM 3V, 10V, 15V, and CRU-Wear material with a surface coating should be discussed.

VI. Die Design Criteria

A. Preferred components:

1. All metal stamping die(s) supplied to KEY SAFETY SYSTEMS will be constructed using the preferred components already identified.

B. Production part materials - Die design relationship:

1. The production material thickness will be used when calculating the die design dimensions.
2. To optimized material usage, flat blank nominal material thickness will be used along with the minimum inside form radii to calculate material used.

C. Calculating operation tonnage of die:

1. The operating tonnage will not exceed 80% of the rated capacity of the press.
2. The calculated operating tonnage of the die will include stripping pressure.
 - a. The stripping pressure for the press tonnage will be calculated with the die closed.
3. All dies will be checked for Reverse Tonnage during initial tryout. Any die having a reverse tonnage of more than 10% of the intended press tonnage must be modified to meet this requirement. Possible corrective actions could be the use of shear or punch staggering.

This reduces the loading in both directions and improves both tool life and press life.

D. General die life and construction:

1. Use a standard Argon stamp retainer and stamps for part number identification.

Size and location to be determined per part print.
2. All dies will be provided with a minimum of 4 steel "set blocks," positioned over the parallels.
 - a. Size of set blocks to be determined by:
 - (1) Die area 250 square inches or less, use 2 inch diameter set blocks.
 - (2) Die are over 250 square inches, use 3 inch diameter set blocks.
 - b. Set blocks will have a .050" deep by .375" wide slot for soft lead coining at shut height.
3. Die sections will have staggered hole patterns for one-way assembly.
 - a. Fabricated stripper pads must be fastened together with screws in addition to



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- being welded.
4. Die section(s) will be minimum of 1.5" thick.
 - a. There must be a .375-500" cutting land with all wire burned sections or holes.

Normal burned angles are not acceptable. These sections must be undercut to provide the desired cutting land or an increased 5 deg. angle used.
 - b. Dies should be designed for use of wire E.D.M. on die sections, trim and notch punches where applicable. Traditional die detail design practice must be used so each section can be reworked during the repair process. All wire burned sections should be segmented when possible.
 5. Cutting sections will be ground or finished by E.D.M. to remove decarb. All die sections will have a ground seating surface.
 6. All die pierce holes will be buttoned unless otherwise specified.
 7. Screw head holes will be counterbored in the die section. A minimum of 3/8" plus die cutting land below the die section surface, and screw threads must enter no less than 1.5 times diameter.
 8. Where possible, screws will be hex socket head cap screws. Other types of screws, such as set screws, will be hex socket.
 9. Clear the first two threads in all tapped holes in hardened tool steel blocks, Except in stripper bolt holes.
 10. Refer to company press information to determine the proper shut height, die size, and parallel size needed.
 - a. Parallels are to be ground both top and bottom.
 - b. Parallel mounting screws will be 2 different sizes from one end to the other to prevent reversing the parallel if removed and re-attached.
 - c. The 2 outer and center parallel if present are to:
 - (1) Extend 3" from the side of the die.
 - (2) Are to be cut into a clamping foot with a maximum height of 2" with a 7/8" slot for clamping.
 - (3) The two end parallels are to be doweled, and have a one inch key slot in the lower center.
 - d. The upper shoe if no parallels are present will have 7/8" clearance holes for fastening, positioned using J.I.C. center.
 - e. Die handling holes of 3/4" or 1" are required on both sides of the top and bottom shoes.
 - f. All parallels with integral feet should be located on J.I.C. center.
 - g. Provide adequate clearance for slug removal.
 11. Large *weldments* in die structure will be machined on the mating surfaces, screwed together, welded, and normalized before final machining.
 12. Welding on die steels to make corrections or modifications is acceptable only to complete tryout and first piece approval. All welded sections must be remade and retried before die is shipped.
 13. All overhung items will be protected from lift truck mast.



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14. Dies with thrust characteristics must be properly heeled and keyed. (Heel blocks must be keyed)
- Heel blocks to have a minimum of 3/8" heeling before work is started.
 - Heel blocks should have screws located on the side of the block toward the thrust.
15. Provide kicker pins in punch sections and spring plungers in the stripper when necessary for positive strip removal. Each section is to doweled separately.
16. All parts must be gravity or mechanically ejected from the surface of the die (no air blow-off). Parts ejection direction to be determined by the part supplier. When parts are blanked through the die they should be disposed of toward the operator side of the press.
- Parts and scrap cannot be mixed.
 - On dies where multiple parts are made, parts must be kept separate.
17. Flattening and restrike stations are to be provided, as dictated by part configuration and part print specification. Flattening, forming, and coining steels will go through the stripper in lieu of using the stripper to perform the above listed die functions, unless unavoidable due to the part complexity.
18. All dies containing a restrike station shall have a minimum shoe thickness of 3.50 inches.

Part thickness of .190 inches and over shall require a minimum shoe thickness of 4.00 inches.

19. All dies containing coining stations shall have a minimum .750" hardened plate under each station for support and a minimum of 3.50" thick shoe.
20. In dies using shave applications, it is best to use a two-out die configuration. This is used to balance cutting forces. Shave punches must be heeled when possible. Shave area to be outboard of strip stock. Use double pilots to locate parts. Use pilots that are located in the lower die half when ever possible. Use two shave stations as follow:
- Station #1 Shave .01 using .001/.0015 as die clearance.
 - Station #2 Shave .005 using .0005/.001 as die clearance.
 - All shave applications must be reviewed.
21. Carrier design must be developed in one of four ways to avoid match cuts and the burrs that are associated with there use. (no burrs are excepted in these area's)
- Cutting of the carrier or cutting of the part leaving a male tab on the parts.
 - Cutting of the carrier or cutting of the part leaving a recess on the parts.
 - Match cut on an angle to the radius tangent point.
 - Trim bypass cuts. (recommended 3.2 R x .75 max. depth).
22. The following tolerance standards should be adhered to when detailing a progressive die:
- 4 place decimal +/-0005"
 - 3 place decimal +/-001"
 - 2 place decimal +/-010"
 - 1 place decimal +/-020"
 - Whole dimensions +/-060"

Note: The acceptable location for screw locations is +/- .005

When the relationship between holes is less than .010 inches, the holes should be



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pierced in the same station.

b. Linear dimensions in the direction of progression must not be stacked.

23. Extrusion punches and draw rings must be coated to prevent galling.

24. A form of die protection (proximity switches, etc.) must be provided to detect pitch within the first three stations of the die (French stop, notch or pilot hole sensor) and

near the end of the die to detect buckling of the strip and to detect part off the die. Part

Supplier to provide specifications on sensors.

25. A progression bar (prog. x 1" x 1") is to be made of 01, stamped with the die progression and hardened to R.C. 52/54. It will be mounted by two 5/16 socket head screws on the front right side of the die.

E. Die safety:

1. The design and construction of all dies will not require the operator(s) or other personnel to place their hands or other parts of their body in a pinch point hazard.

a. The use of hand tools must be approved in writing by the Tooling engineer.

b. Guards will be provided as needed.

2. All dies will be drilled to accommodate eye bolts for lifting and turning the dies. Four tapped handling holes will be provided along the top and bottom edges of the die set. These holes will be a minimum of 3/4" - 10 x 1.75" thread depth.

3. The weight of the die upper half will be stamped on the front face in the left hand corner of the punch shoe and the weight of the lower half will be stamped on the front left hand face of the lower shoe in accordance with OSHA requirements.

4. Break all non-functional sharp corner.

F. Scrap removal:

1. Parts must fall free from die, scrap must shed properly, no air blow off or assist. If a cylinder ejector must be used, incorporate a proximity safety switch and use non-ferrous materials where it enters the die, or it must be a positive return design.

2. Dies will be constructed with provisions for positive stripping and ejection's of the finished part and all generated scrap.

a. Part air blow-off has to be specifically approved by the Tooling engineer in writing.

The air blast must be cycled with the press stroke. A flow nozzle must be used to reduce noise and volume of air released.

3. Where required, scrap will automatically be removed from the die. The die supplier will provide chutes to prevent the possible build-up of parts and or scrap under the die. Scrap should not exceed 6" in length. All dies should include a scrap cutter when applicable.

4. Tooling Engineer will specify additional requirements, such as containers or conveyors, supplied with the die.

G. Die sets:

1. All die sets will be stamped per stamping instructions in section VII:

2. Upper shoe will be stamped with the shoe weight respectively using a minimum of .25" high



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letters.

3. Die sets will include:

- a. Guide pins & bushings that are the precision ball bearing type ball cage must never leave the bushing in press operation.
- b. Guide pins will be staggered, or one pin made smaller to prevent the incorrect assembly of the die set.
- c. Diameter of guide pins must be minimum of 75% of shoe thickness.
- d. Guide pin ends must have .250" clearance when die is fully closed.
- e. 4 post die sets are to be used unless otherwise specified.
- f. Standard guide pins and bushings must be guarded.

4. Provide thrust blocks when unbalanced trimming or forming occurs.

5. Heel block wear plates should be tool steel on the bottom shoe and Ampco bronze on the top shoe.

H. Die mounting requirements:

1. Provisions for die mounting will be specified by the part supplier.
2. Top and bottom shoes or parallels will be provided with 2" clamping height surface, slotted for bolts suitable for the designated press.
3. Progressive dies will include a provision for aligning the centerline of the die with centerline of the press, this will be identified at the preliminary review by the part supplier.
4. For removal of the upper or lower die shoe from the press, guide pins must leave the guide pin bushings by .25 inches by using RAM adjustment.

I. Maintenance requirements:

1. Die sections will be mounted with screws through the die section into the shoe, in a manner that will permit section removal while the die is in the press.
 - a. All die sections will be provided with "*Jack Screw Holes*" A method for removal from the dowels. If Jack Screws cannot be used than pull dowels need to be used or angled slots need to be installed into the sections for pry bar access.
2. All cutting steels which carry a form radius will be designed to be sharpened without redressing the form radius. *Inserts should be used whenever possible.*
3. For maximum support use nest blade punches.
 - a. Entire assembly will be designed to be shimmed at sharpening.
 - b. Tap into blade for mounting.

J. Die lubrication:

1. Easy accessibility provisions will be made for lubricating all bushings.
2. All Cam dies will be provided with an easily accessible means of lubricating slides, cam surfaces, guides, normally with grease fittings, and grease grooves.
3. Insert draw rings will have Zerk Fitting to inject grease to each insert.

K. Die protection:



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1. The design is to include positive stops where possible and this will be probed for feed detection. If this is not possible then some type of probe must be designed into the first three stations of the die to detect pitch and proper feed progression. Also an additional probe will be installed at the end of the tool to detect strip buckle and part off.
All working parts of the probe are to be hardened.
3. In die probing for dimensional tolerance will be addressed at the design review.
All tools that possess the possibility that a draw part could become stuck to the form punch and another part could be installed or progress into that station, causing a double part condition, must have a sensor to detect this condition and stop the press.
4. All dies used in conjunction with automatic transfer devices will be equipped with a limit switch or some other electrical signaling device to assure the positive transfer of the part after each stroke of the press.
5. All transfer dies must be protected by limit switches to stop the press in the case of faulty operation.

L. Shear clearances:

1. Shear clearances should be designed to minimized burrs with consideration to die life.
8% per side generally used.

M. Stock guiding and control:

1. Guide rails are to be hardened and doweled with a well defined start line ground on the top surface if a start line cannot be put on the guide rails it will be added somewhere else.
2. Direction of feed shall be specified by the part supplier. Bends will be perpendicular side general whenever possible.
3. Dies will be provided with locators for positive blank location.
4. Stock guides will be:
 - a. Hardened and ground 01 tool steel RC 54/56.
 - b. One or two piece construction.
 - c. Fixed fastened and doweled to the stock shelf and die section, unless otherwise specified or approved by the Tooling engineer.
5. Guide rails to have .010 clearance per side over high limit of stock width.
 - a. A die should have sufficient pilots to control the stock adequately in order to consistently produce parts to part print tolerances.
 - b. Pilot holes should be pierced larger in diameter than the pilots to adequately control strip as necessary, (.005 larger standard).
 - c. When upper mounted pilots are required, use heavy duty ball lock punch blanks.
6. The pilot full diameter will extend through the stripper and be long enough to locate the stock before the stripper contacts the material (one material thickness).
7. Pilot lower holes are to be buttoned and 2 times material thickness plus 1/32" I.D. Pilot clearance holes must go completely through the detail and die shoe. Pilots should be of sufficient size and strength to allow this clearance.
 - a. Buttons are encouraged when piloting in hardened tool steel, based on design



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constraints.

8. All pilots must be a minimum 5/16" diameter.
9. Do not depend on the pilots to keep the part from pulling when forming or trimming all on one side of material. Use back-up gages or add a flange in the scrap.
10. Only tooling holes may be used to pilot. Repiercing to a larger size when piloting is complete, is allowed.
11. Use solid stock lifters whenever possible.
12. Progressive dies will have a coil start line marked on die(s).

N. Die materials: Reference section III. B.

1. Identify all details with:
 - a. Detail number
 - b. Detail type.
 - c. Rockwell hardness.
 - d. Tool number.
 - e. Type of Die steel
 - f. Make sure these are present after grinding. Do not stamp sections in areas susceptible to cracking.
2. Cutting steels will be D-2 hardened to RC58-60.
 - a. Form steel and punches will be D-2 or better tool steel hardened to RC58-60. And surface coated if the part requires it.
 - b. All surfaces subject to wear, will be inserted with type D-2 tool steel or better and hardened to RC58-60.
 - c. Draw beads punches and die sections will be made from D-2 tool or better steel.
 - d. In any application where we are stamping a high strength or high carbon material the use of CPM-M4, CPM 10V, CPM 15V, and *CRU-Wear* materials and a coating should be discussed.
 - e. Wear plates on cam surface will be hardened and ground 01,S7 or Ampco 21.
 - f. Wear surfaces on pressure pads and draw rings will be hardened.
 - (1) Welding on any portion of the draw rings is prohibited.
3. Composite die sections are not acceptable.

O. Parallel:

1. When required by the die design, the Vendor will furnish and mount ground parallels running from front to back, mounted with the capability for fork truck die handling.
 - a. Dies over 10,000 pounds use eight inch clearance between parallels.
2. Parallels are required when blanks or scrap are discharge through the die shoe.
3. Both end parallels will be doweled with a minimum .5" diameter dowel, and have a 1 inch key slot cut into the center unless some other form of quick die location is being used.

P. Dowels:

1. Dowels must be press fit in die shoes and strippers, and push fit in die sections.



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2. Dowels must be a press fit in all locating nests and stops.
3. All dowels must have accessible knockout holes without dismantling.
4. Use blind dowel holes only when it's impossible to drill through the shoe, if blind dowel holes are required, then removable pull type dowels must be used.
5. Dowels must not be used to withstand side thrust force (keys are to withstand this force and should be specified when quoting).

Q. Punches and buttons:

1. All punches and buttons are to be marked with:
 - a. Manufacture name.
 - b. Material
 - c. Internal customer job number (Detail number, re-order number).
2. Ball lock punches with heavy duty ball seats are required with shedder pins and are to be .002" under maximum on standard tolerance unless otherwise specified by the company.
 - a. Use 7/8" long press fit buttons as standard if possible.
 - b. All shaped buttons are to be keyed, or located by a dowel.
Dowel locators are preferred due to space requirements.
 - c. Hardened backing plates are required on all punch retainers and where stamps are used with minimum thickness of .375.
 - d. All pilot holes are to be 2 times material thickness plus 1/32" unless otherwise specified.
3. Standard removable ball lock punches and buttons will be used, with heavy duty style ball lock.
4. All buttons will be light press fit unless otherwise specified.
5. Large punches with ball lock shanks will have a tapped hole in the face of the punch for punch removal purposes.
6. Retainer size should not exceed 12x12 inches unless approved by the Tool Engineer, punches and stamp retainers will be backed by hardened and ground tool steel plates 3/8" minimum thickness.
7. Retainers used to locate trim punches and sections must be hardened and ground.
8. Like punches and buttons will not have standard ball lock locations and shank diameters.
The retainer design should be "fool-proofed" whenever practical to prevent putting buttons in the wrong retainer holes (safety requirements).
9. Blank and trim entry will occur before piercing punches by one-half stock thickness.
10. On compound dies, piercing and blanking punches must be on the same plane to prevent material slippage.
11. All punches and trim steels must have slug ejectors.
12. Die buttons must be mounted in hardened tool steel, A2, 4140, or 6150 RC 50/52.
13. All wire burned sections are to be mounted in hardened tool steel with hardened backing plate.
14. Clearance between punches and cutting sections should reflect the following tolerances unless otherwise specified.



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Q. Punches and buttons continued:

Material thickness	Recommended Clearance per Side - Trim/pierce	
.0 - .04	Mild steel	6 - 7% stock thickness
.04 - .09		8 - 9% stock thickness
.09 - .160		9 - 10% stock thickness
.160 - up		Contact the material supplier
.0 - .06	Stainless steel, 4130 & 1050	10-15% stock thickness
.06 - up		13-17% stock thickness
.0 - .06	Aluminum	5 - 8% stock thickness
.06 - up		6-10% stock thickness

15. Punches and buttons are to be standard items whenever possible:
 - a. Standard pierce punches are to be M-2 (H.S.S.) hardened to RC58-60 and ground with a slug ejector whenever possible.
 - b. Wire E.D.M. "stick" punches having their shape burned through the retainer, are recommended.
 - c. For all but the most basic shapes. Use heavy duty ball-lock punches with a shedder pin and with a 1/2" minimum shank diameter whenever possible.
16. All non-standard punches and punch sections are to be fabricated from M-2 and heat treated to RC58-60.
17. Shedder pins should be in all punches including blanking, cutting, trimming, and piercing punches.
18. Depth of the counter bore for a socket head cap screw in cutting sections is to be equal to height of the head plus die life of sections. If the die sections permit, provide 1" depth to assure that no screw head will interfere with the part after sharpening the sect

R. Springs:

1. The use of wire springs should be discouraged, but if they must be used then the lifter must be designed with a cap for easy spring removal.
2. Compression of springs must not exceed manufacturers recommendation for high speed and long life.
3. Spring cans are required, as practical and should not disengage from the spring pocket.
4. Drop in nitrogen cylinders are preferred over springs, and all tools should be quoted with there use in mind.

S. Strippers:

1. Strippers are to be heavily constructed when design dictates.
 - a. Strippers should be constructed in two or three pieces to aid in handling.
 - b. The strippers thickness will be established by size of die.



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- c. The minimum thickness for a stripper is 1.250".
 - d. Fabricated stripper pads must be fastened together with screws in addition to being welded. (A full detail drawing is to be provided.)
 - e. Use AISI Type 6150 AISI Type 4140 hardened tool steel on all wear surfaces.
 - f. Fabricated stripper pads are acceptable provided the welded details are also fastened together with cap screws (safety requirement).
2. Strippers of 2 or 3 piece construction are to have 2 balanced 3/4-10 inch tapped holes for removal with eye bolts.
 3. Heel blocks or keys are required to prevent stripper or pads from moving. Keys should be twice as wide as high.
 4. Bridge (solid) strippers are not acceptable.
 5. The stripper will be drilled, segmented, or windows will be provided to allow for punches, buttons, or die section removal without removing the stripper.
 - a. Punch removal clearance will accommodate punch puller and ball release tool.
 6. All strippers will be positively retained using die pad retainers
 - a. Spools are acceptable as long as they are of the anti-rotation style, and there isn't room in the tool for keeper blocks
 - b. Shoulder screws are not acceptable and no pre-load on retainers.
 - c. For all stripper gibs (keepers) use standard integral units whenever possible or fabricate from AISI 01 or AISI Type 06 tool steel (hardness: Rockwell "C" 54-56).
 7. Stripper pads will make uniform contact in advance of the working die sections.
 8. Do not use the stripper for forming operations (unless guided and specified by the Tool engineer). If the stripper is used to form etc. it must be mounted with pins and bushings and properly retained to compensate for any side forces.
 9. Areas of the stripper used to mount or support spring pressure are to be a minimum thickness of 3/4".
 10. The stripper will be a minimum of 3/4" thick above the stock guides.
 11. The stripper will be made of pre-hardened 4140 (Maxel), or 6150 with a RC28-35. Boiler plate is also excepted for larger strippers.
 - a. All strippers will have 1/2"-13 tapped lifting holes with a minimum depth of 1".
 - b. All wear surfaces are to be hardened or inserted with hardened details.
 12. Provide stripping on all cam pierce operations.
 13. Weld projection punches and die buttons will not be mounted in the stripper. If they must than refer back to number 8 in this section.
 15. Striper face must extend 1/8" below working face of punch.
 16. Stripper windows are required to access all punches for in die maintenance and should be made of CRS case hardened to .040" depth or 01 hardened to RC 52-54.
 - a. Split all stripper windows that exceed twelve (12) inches in length.
 17. Two jack screws must be provided in windows and die section for ease of removal . All sections that do not have hack screw holes must have pry slots.
 - a. Minimum screw 5/16 for all stripper windows. And a minimum of 4 screws per window.



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- b. All stripper windows to be a minimum of 1/2 inch.
18. Windows must not be press fit into stripper.
 19. The stripper must have a minimum of .250" clearance from bottoming on the heel blocks when the die is on the stop blocks.
 20. Install a shedder pin in the stripper at the cut off to prevent the part from sticking to the stripper, plus include shedder pins in areas of extended pilots.
 21. Draw applications must have a binder or pad designed into it so the metal flow can be controlled using a secondary power source such as gas cylinders or air cushion.
 22. All stripper retainers must be removable from the working surface if the die.
 23. Hardened backing plates are required under all pads that bottom out. Balance all pads on a minimum of three (3) balance blocks.
 24. No work should be done with the stripper unless it is unavoidable. All strippers with form inserts, pads, and lance/pierce details must be guided by pins and bushings and must bottom out on balancing blocks. All inserts are to be hardened. All side forces generated must be compensated for by some type of heel of retainer.

T. Nitrogen system:

1. Manifolds will be mounted with the screws going through the manifold into the punch or die shoes.
2. Pressure gauges must be provided on the system.
3. Charging valves must be provided with easy access.
4. Maximum pressure must be stamped on the manifold.
5. Controls must be recessed inside the punch or die shoe and facing the operator.
6. Where possible screw and dowel hole clearance will be provided in the manifold.
7. Parallel plumbing of the cylinders is desired for the system.
8. When possible cylinders will be designed with uniformity.
9. All reference materials for the system including the manifold, cylinders, connections and rebuild kits must accompany the die upon shipment.
10. There will be a minimum of .250" additional travel available when the die is on the stop blocks.
11. The cylinders must not be under pre-load condition in system.
12. The contacts on the pads must be made from prehardened 4140 (Maxel) minimum with a .020" +/- .010: tolerance air gap.
13. Provide drain slots for nitrogen cylinders.

U. Positive knockouts

1. The top die shoe must be drilled for positive knockout if required.

V. Pressure pins:

1. A.I.S.I. 1045 air pins with flame hardened chamfered ends will be furnished by the supplier.
2. Unless otherwise specified, the six inch J.I.C. pattern will be followed for the



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drilling of pressure pin holes in the shoe of all draw dies.

3. The length of air pins will be determined as follows:
 - a. The length and diameter of the air pins above the top surface of the Bolster will be furnished by the tool shop.
4. The length of the air pins above the top surface of the Bolster will be legibly stamped on the die shoe in the following manner:
Length of air pins above Bolster " _____ " (put in dimension in inches).
5. The pins will be stamped with the die number and total length of the pin.

W. Forming and drawing dies;

1. Unless otherwise specified by the Tooling engineer, all draw dies will have a nitrogen system.
2. All flange and form steels are to be made shimmable and heeled whenever possible.
In severe forms the sections should be coated per a specified process enhancement coating.
3. Ready benders are recommended for critically dimensioned bends and associated features.
4. All ready bender units will have a minimum 3/8" key cut perpendicular to the form to ensure consistency when shimmed.
5. The base of all form punches or sections is to be at least one and a half (1 1/2) times the height.
6. All cutting sections are to be separated from any form steel.. This is to eliminate the problem of regrinding forms when sharpening and shimming cutting steels.
7. Under cut all form sections for over bend development (5 degrees).
8. Draw beads will be inserted.
9. Vent holes will be provided to avoid "air locks" in the die.
10. Blank holding rings, pressure pads, etc. will be confined to prevent accidental removal, and guarded to prevent foreign objects from getting under them.
11. Large blank holding rings will be equipped with lifting straps, extending from the upper draw ring to the lower blank holding ring.
12. All pressure rings will be bronze inserted on the wear surface facing the punch or D-2 as required.
13. Pads which are bottomed out, will not have spring pockets.
14. Pads that bottom out will have hardened backing plates attached to the shoe.
15. Form dies are to bottom out on the radius, and all formed radii must be fully covered by the punch steel to provide the ability to coin the radius, to set the material.

X. Cam and slide type dies and drivers:

1. Make cam slides and heat treat as follows:
 - a. Large slides.
Machine steel (carbonize and harden .060 inches deep)
AISI Type 6150 tool steel (flame harden wear surfaces)
AISI Type 4140 tool steel (flame harden wear surfaces)
 - b. Small slides
AISI Type 6150 tool steel (thru harden)



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AISI Type 4140 tool steel (thru harden)

2. Insert cam slide in area of contact with driver. Make insert from AISI Type 01, S-7 tool steel (hardness: Rockwell "C" 54-56).
3. All cam slides and heel blocks must be designed to be removable in the press.
4. Insert heel block in area of contract with the cam driver. Make from AISI Type 01 or S-7 tool steel (hardness: Rockwell: "C" 54-56).
5. Use AISI Type S-7 or AISI Type 01 tool steel for cam drivers (hardness: Rockwell "C" 54-56).
6. The driving angle on the cam driver should be 40 degrees off vertical.
7. Use standard wear plates under all cam slides.
8. A center key, in addition to the side gibs (keepers), is to be used to guide all slides whenever the width of the slide exceeds the length.
9. Use standard gibs (keepers) to retain cam slides. The gibs must contain any side movement of the slide in addition to the vertical movement.
10. A stop should be mounted on the die shoe to control the "open-die" position of slide.
11. Provide 1/4 inch metal guard to enclose return springs and spring rods.(safety requirements).
12. Cam surface will be provided with wear plates containing lubrication grooves.
13. Cams will be rigidly guided and supported throughout their entire operation cycle.
14. All cam slides to be adjustable in the press either by an insert on the cam slide or on the driver.
15. Positive return cams are recommended.
16. Provide positive stripping.
17. Return springs and rods must be adequately protected from handling damage if they extend beyond the edge of the die shoe, use positive returns when possible.
18. If practical, cam pierce stations should be designed to facilitate punch removal for in press maintenance.
19. All Cam driven devices on transfer dies will be designed to operate without interfering with the transfer mechanics.
20. Provide for lubrication of slides, cam surfaces, guides, etc.

VII. Stamping and Marking of the Die;

A. The following die information will be stamped on the front and back edge in the Center of the lower die shoe:

1. Tool Number as specified on P.O.
2. Product drawing number.
3. Tonnage required regular and reverse.
4. Tool Vendor, date, location, (City, State, and County).
5. Shut height (in inches, 3 decimal places).
6. Length of pressure pin, diameter and length (if applicable).
7. Air pressure pin, diameter an length (if applicable).
8. Stock thickness, coil width and progression.
9. Upper die weight.



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10. Total die weight.
 11. Nitrogen pressure (Manifold or Individual cylinders if applicable).
 12. Feed height of material (in inches, 2 decimal places).
- B. All dies are to be painted as requested and the Supplier Internal job # should be stenciled on the front of the upper and lower die shoes.
- C. The part # will also be stamped into the upper die shoe front, back and both ends in the right hand corner of each face (.250" min. stamp size).
- D. The upper die shoe weight will also be stamped in the left hand corner of the upper shoe. **Note:** use .250" min. stamp size.
- E. The Die will also be tagged the Property of Key Safety Systems on the lower die shoe, right hand corner operator side.

VIII. Part/Lot Identification Steel Parts;

1. The Specific area for Part/Lot identification will be as shown on the applicable part print by a rectangular symbol. All parts require identification.
2. A. Identification will consist of **9 DIGITS** and could be **10 DIGITS** if a vendor has more than one set of tools for the same part number. Definition of each digit follows:

DIGIT I - Used only when a vendor has more than 1 tool, two out tool , or set of tools such as line dies, that produce the same part number. A numeric digit (1,2,3 etc.) will be used to distinguish the DIE/TOOL from which parts were produced. Numbers will be supplied by the Buyer.

DIGIT II, III - Vendor Code as assigned by the Buyer.

DIGIT IV thru VI – 4th, 5th, and 6th digIts of the part number, e.g. P/N E5025500-00.

DIGIT IX - Day of the week parts were produced (i.e. Monday thru Sunday).

DIGIT X – Heat Code used to identify the Material Heat used to produce part (i.e. 1,2 etc.) This will be tracked with a separate Quality document. An example is provided on page 20 of this Standard.

B. Example: 2AT 255 28 4 1

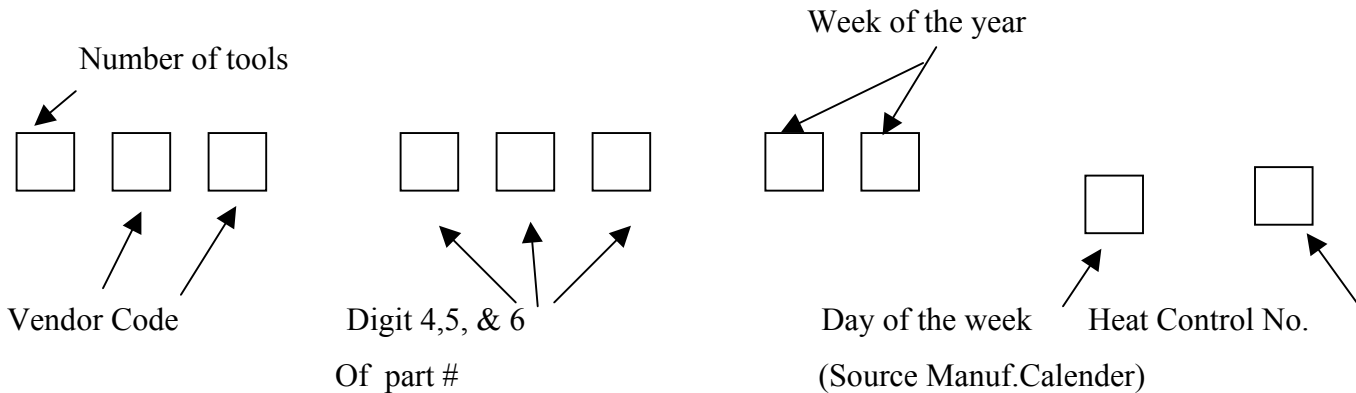


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Second tool for P/N E5025500-00 produced by Aristocrat (AT) on the fourth day (Thursday) of week 28, with Heat Code 1

- 2. Whenever possible, identification will be depression stamped using a standard Argon stamp retainer with tapered stamps (refer to Argon Tool and Manufacturing Co.) Where space limitations exist, alternate methods (Such as ink spray, Acid Etch, etc.) may be used when approved by Product Engineering, Plant Product Engineer, or Purchasing .

METHOD





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ARGON TM STAMP INFORMATION PART IDENTIFICATION

1. For 3/32 inch high characters use the following:

Argon Stamp Retainer MR-5 (Holds 10 narrow stamps)

Argon Stamp Retainer MR-7 (Holds 14 narrow stamps)

Argon Tapered Stamps ARG-090

2. For 1/8 inch high characters use the following:

Argon Stamp Retainer MR-7 (Holds 7 narrow stamps)

Argon Stamp Retainer MR-9 (Holds 9 narrow stamps)

Argon Tapered Stamps ARG-180



KEY SAFETY SYSTEMS, INC.

SPECIFICATION
NUMBER

1003745

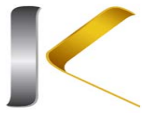
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DATE: 03/25/04

REVISION: 1

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**ALL STAMPS WILL BE DESIGNED TO BE EASILY ACCESSED IN THE PRESS TO
FACILATE LOT TRACEABILITY.**



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appropriate by the user plant. In the case of a multi-station die, these requirements will apply to each individual station.

- B. When all critical dimensions on the layout part check to print, a layout report including actual measurements is to be filled out by the vendor. Each dimension on the part print is to be identified by a circled number and this number is to correspond to the view number on the layout report. Out of print variations (if any) are to be recorded.
- C. A completed layout report, marked part print, and six (6) sample parts are to be submitted to the receiving plant PPAP group for approval.
- D. When sample parts are approved by the using plant, the vendor will be notified at that time for the balance of the parts required, as indicated by the purchase order or final approval portion of this procedure, should be run. The appropriate Key Safety Systems personnel must be in the vendor's plant to observe the tool run at this time.

Note: If a part is rejected at any step in this initial sample procedure, the tool must be corrected and new samples run.

- F. Design features found not in accordance with these specifications will be promptly corrected. The cost of disassembly correction, and reassembly will be the responsibility of the die supplier.

X. Tryout Recertification and Final Acceptance.

- A. The vendor will submit to the using plant a production lot run under normal operating conditions utilizing production materials and equipment. This production lot will consist of the quantity of parts specified by the receiving plant personnel and will be produced with no machine or tool adjustments.

If adjustments or process changes are made, the the production run will be discontinued, the parts previously produced will be segregated. And another production run will be started.

As the run progresses, sample parts will be drawn and documented in quantities and frequencies as specified the receiving Key Safety Systems personnel.

- a. A representative from Key Safety Systems should be on site to monitor the sampling process to assure compliance and/or to offer assistance whenever possible.
- B. The production lot and the samples will be shipped to the using plant and will be accompanied by any requested tool set up instructions or operating parameters
- C. The using Plant will inspect the sample parts for all dimensions indicated as requiring statistical controls and analyze the resulting data using accepted statistical methods to verify the stability of the manufacturing process. If the data indicates process stability, a process capability analysis will be conducted. Acceptable process capability requires that the measured process average \pm three (3).

- 1. Standard Dimensions must fall within the blueprint specified tolerance or in the case of a unilateral requirement, to the favorable side. For characteristics requiring go/no go evaluation and for non-S.P.C. dimensions, all items must meet drawing specifications or comply with applicable Engineering Deviation Approvals.

- D. When the sample parts are approved by the using plant, the vendor will be notified and final approval will be granted. If the parts are rejected during the final sampling procedure, the



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die and/or process must be corrected and a new sample lot run for analysis.

Note: A vendor's inability to provide the required production or inspection facilities at his own location does not relieve him of such responsibility. The vendor must procure a source or us a Key Safety Systems approved alternate. Any anticipated costs for compliance to this approval procedure should be included in the initial quoted die price.

E. Any die rework required to produce acceptable parts or to make the die(s) conform to the ordered specifications will be the die supplier's responsibility (freight charges included).

F. When Key Safety Systems requirements will not permit return of the new die for rework, after informing the die supplier, the corrections will be made at the facilities and the die supplier will be submitted to Key Safety Systems before final payment is made for die(s) ordered.

XI. Payment Terms:

A. Payment terms will be specified.

XII. Substitutions:

A. Substitutions or deviations, from any of the requirements of these specifications, will not be permitted except on specific approval, in writing, by authorized Key Safety Systems personnel.

XIII. Changes:

A. Key Safety Systems will have the right to change the production part design and/or the die design during the die construction.

B. Any change will be documented to identify the cost and effect on delivery schedule to make the necessary changes.

C. The agreed upon price change and delivery will be approved by a written revision to the Key Safety Systems purchase order.

1. The die supplier should not proceed with a work scope change until they have received a P.O. and a released print reflecting the change.

D. If the work is not progressing satisfactorily, the Key Safety Systems buyer reserves the right to remove such work from the seller's shop if deemed necessary to meet delivery. Subsequent reimbursement will be made on the basis of a negotiated settlement. This settlement will be based on actual work completed. Cancellation charges must be supported with invoices and time keeping documentation. The cost must be related to actual cost's incurred and not theoretical cost's. shop

(P.1)

Company Pt. # _____ Die Source Pt.# _____

Die Source and location: _____

In keeping with our policy to run high quality tool's this check sheet is to be shipped



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back to us with the tool you have built. All items checked below should be inspected and adhered to by the leader responsible for our job.

His name should appear below on this sheet.

PLEASE RETURN THIS SHEET TO THE TOOL ROOM MANAGER OR PERSON RESPONSIBLE FOR INCOMING TOOLS.

Date _____ Leader _____

Check List Standard

- 1. All purchased items were checked by leader.
- 2. All details stamped; Material, Rockwell, Job #, Detail # and the numbers are still discernible after grinding.
- 3. Lubrication fittings and grooves are on all wear surfaces
- 4. Appearance; Chain burrs ect., Non-functional edges are broken or removed .
- 5. 3/8" x .050 deep slot on all stop blocks. (unless otherwise specified)
- 6. Slug and part clearance. (No ledges)
- 7. Spring cans or guards required on all springs (except lifters)
- 8. Stamped; Start line, Part # , Pitch , Stock size, Shut height, upper and lower Die shoe weights and nitrogen manifold pressure settings.
- 9. Guards at pinch points painted safety yellow
- 10. Stop blocks over parallels with 1/2" resurfacing pad on upper shoe

- 11. Jack screw holes in doweled or pocketed details
- 12. Shedder pins in all trim and pierce punches
- 13. Ball release holes in pad and strippers (Punches removable in press)
All stripper windows are to be case hardened .040 deep or 4140.
- 14. Guards and chutes where needed
- 15. Lower trim sections are relieved and do not hold an excessive amount of scrap slugs.
- 16. Pins vented in die set
- 17. 5/8" screw minimum in parallels with clamping feet. Also opposite mounting screw will be one size larger for parallel positive location during reassembly.
- 18. Handling holes 3/4" minimum in upper and lower shoe.
- 19. All dies opened, cleaned, greased and oiled before shipment
- 20. All screws checked for tightness and dowels checked

- 21. Gaging, Part locates easily, proper lead, wear surfaces hardened.
- 22. Ease of feeding strip into progressive die. Stock guides doweled with .010



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clearance per side plus the maximum stock width.

(Adjustable stock guides must be approved)

- () 23. All cam punches are to have shudder pins where possible
- () 24. All flange and form steels are shimable and heeled where possible
- () 25. All extreme forms are coated to company specified coating
- () 26. All parallels are ground to a common height
- () 27. Die has all required customer part I.D. stamps and they can be removed in the press
- () 28. All trim sections and holes are undercut and have .375 to .500 of land depending on the material thickness.
- () 29. Die scrap does not exceed 6" in length

- () 30. Die has a feed and pitch sensor within the first three stations
- () 31. Die shut height _____ Die Stamped Y N
- () 32. Die feed level _____ Die Stamped Y N
- () 33. Upper Shoe weight _____ Die Stamped Y N
- () 34. Lower Shoe weight _____ Die stamped Y N
- () 35. Tonnage required to make part _____
- () 36. The Die has been Identified and Stamped per Key Safety Systems Tool Standards
- () 37. Parts fall from die without assistance or a proper parts ejection device is in place. No Air Assist !
- () 38. Parts fit gage and are to print specifications
- () 39. Number of parts run to date _____

- () 40. Perishable Tooling list sent with Tool
- () 41. Last strip shipped with die (Die source to retain one strip)
- () 42. Progression bar is attached to front right corner of the die shoe.

Project Engineer's signature _____ Date _____

Foreman's signature _____ Date _____

Shipper # _____



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****THIS CHECK LIST IS MADE ONLY TO HIGHLIGHT KEY AREAS IN
THE BUILD PROCESS AND IS IN NO WAY TO BE CONSIDERED OUR
FULL DIE BUILD STANDARDS.****
