

# **ORCHID**

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**Mount Juliet, LLC.**

## **TOOLING *and DESIGN* SPECIFICATIONS**

**Orchid Mount Juliet, LLC.  
94 Belinda Parkway  
Mt. Juliet, Tennessee  
37122**

## REVISIONS

Revision Level	Revision	Date
R1	Released	02/03/97
R2	Revised During QS-9000 Documentation Process	10/12/98
R3	Revised to promote Continuous Improvement	04/03/00
R4	Periodic Review	08/28/08
R5	Update standards	6/9/14

**APPROVALS**

\_\_\_\_\_  
Engineering Manager      **date**

\_\_\_\_\_  
General Manager      **date**

\_\_\_\_\_  
Tooling Manager      **date**

\_\_\_\_\_  
Quality Assurance Manager      **date**

**ORCHID QUALITY POLICY**

*To Safely Meet or Exceed Our Customer Expectations  
By continually improving Quality, Delivery and Performance through  
innovation, technology, and a skilled work force.*

**ORCHID ENVIRONMENTAL POLICY**

*Environmentally Responsible in all areas of business through Compliance,  
Improvement, and Prevention.*

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**1. TOOLING AND/OR EQUIPMENT QUOTING AND PURCHASE TERMS**

**NEW TOOLING**

- 1.1. The term buyer, as used herein, shall mean Orchid Mount Juliet, LLC. except as qualified.
- 1.2. The term vendor, as used herein, shall mean the successful bidder, contracted as the builder *or designer* of tools, dies, gages and/or equipment.
- 1.3. If the bidder is unable to submit his bid before the specified due date and still wants his bid considered, he must immediately contact Orchid Engineering for instructions regarding any extension of time for bidding.
- 1.4. Bidders shall, before submitting their bid, carefully examine the drawings and make all investigations essential to a full understanding of buyer's requirements. No allowance will be made for lack of full knowledge of actual requirements.
- 1.5. Verbal instructions are to be avoided. However, in special cases where such may be necessary, the bidder shall clearly define in his quotation any verbal instructions or conditions which augment, modify or clarify the job as set forth in the material furnished with the request for quotation.
- 1.6. Bidders must submit their quote based on the latest release of Orchid Tooling Specifications so as not to jeopardize consideration of their quotation. The bidder may submit an alternate bid or any substitutions by stating the addition to or deduction from the base bid due to substitution.
- 1.7. Orchid Engineering may provide concessions for some low-volume tooling. The Bidder is liable for all specifications unless Bidder has documented concessions from Orchid Engineering. No verbal agreements.
- 1.8. Bidder *may submit quote by their standard quote sheet either by email or regular mail.*
- 1.9. In-die lubrication should be determined prior to quotation. Contact the Program Manager for details. If an in-die lubrication system is required, Orchid Engineering will provide specifications for connections and nozzles.
- 1.10. After issuance of the purchase order, no substitutions of any nature shall be made by vendor without approval of the *Orchid* Program Manager having cognizance over the work being performed. However, no claim by vendor for extra compensation for alterations and/or additions will be accepted unless authorized by Orchid Program Manager. Authorization shall be in the form of an amendment to the original purchase order.
  - 1.10.1. **Note:** Approved drawings alone shall not constitute such authority.
- 1.11. Vendor may subcontract work at his discretion. Vendor shall be solely responsible for work subcontracted by the vendor.
  - 1.11.1. Orchid must be notified prior to acceptance of tooling purchase order if any or all of the tooling will be built in a low cost country.
- 1.12. If the work is not progressing satisfactorily, buyer reserves the right to remove such work from vendor's shop if deemed necessary to meet delivery and 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 relative to the % of work complete and not theoretical shop costs.

- 1.13. Buyer will furnish tryout material. Material will be as specified on the tool drawings. Vendor must notify the Program Manager in writing within seven (7) days from receipt of material of any discrepancies or shortages. No other material is to be used unless authorized by Program Manager.
- 1.14. Vendor must meet or better the delivery date specified on the purchase order issued for the tooling *or design* without additional compensation from buyer for any required overtime in excess of that included in vendor's quotation, exclusive of any confirmed changes or delays caused by buyer.
- 1.15. Approval to ship tooling will be given to vendor by the *Orchid* Program Manager after adequate tryout has been made by vendor to meet requirements as established in buyers purchase order.
- 1.16. Costs of preparing completed tooling, skidding, crating, shipping, etc. are vendor's responsibility and are to be included in the quoted price of the tooling.
- 1.17. All tooling (dies, fixtures, gages or special machines) covered by this purchase order must be proven statistically capable at +/- 5 standard deviations (or as agreed to) over the short term for those critical/significant characteristics designated by Orchid or our customer. Capability must be proven in your shop before acceptance of tooling and payment of purchase order. Reference Section 4 (PPAP)
- 1.18. Orchid shall have the right to request changes, but additional changes and billing thereof must be authorized by an amendment of the purchase order. If such changes affect delivery or the amount to be paid, vendor shall notify Orchid Engineering immediately and negotiate an adjustment in the terms of the purchase order contract.
  - 1.18.1. **Note:** Approved drawings alone shall not constitute such authority.
- 1.19. Orchid reserves the right for authorized personnel to check and inspect all tooling and equipment during the fabrication process.

## ENGINEERING CHANGES

- 1.20. Engineering changes are common in the tooling industry. We realize vendors must cover costs incurred for legitimate changes. We also expect our vendors to be fair and professional when determining what those charges will be.
  - 1.20.1. Engineering changes must be completed in accordance with this specification.

**REFURBISHMENT**

- 1.21. When quoting tools for refurbishment, quote with the intent that anywhere we can apply these specifications, we will. Vendor responsibilities include:
  - 1.21.1. Tryout tool prior to returning it to Orchid
  - 1.21.2. Inspect (6) pieces from each cavity 100%, prior to returning tool to Orchid
  - 1.21.3. Having a representative present for tool run-off at Orchid
  - 1.21.4. Supply Orchid Engineering Cad data, prints and updated die design (if applicable) used during refurbishment (ref Section 3 Design Requirements)
- 1.22. We realize that refurbishing a tool that has been in service for a while involves certain unknowns. Orchid Program Managers will work with Vendors to bring the tool to the best possible condition for our customer.
- 1.23. Vendors cannot be held liable for pre-existing conditions, but are responsible for the quality and performance of the work they perform. The intent is not to Band-Aid or patch the tool, the intent is to improve the operating condition.
- 1.24. Any hidden or unknown tool conditions revealed at tool disassembly shall be conveyed to the appropriate Orchid Program Manager immediately. No work or changes should proceed until agreed upon with Orchid Program Manager.

## 2. VENDOR'S RESPONSIBILITIES

- 2.1. The vendor is to read, and fully understand all tool drawing standards, tool specifications, and part print tolerancing. If the vendor does not understand them, it is their duty to contact Orchid Engineering for clarification.
- 2.2. All tools are to be built in accordance with working drawings such as part prints, tool drawings, sketches, etc. Vendor shall stamp or etch part number, tool number and/or equipment number on all tools in accordance with instructions contained in buyer's specifications.
- 2.3. Vendors must supply written progress reports to Orchid Engineering every week, commencing one week after verbal receipt of purchase order. Reports continue until successful die tryout and approval.
  - 2.3.1. Frequency of progress reports may be decreased at the *Orchid* Program Managers discretion.
- 2.4. All tools must comply with OSHA Safety Standards. It is the vendor's responsibility to be informed of the latest revisions to the OSHA safety standards.
- 2.5. After preliminary strip layout approval, the tonnage must be calculated. If this tonnage exceeds 80% of the selected press rating, the Orchid Program Manager must be notified immediately.
- 2.6. Vendor is to exercise proper care in handling gages, jigs, and/or checking fixtures, etc., furnished by buyer and will be held responsible for any mutilation or damage as a result of improper usage while in vendor's custody.
- 2.7. Tooling will be approved as described in section 4 Production Tool Approval Procedure of this specification. The fact a part fits the attribute gage is not approval criteria.

### **3. DESIGN REQUIREMENTS**

- 3.1. An appropriate Cad program determined by Orchid Program Management will be used for all tooling and gage designs. Designs must include enough detail to clearly convey construction.
- 3.2. Unless otherwise specified, design using the English unit of measurement.
- 3.3. Details should be on individual borders *and saved as individual part files with 4 digit tool number, 3 digit detail number, and 2 digit rev level in the title of the electronic file. (Example 7008-001\_01)*
- 3.4. Cad files shall be labeled with the designated Orchid tool number and the appropriate revision level.
- 3.5. Tool components shall be identified by balloons on the bottom and top plan views.
- 3.6. Complete and updated final CAD must be supplied to Orchid.
- 3.7. Design Approval Process
  - 3.7.1. Orchid requires the vendor representative to present a preliminary strip layout for review. Vendor's ideas and suggestions are welcomed and solicited during this review process. If changes are required a marked up copy will be provided to the vendor.
  - 3.7.2. The vendor representative must then present preliminary die designs (top plan views, bottom plan views, main cross section and other views for clarity) to be reviewed with Orchid Engineering.
    - 3.7.2.1. The preliminary design should include the type of materials, screw sizes, approximate locations for heel blocks, lubrication and sensor connections, etc, etc. If required, copies of the marked up sheets will be returned indicating changes desired.
  - 3.7.3. After changes are incorporated the final design must be submitted to Orchid Engineering. Orchid Engineering must approve the final design before tool build is started.
- 3.8. All cutting and forming sections are to be detailed. DXF, DWG, *STEP* or IGES files can be substituted for punch and die contours, provided they are exactly representative. (i.e. punch geometry is to be offset by the break clearance amount) *Solid Works Part and Asm. files are preferred over the others mentioned. DWG 2D drawings can be used in the case that the design software used will not export to Solid Works.*
- 3.9. All wire cut die sections are to be completely detailed. Bolt holes, slug ejectors, dowel holes, etc., are to be accurately dimensioned and machined.
- 3.10. The original designs/design files are the property of Orchid. This is proprietary information and is not to be supplied to anyone other than Orchid Engineering without written permission.
- 3.11. Provide a complete material list specifying size of detail blocks, purchased parts information, and a complete punch and button list. Provide this Bill of Material on 8 ½ x 11 sheets for easier access.
  - 3.11.1. This information must be received before final payment will be released.

- 3.12. Always give information necessary to order purchased parts, including the description, manufacturer and catalog numbers.

#### **4. PRODUCTION TOOL APPROVAL PROCEDURE**

4.1. The vendor is responsible for:

4.1.1. Run a minimum of 300 pieces in continuous mode, select every 10<sup>th</sup> piece for capability requirements. If the run is stopped or adjustments made the run must be started over. The respective Orchid Program Manager must be present during final tool tryout and sample run.

4.1.2. Vendor must submit dimensional layouts on (6) pieces. All must be dimensionally correct.

4.1.3. All dimensions designated as S/C's & C/C's must pass a (30) piece capability study prior to shipping the tool and receiving final payment. Capability requirements for S/C's & C/C's are a cpk > 1.67 unless otherwise specified on purchase order.

4.1.3.1. If the vendor cannot provide the complete capability study, the dimensional data for all S/C's should be recorded from the (30) pieces and submitted with the (6) piece layouts.

4.1.4. Non-S/C's must not exceed 50% of print tolerance from nominal dimension. If a trim line dimension were .400 +/- .010, .405/.395 would be allowable at initial submission. Hole sizes and mis-matches would be exceptions to this rule.

4.1.5. Capability for hole diameters may be calculated using unilateral tolerance to determine acceptability.

4.2. **NOTICE:** If the tool produces multiple parts, all requirements are per cavity.

4.3. Parts should be run on production type presses with coil feeding equipment. At this time any necessary adjustments will be made to enhance the productivity of the tool at the vendor's expense.

4.3.1. Intent: During run off at vendors shop parts not falling off die, scrap shedding, pads sticking etc. must be fixed. Orchid will not accept a die that will not run at SPM (strokes per minute) specified due to die or design problems.

4.4. If the selected tooling vendor does not have adequate production equipment, arrangements must be made to tryout the tooling elsewhere. The Orchid Program Manager may waive this requirement if the process can be proven capable by manual feeding. As a last resort, time may be rented from Orchid at current production rates. Use of Orchid equipment is not included for tryout and debugging, only for the final PPAP run. All issues should have already been resolved.

4.5. Method of measurement to be approved by the Orchid Quality Assurance department.

4.6. Submit the above inspection layouts and capability records to the appropriate Program Manager for review.

4.7. All dimensions requiring capability studies will be identified on the Quality Requirements sheet. Sample parts submitted for approval must be accompanied by a complete vendor layout report.

4.7.1. The tool supplier will be notified by Orchid Engineering as to the status of the tool:

4.7.1.1. Approval - the tool has been approved for production.

- 4.7.1.2. Rejection - the tool has failed to meet requirements.
- 4.7.2. The vendor must make necessary corrections to the tool. The capability requirements will be repeated until the tooling is approved.
- 4.7.3. The vendor will make any corrections unless time does not permit. In that case the tool will be brought to Orchid and the vendor will be charged for the corrections being made in house.
- 4.7.4. Final PPAP run must be at Orchid under production setting. The tool vendor must plan to have a representative present that is capable of communicating any issues back to the vendors shop. This representative must also be able to make any minor adjustments needed to complete the PPAP run.
- 4.7.4.1. In some cases, scheduling requires the PPAP run to be made on the off shifts or weekends. The Program Manager may waive the requirement for a representative to be present based on the trial run at the vendor and the simplicity of the tool.

**5. CLASS "A" – GENERAL TOOLING SPECIFICATION**

5.1. In designing and building any die, the vendor is to work with six (6) specifications:

5.1.1. First—Latest OSHA safety standards

5.1.2. Second—Tool drawing standards/electronic design data

5.1.3. Third—General specifications for all dies

5.1.4. Fourth—Specifications for the category the purchase order designates

5.1.5. Fifth—Press data - All dies will be designed for a specific press. Pertinent press information will be furnished by Orchid such as tonnage, shut height, stroke, strokes per minute, bolster and ram layout, feed height, and direction of feed

5.1.6. Sixth—Comply to part print tolerance and notes

5.2. Plan views of dies are to be drawn to full size, in open position (top half inverted). Maintenance work is done on open dies and we insist that all dies are drawn open. Include section views showing cams in retracted position with driver at initial point of contact on all designs.

5.3. The centerline of die should be to the centerline of the shoe, or as near as possible.

5.4. Die sets are to be heavy duty, all steel ball bearing set. *Used Danly Style Type II ball cages and pins.*

5.4.1. Die set thickness to be determined at preliminary review.

5.4.2. Guide pins must not protrude through die set when die is shut. In an approved situation where the decision is made to use standard pins and bushings, slots must be provided to permit escape of air.

5.5. *All progressive dies will have and first hit/start of strip line, if scrap is left in the die during the start of a strip, that piece should be painted red and bolted on the die set near the location the slug will be left.*

5.6. All cutting and form steels are to have detailed information, dimensionally correct in all aspects. Dowels and button holes to be either wire EDM or jig ground. Details must match CAD.

5.7. Stick punches contained in wire burned retainers must be retained by one of the following options: (no screws smaller than 5/16, no less than (2) screws -- Absolutely NO FLATHEAD SCREWS!!!)

5.7.1. 1<sup>st</sup> Choice: If the size of the punch permits, drill and counter bore for *at least* (2) 5/16"-18 or larger SHCS. *No closer than a 1/4" to the edge of the block.*

5.7.2. 2<sup>nd</sup> Choice: Punch can be drilled and tapped for *at least* (2) 5/16"-18 or larger screws, *no closer than a 1/4" to the edge of the block.*

5.7.3. Punches too small for screws should be designed with taper lock design (sketch included) unless punch shape will not allow it to be used.

- 5.8. All ball lock punch retainers must be hardened; other hardened retainers shall be hardened to Rockwell C 54-56. Retainers not hardened must be at a minimum, pre-hardened 4140.
- 5.9. Button retainers must be a minimum of pre-hardened 4140 with a hardened backing plate (Backing plate must be attached to retainer). Thickness of backing plate to be proportionate to material being stamped.
- 5.10. ¼” screws or smaller to be avoided. Absolutely NO FLATHEAD SCREWS!!!
- 5.11. All die details to be stamped or etched with *tool and* detail number and material identification.
- 5.12. All die sections to be face mounted for removal in press where possible.
- 5.13. Top of socket head cap screws to be below the die life of die sections.
- 5.14. All doweled sections to have tapped holes for jack screws for easy removal. Large sections shall also have slots for pry bars.
- 5.15. Design life on blanking and trimming die sections as follows:
- 5.15.1. Material thickness of .06” and under, 5/16” life with ¼° taper relief.
  - 5.15.2. Material thickness .06” up to .125”, 3/8” life with ½° taper relief.
  - 5.15.3. Material thickness .126” and up, 3/8” life with 1° taper relief.
  - 5.15.4. No sudden death die life on buttons or blank and trim steels
  - 5.15.5. When possible, design purchased punches/buttons, trim punches and die steels with minimum radii. Radii size should be determined at preliminary strip layout review.
- 5.16. Dowels should be tap fit in die shoes and slip fit in die sections. Blind dowels are not acceptable without prior approval. In applications where Blind dowels are unavoidable, threaded pull dowels must be used.
- 5.17. All die components weighing over 15 lbs. must have handling holes.
- 5.18. Use die buttons for all piercing, pilots and extruding, unless otherwise approved.
- 5.19. Do not trim and form in the same die section. If condition is unavoidable the section must be inserted and the main support block must be keyed. Obtain approval and direction from Program Manager.
- 5.20. Mis-match on notch sections to be a min. of .01”, consult Program Manager. Final determination to be made at strip layout review.
- 5.21. Insert form sections, thus providing adjustability for stock thickness variances (adjustable in press). Based on print dimensions, make the appropriate side of the form adjustable so part dimensions are not affected when adjusted. Exceptions upon written approval from Program Manager.

- 5.22. All form stations where part galling could occur requires either the form block and/or the form punch to be hard surface coated. The cost associated with this coating is the responsibility of the tool builder and should be noted and included in the original tooling quote. There is a variety of coatings available, consult with the Program Manager prior to application.
- 5.23. All special retainers, punches, and buttons to be identified with tool numbers, *detail number*, and detailed drawings to be furnished for it.
- 5.24. Use (D-2) grade at a minimum for all cutting and forming steel unless otherwise specified. Cutting steel hardened to Rockwell C 56-58, forming steel to Rockwell C 58-60. Higher grades of steel may be required due to part design and/or material specifications.
- 5.25. All die sets to be foolproof by offsetting one (1) pin or heel plate.
- 5.26. No two (2) post die sets will be accepted, without approval. *Die sets that have side thrust* must have box heels. V-type heels are acceptable on smaller die sets. Die sets should be large enough to accommodate heels, die protection and lubrication connections.
- 5.27. Consider ease of maintenance on all cut-off and weak die conditions. Insert where practical.
- 5.28. All tooling will be disassembled and visually inspected prior to full production. If poor die practice or craftsmanship is evident, the tool vendor will be required to address the issues in a professional manner.
- 5.29. Failure to update designs and detail drawings to match the tool, during tool build, will require full support from the tool vendor when discrepancies are found, especially in emergency situations.
- 5.30. Refer to stencil sheet (F80014) for required die markings. Stamp all dies on bottom die-set front edge of shoe with:
- 5.30.1. Part number, tool number
  - 5.30.2. Shut height, material width, material thickness range and progression.
  - 5.30.3. Weight of upper die, total die weight
  - 5.30.4. Nitrogen pressures
  - 5.30.5. Name of company who built the die
- 5.31. Paint dies as per color code, specified by Program Manager.
- 5.32. *All dies must have quick-change Locator plates on lower shoe. Size and location to be determined at design reviews.*
- 5.33. Dies built for presses 300 tons and up should have clamping slots on the top half. If parallels are required they should have a milled mounting foot, 2" thick.
- 5.34. Tools built for presses 250 tons and under should have 1" mounting plate on top half. Clamping specifications and shut height issues will be resolved during preliminary design review.

- 5.35. All dies to have four (4) set-up blocks. (near corner of die, mounted over a parallel) If top half has parallels, they also should support the set-up blocks. Each set-up block to be grooved at center .50" wide and .040" deep, and removable when die is in press. Set-up blocks are to be correct for proper shut height with a .010" air space. Lead check should result in a reading of .050".
- 5.36. Use only hardened fasteners that meet or exceed the specifications given in the "ASTM A574" standard.
- 5.37. Lower Parallels must be a min. of 4" tall to allow for scrap removal. Anything less must be approved by Orchid Engineering.
- 5.38. *Die Handling Holes must be designed to carry twice the weight of the tool and the size of the hole must be stamped or machined into the die set next to each hole (can be on the inside surface of the die set) holes in the upper and lower should be the same size.*
- 5.39. *If the tool is a two out and the parts are different, the part number stamps should be error-proofed to prevent incorrect installation.*

## **6. CLASS “A” - STRIPPERS**

- 6.1. Working strippers containing buttons, pilots, form areas, or shearing sections must be guided with guideposts and bushings of sufficient size to properly contain them. Guide posts and bushings should be self-lubricated or have lubrication fittings. *Preferred method is to use Standard Lifter Brand Lifter Guides.*
- 6.2. In applications where guideposts are not required, keeper blocks must be self-lubricating or have lubrication fittings accessible while in the press.
- 6.3. Strippers are to have access windows for in press removal of all pierce punches, pilots, small blank/gut punches and/or retainers.
- 6.4. All stripper springs must have spring cages.
- 6.5. Spring installation options:
  - 6.5.1. Springs may go through the top half punch holder with a top plate mounted to retain the springs (if shut height permits).
  - 6.5.2. Flat bottom spring pockets. (provide drain/vent holes, where appropriate)
  - 6.5.3. Never exceed the manufacture recommendations for spring travels.
- 6.6. Provide shedder pins in strippers near pilot holes, if no keepers are in the area of die to retain strip.
- 6.7. Shoulder screws are not permitted for retaining strippers, use keeper blocks. Reverse type spool retainers may be used in some applications with Program Managers approval. *Preferred method is to use Standard Lifter Brand Lifter Guides.*
- 6.8. Provide hardened (A-2, 52-54 Rockwell “C”) inserts on working surface of all strippers.
- 6.9. All progressive dies are to have leveling pads for strippers.
- 6.10. Strippers over *15 lbs.* must have handling holes.
- 6.11. Pockets milled in strippers must have a minimum of 1/16 fillet radius to help eliminate cracking. This is good die practice and should be used in all areas of die construction.
- 6.12. Include a detailed print of the stripper.
- 6.13. *Nitrogen cylinders should be used in as many places as feasible on dies design to hit more than 50,000 parts per year. In all cases the Nitrogen spring of chose is Special Springs from Moeller manufacturing.*

**7. CLASS “A” - PUNCHES, BUTTONS, AND SPRINGS**

- 7.1. Use heavy-duty ball-lock retainers and high-speed steel ball-lock punches exclusively (M2).
- 7.2. Slug shedders must be provided on all punches (both pierce and trim punches).
- 7.3. All head type punches, pilots, or buttons require written approval from Orchid Engineering. Headed pilots are acceptable when mounted into a stripper *or as approved by Orchid Engineering*.
- 7.4. All close tolerance holes are to be pierced and cam pierced in the same station if tooling condition permits.
- 7.5. Punches that cut only on one side must be heeled, with the heel entering the die before the punch starts cutting.
- 7.6. All pilot holes must have slug clearance through the die shoe and parallels. Straight portion of pilots are extended below stripper no more than a metal thickness when die is open.
- 7.7. No pilots previous to pitch stop unless positive primary gaging is provided.
- 7.8. Pilot last station previous to cutoff.
- 7.9. Do not use a part print hole for piloting unless hole is re-pierced to part print diameter or otherwise approved by Program Manager.
- 7.10. Target size of pierced holes in the part to be .001” under the high limit unless otherwise noted during design review.
- 7.10.1. When possible, design purchased punches/buttons, trim punches and die steels with minimum radii. Radii size should be determined at preliminary strip layout review.
- 7.11. For holes requiring more than standard shear, a station to shave holes may be considered. Contact Orchid Engineering department for further explanation.
- 7.12. Provide through holes for all dowel, slugs, and pilot holes.
- 7.13. Vendor will provide a punch and a button master list, or equivalent, with catalog numbers upon completion of the tool design. A complete set of purchased spare punches, pilots and die buttons must be provided with all dies. A “complete set” means enough to replace all, if there are (5) .500 diameter punches in the tool, you must provide (5) .500 diameter punches.
- 7.14. All die buttons must be key retained or otherwise designed for easy removal in press. This requirement may be discussed during preliminary review and may be waived by the Program Manager.
- 7.15. Reference the requirements for small stick punches in the Design Section. See sketch in the attachments sheets.

## **8. CLASS “A” - NITROGEN MANIFOLDS/SPRINGS**

8.1. If higher pressures are required than springs can provide, use nitrogen Manifolds. Manifolds are to be manufactured by Teledyne Hyson, Dadco, Standfast or Forward Industries.

8.2. Die prints to include data on cylinders as follows:

8.2.1. Manufacturer and Model

8.3. All manifold designs should be standard catalog cylinder sizes. If longer rod extensions are necessary, transfer pins, or kiss blocks should be used between the pad and cylinder rod. When cylinders are used in the lower dies, drain slots are to be machined within the die shoe or manifold plate for drainage of liquids from milled pockets.

8.4. Manifold systems are preferred for all form and draw applications. However, if self-contained cylinders are used, they are to have the dynamic lube system, self-aligning rods and be plumbed together with a control and filler regulator. Consideration should be given to whether the self-contained or system mode is best suited to the application.

8.5. *Self-contained gas springs should be used in all cases feasible in dies designed to run more than 50,000 parts per year. In all cases the Nitrogen spring of chose is Special Springs from Moeller manufacturing*

8.6. Hardened (52-54 Rockwell “C”) “kiss” blocks should be used in any applications where cylinder pistons are contacting soft steel.

8.7. Use nitrogen cylinders for cam returns, no springs, unless approved by Orchid Engineering.

## 9. CLASS "A" - PROGRESSIVE DIES

- 9.1. Provide positive means of part ejection from die. Avoid blow off without written permission. Consult with the Program Manager.
- 9.2. All dies must stamp part identification numbers. If more than one out die, each part must be identified. Use Argon stamp holders and stamps to designate cavity, run code date, and part number if part size permits, at a minimum run code date each part. Refer to Die Steel-Stamp Specification F80015.
- 9.2.1. Preference is to have part number and run code in separate stamp holders for automotive parts if room permits.
- 9.3. All dies should have pitch stops or equivalent. On material thickness over 1/8" thick, trim both sides of strip for camber stress relief and provide a stop on both sides. Allow overfeed of .010 and assure full strip advancement.
- 9.3.1. Exceptions due to part design to be approved by Orchid Engineering.
- 9.4. A form of die protection (proximity switches or sensors) must be provided at the pitch notch to assure strip advancement, near end of die to detect buckling of the strip and to detect part off die (required for each cavity, if multiple out tool). Orchid to provide specifications based on requirements: Orchid to provide sensors, tool shop responsible to attach.
- 9.4.1. Pitch notch sensors shall be located on the fixed guide rail side of tool.
- 9.4.2. *A groove should be milled into the die set to allow for the sensor wires to be buried into the die set to prevent damage to the wire, the location will be finalized during the design review process.*
- 9.5. Parts to be notched off end of die not drop through, unless otherwise approved at design approval.
- 9.6. Harden all stock guide rails.
- 9.6.1. Back rail to be doweled into place.
- 9.6.2. Front rail to be adjustable to + or - 1/8" from nominal. Rail should slide on hardened key for alignment. (ref. sketch A)
- 9.7. Formed parts must be raised up off die sections for easy part ejection and strip feed.
- 9.8. Proper feed line height must be maintained on all dies.
- 9.9. All dies having unbalanced forming or trimming pressures must have thrust blocks with hardened tool steel wear plates to maintain die line up.
- 9.10. All cams and cam slides must work on wear resistant bronze or hardened tool steel wear plates. Use off the shelf, laminated slides *were feasible*. Purchased cam units are acceptable as long as they are self-lubricating or have grease fittings.

- 9.11. All movable sections and cams must have grease fittings and grease grooves for proper lubrication. Self-lubricating bronze with graphite plugs are acceptable types of wear plates.
- 9.12. Progressive dies must have pilots and must engage for stock feeder release feature.
- 9.12.1. Ball Lock pilots should be standard blank sizes when possible, .500, .625, .750, etc.
- 9.12.2. The button for the 1<sup>st</sup> pilot should be .003 over pilot size; all other pilot buttons can be the same size as the pierce button for the pilot hole.
- 9.13. Die must have two (2) places between lower parallels *designed to meet the criteria of the attached lift truck fork location chart. Must be wide enough spread for a safely balanced load.*
- 9.14. All formed radii are to be coined. Restrike forms in later stations, if required.
- 9.15. Balance all die loads to equalize pressure to the center of the press ram, as near as possible.
- 9.16. All dies with draw areas in form steels to have hard surface coatings. Reference note in General Tooling Specification section.
- 9.17. All progressive dies must have stock lifters. Spring mounted lifters must be made of pre-hardened steel or bearing bronze. They should have more than adequate lead on edges and should be mounted so they can be serviced in press. No stripper bolts or screws from the bottom side will be allowed. Provide spring cans and drain holes in all spring pockets. *Preferred method is to use Standard Lifter Brand Lifter Guides.*
- 9.18. Scrap cutters shall be provided to eliminate handling of long skeletons or scrap material.
- 9.19. During the initial quotation process, DO NOT include costs for scrap removal, such as chutes or shakers. If awarded the business, the proper method of scrap removal will be determined at the strip layout review. At that time, a secondary quotation should be provided, if required.
- 9.20. Intentions are that gravity chutes or pneumatic shakers be used to carry scrap and parts (separately) clear of bolster. Use Rigid-Tex or equivalent for all chutes.
- 9.21. Last hit strip showing all stations in die must be included with die when shipped to Orchid.
- 9.22. All dies will be checked for Reverse Tonnage during initial tryout at Orchid. Tool vendor must modify any tool having a reverse tonnage more than 8% of the press tonnage. Shear can be ground on the punch or die, the punches can be stepped or add urethane cushion blocks, appropriate for the tool and mounted per manufacture's standards. This reduces the loading in both directions and improves both tool life and press life.
- 9.23. Use only hardened fasteners that meet or exceed the specifications given in the "ASTM A574" standard.
- 9.24. Lower Parallels must be a min. of 4" tall to allow for scrap removal. Anything less must be approved by Orchid Engineering.

**10. CLASS “B” – GENERAL TOOLING SPECIFICATION** (Less than 60k per year or as approved by Orchid Engineering)

- 10.1. In designing and building any die, the vendor is to work with six (6) specifications:
- 10.1.1. First—Latest OSHA safety standards
  - 10.1.2. Second—Tool drawing standards/electronic design data
  - 10.1.3. Third—General specifications for all dies
  - 10.1.4. Fourth—Specifications for the category that the purchase order designates
  - 10.1.5. Fifth—Press data - All dies will be designed for a specific press. Pertinent press information will be furnished by Orchid such as tonnage, shut height, stroke, strokes per minute, bolster and ram layout, feed height, and direction of feed
  - 10.1.6. Sixth—Comply to part print tolerance and notes
- 10.2. Plan views of dies are to be drawn to full size, in open position (top half inverted). Maintenance work is done on open dies and we insist that all dies are drawn open. Include section views showing cams in retracted position with driver at initial point of contact on all designs.
- 10.3. The centerline of die should be to the centerline of the shoe, or as near as possible.
- 10.4. Die sets are to be heavy duty, all steel ball bearing set.
- 10.4.1. Die set thickness to be determined at preliminary review.
  - 10.4.2. Guide pins must not protrude through die set when die is shut. In an approved situation where the decision is made to use standard pins and bushings, slots must be provided to permit escape of air.
- 10.5. *All dies progressive dies will have and first hit/start of strip line, if a slug is left in the die during the start of a could that piece should be painted red and bolted on the die set near the location the slug will be left.*
- 10.6. All cutting steels are to have detailed information dimensionally correct in all aspects. Dowels and pierce holes to be either wire EDM or jig ground. Details must match CAD.
- 10.7. Stick punches contained in wire burned retainers must be retained by one of the following options: (no screws smaller than 5/16, no less than (2) screws -- Absolutely NO FLATHEAD SCREWS!!!)
- 10.7.1. 1<sup>st</sup> Choice: If the size of the punch permits, drill and counter bore for *at least (2) 5/16”-18 or larger SHCS. No closer than a 1/4” to the edge of the block.*
  - 10.7.2. 2<sup>nd</sup> Choice: Punch can be drilled and tapped for *at least (2) 5/16”-18 or larger screws, no closer than a 1/4” to the edge of the block.*

- 10.7.3. Punches too small for screws should be designed with taper lock design (sketch included) unless punch shape will not allow it to be used.
- 10.8. Retainers not hardened must be at a minimum, pre-hardened 4140.
- 10.9. ¼” screws or smaller to be avoided. Absolutely NO FLATHEAD SCREWS!!!
- 10.10. All die sections to be face mounted for removal in press where possible.
- 10.11. Top of socket head cap screws to be below the die life of die sections.
- 10.12. Design life on blanking and trimming die sections as follows:
- 10.12.1. Material thickness of .06” and under, 5/16” life with ¼° taper relief.
  - 10.12.2. Material thickness .06” up to .125”, 3/8” life with ½° taper relief.
  - 10.12.3. Material thickness .126” and up, 3/8” life with 1° taper relief.
  - 10.12.4. No sudden death die life on blank and trim steels
  - 10.12.5. When possible, design purchased punches/buttons, trim punches and die steels with minimum radii. Radii size should be determined at preliminary strip layout review.
- 10.13. Dowels should be tap fit in die shoes and slip fit in die sections. Blind dowels are not acceptable without prior approval. In applications where Blind dowels are unavoidable, threaded pull dowels must be used.
- 10.14. Do not trim and form in the same die section. If condition is unavoidable the section must be inserted and the main support block must be keyed. Obtain approval and direction from Program Manager.
- 10.15. Mis-match on notch sections to be a min. of .01”, consult Program Manager. Final determination to be made at strip layout review.
- 10.16. Insert form sections, thus providing adjustability for stock thickness variances (adjustable in press). Based on print dimensions, make the appropriate side of the form adjustable so part dimensions are not affected when adjusted. Exceptions upon written approval from Program Manager.
- 10.17. Where EDM sections are used, a copy of the EDM Program will become the property of Orchid Engineering.
- 10.18. Use (*D*-2) for all cutting and forming steel unless otherwise specified. Cutting steel hardened to Rockwell C 56-58, forming steel to Rockwell C 58-60.
- 10.19. All die sets to be foolproof by offsetting one (1) pin.
- 10.20. No two (2) post die sets will be accepted, without approval.
- 10.21. Consider ease of maintenance on all cut-off and weak die conditions. Insert where practical.

- 10.22. All tooling will be disassembled and visually inspected prior to full production. If poor die practice or craftsmanship is evident, the tool vendor will be required to address the issues in a professional manner.
- 10.23. Failure to update designs and detail drawings to match the tool, during tool build, will require full support from the tool vendor when discrepancies are found, especially in emergency situations.
- 10.24. Refer to stencil sheet (F80014) for required die markings. Stamp all dies on bottom die-set front edge of shoe with:
- 10.24.1. Part number, tool number
  - 10.24.2. Shut height, material width, material thickness range and progression.
  - 10.24.3. Weight of upper die, total die weight
  - 10.24.4. Nitrogen pressures
  - 10.24.5. Name of company who built the die
- 10.25. Paint dies as per color code, specified by Program Manager.
- 10.26. *All dies must have quick-change Locator plates on lower shoe. Size and location to be determined at design reviews.*
- 10.27. Dies built for presses 300 tons and up should have clamping slots on the top half. If parallels are required they should have a milled mounting foot, 2" thick.
- 10.28. Tools built for presses 250 tons and under should have 1" mounting plate on top half. Clamping specifications and shut height issues will be resolved during preliminary design review.
- 10.29. All dies to have four (4) set-up blocks. (near corner of die, mounted over a parallel) If top half has parallels, they also should support the set-up blocks. Each set-up block to be grooved at center .50" wide and .040" deep, and removable when die is in press. Set-up blocks are to be correct for proper shut height with a .010" air space. Lead check should result in a reading of .050".
- 10.30. Use only hardened fasteners that meet or exceed the specifications given in the "ASTM A574" standard.
- 10.30.1. Lower Parallels must be a min. of 4" tall to allow for scrap removal. Anything less must be approved by Orchid Engineering.
- 10.31. *Die Handling Holes must be designed to carry twice the weight of the tool and the size of the hole must be stamped or machined into the die set next to each hole (can be on the inside surface of the die set) holes in the upper and lower should be the same size.*
- 10.32. *If the tool is a two out and the parts are different, the part number stamps should be error-proofed to prevent incorrect installation.*

## **11. CLASS “B” - STRIPPERS/SPRINGS**

- 11.1. Working strippers containing buttons, pilots, form areas, or shearing sections must be guided with guideposts and bushings of sufficient size to properly contain them. Guide posts and bushings should be self-lubricated or have lubrication fittings. *Preferred method is to use Standard Lifter Brand Lifter Guides.*
- 11.2. In applications where guideposts are not required use keeper blocks, standard spools or reverse type spool retainers. **Shoulder screws are not permitted for retaining strippers.** *Preferred method is to use Standard Lifter Brand Lifter Guides.*
- 11.3. Use standard die springs w/spring cages, if higher pressures are required than springs can provide, use nitrogen die springs. *All nitrogen cylinders and manifolds are to be manufactured Special Springs from Moeller Manufacturing in all cases feasible.*
- 11.4. Die prints to include data on cylinders as follows:
- 11.4.1. Manufacturer and Model
- 11.5. Spring installation options:
- 11.5.1. Springs may go through the top half punch holder with a top plate mounted to retain the springs (if shut height permits).
  - 11.5.2. Flat bottom spring pockets. (provide drain/vent holes, where appropriate)
  - 11.5.3. Never exceed the manufacture recommendations for spring travels.
- 11.6. Self-contained gas springs may be used as a substitute for coil springs in some instances of limited space or inadequate pressure. *In the case that gas springs are used it should be Special Springs from Moeller Manufacturing if Feasible.*
- 11.7. Provide shedder pins in strippers near pilot holes, if no keepers are in the area of die to retain strip.
- 11.8. Pockets milled in strippers must have a minimum of 1/16 fillet radius to help eliminate cracking. This is good die practice and should be used in all areas of die construction.
- 11.9. Include a detailed print of the stripper.

**12. CLASS “B” - PUNCHES AND PILOTS**

- 12.1. Use headed (*M2*) punches w/ejectors and pre-hardened retainers.
- 12.2. Punches that cut only on one side must be heeled, with the heel entering the die before the punch starts cutting.
- 12.3. All pilot holes must have slug clearance through the die shoe and parallels. Straight portion of pilots are extended below stripper no more than a metal thickness when die is open.
- 12.4. No pilots previous to pitch stop unless positive primary gaging is provided.
- 12.5. Pilot last station previous to cutoff.
- 12.6. Consider using a part print hole for piloting, consult with Program Manager. *This Method should only be used as a last resort to reduce cost to the tool.*
- 12.7. Target size of pierced holes in the part to be .001” under the high limit unless otherwise noted during design review.
- 12.7.1. When possible, design purchased punches/buttons, trim punches and die steels with minimum radii. Radii size should be determined at preliminary strip layout review.
- 12.8. For holes requiring more than standard shear, a station to shave holes may be considered. Contact Orchid Engineering department for further explanation.
- 12.9. Provide through holes for all dowel, slugs, and pilot holes.
- 12.10. Vendor will provide a punch and a button master list (F80016), or equivalent, with catalog numbers upon completion of the tool design.
- 12.11. Reference the requirements for small stick punches in the Design Section. See sketch in the attachments sheets.

### 13. CLASS "B" - PROGRESSIVE DIES

- 13.1. Provide positive means of part ejection from die. Avoid blow off without written permission. Consult with the Program Manager.
- 13.2. All dies must stamp part identification numbers. If more than one out die, each part must be identified. Use Argon stamp holders and stamps to designate cavity, run code date, and part number if part size permits, at a minimum run code date each part. Refer to Die Steel-Stamp Specification F80015.
- 13.2.1. Preference is to have part number and run code in separate stamp holders for automotive parts if room permits.
- 13.3. All dies must have pitch stops. On material thickness over 1/8" thick, trim both sides of strip for camber stress relief and provide a stop on both sides. Allow overfeed of .010 and assure full strip advancement.
- 13.3.1. Exceptions due to part design to be approved by Orchid Engineering.
- 13.4. A form of die protection (proximity switches or sensors) must be provided at the pitch notch to assure strip advancement, near end of die to detect buckling of the strip and to detect part off die (required for each cavity, if multiple out tool). Orchid to provide specifications based on requirements: Orchid to provide sensors, tool shop responsible to attach.
- 13.4.1. Pitch notch sensors shall be located on the fixed guide rail side of tool.
- 13.4.2. *A groove should be milled into the die set to allow for the sensor wires to be buried into the die set to prevent damage to the wire, the location will be finalized during the design review process.*
- 13.5. Parts to be notched off end of die not drop through, unless otherwise approved at design approval.
- 13.6. Harden all stock guide rails.
- 13.6.1. Back rail to be doweled into place.
- 13.6.2. Front rail to be adjustable to + or - 1/8" from nominal. Rail should slide on hardened key for alignment. (ref. sketch A)
- 13.7. Formed parts must be raised up off die sections for easy part ejection and strip feed.
- 13.8. Proper feed line height must be maintained on all dies.
- 13.9. All dies having unbalanced forming or trimming pressures must have thrust blocks with hardened tool steel wear plates to maintain die line up.
- 13.10. All cams and cam slides must work on wear resistant bronze or hardened tool steel wear plates. Use off the shelf, laminated slides *were feasible*. Purchased cam units are acceptable as long as they are self-lubricating or have grease fittings.

- 13.11. All movable sections and cams must have grease fittings and grease grooves for proper lubrication. Self-lubricating bronze with graphite plugs are acceptable types of wear plates.
- 13.12. Progressive dies must have pilots and must engage for stock feeder release feature.
- 13.12.1. Pilots should be standard blank sizes when possible, .500, .625, .750, etc.
- 13.12.2. The hole for the 1<sup>st</sup> pilot should be .003 over pilot size; all other pilot holes can be the same size as the pierce hole for the pilot.
- 13.13. Die must have two (2) places between lower parallels *designed to meet the criteria of the attached lift truck fork location chart. Must be wide enough spread for a safely balanced load.*
- 13.14. All formed radii are to be coined. Restrike forms in later stations, if required.
- 13.15. Balance all die loads to equalize pressure to the center of the press ram, as near as possible.
- 13.16. All progressive dies must have stock lifters. Spring mounted lifters must be made of pre-hardened steel or bearing bronze. They should have more than adequate lead on edges and should be mounted so they can be serviced in press. No stripper bolts or screws from the bottom side will be allowed. Provide spring cans and drain holes in all spring pockets. *Standard Lifter Brand Lifter Guides can be used if approved by Orchid Eng.*
- 13.17. Scrap cutters shall be provided to eliminate handling of long skeletons or scrap material.
- 13.18. During the initial quotation process, DO NOT include costs for scrap removal, such as chutes or shakers. If awarded the business, the proper method of scrap removal will be determined at the strip layout review. At that time, a secondary quotation should be provided, if required.
- 13.19. Intentions are that gravity chutes or pneumatic shakers be used to carry scrap and parts (separately) clear of bolster. Use Rigid-Tex or equivalent for all chutes.
- 13.20. Last hit strip showing all stations in die must be included with die when shipped to Orchid.
- 13.21. All dies will be checked for Reverse Tonnage during initial tryout at Orchid. Tool vendor must modify any tool having a reverse tonnage more than 8% of the press tonnage. Shear can be ground on the punch or die, or the punches can be stepped. This reduces the loading in both directions and improves both tool life and press life.
- 13.21.1. Another option is to add urethane cushion blocks, appropriate for the tool and mounted per manufacture standards.

**ATTACHMENTS LIST**

1. *F95069 – Check List for Tool Buy Off (For review prior to Orchid Inspection)*
2. F80014 – Die-Shoe Stencil Specifications
3. F80015 -- Die Steel-Stamp Specifications
4. F95008 -- Tool Progress Report (Example)
5. F95020 -- Engineering Change Quote Request
6. F95030 – Engineering Die Information Sheet
7. F95031 -- Vendor Acknowledgment Sheet (must be signed and returned)
8. F95016 – RFQ Specification Sheet
9. Example of “Detail” sheet
10. Taper lock punch drawing
11. *Standard Purchased Items List*
12. *Print for Pitch Notch*
13. *Print for Stop Blocks*
14. *F95070 - Tool Design approval check list (strip, 50%, 100% approval)*
15. *Fork Lift Fork Spread Chart (HiLo)*