DELPHI

TOOL DESIGN - MANUFACTURING DESIGN SPECIFICATIONS FOR TOOLING AND EQUIPMENT

SECTION H - DIE DESIGN

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TOOL DESIGN - MANUFACTURING DESIGN SPECIFICATIONS FOR TOOLING AND EQUIPMENT

SECTION H - DIE DESIGN

H.1 GENERAL

1.1 All die drawings must adhere to the general specifications of **Section "A" thru "F"** of the DTS Manufacturing Design Standards.

Preliminary layouts including blank layout, strip layout, and general die/punch holder layout shall be submitted for DTS Manufacturing Design approval prior to detailing and/or build.

1.2 Die drawings must include the following:

1.2.3 A plan view of the die with the punch holder removed.

1.2.4 A plan view of punch "inverted". The inverted position is established by opening the die as a book from left to right.

1.2.5 A complete cross section of the die and any additional sections to show the entire die construction must be provided.

1.2.6 Supplementary section views highlighting critical conditions must be provided.

1.2.7 Detail "Special" and/or altered purchased punches and die bushings.

H.2 GENERAL DIE LAYOUT

2.1 Die centerlines shall be dimensioned in relation to the die set guide post center lines.

2.2 Show the press centerlines and reference dimension them to the die center lines as applicable.

2.3 The offset post of a four post die set is normally located at the right front and identified.

2.4 Feed direction of die shall be shown and match the press centerline from operator perspective.

2.5 Show the bed opening in phantom and label it if applicable to scrap disposal.

2.6 Show and dimension all die shoe mounting holes for the bolster and slide.

2.7 Show and dimension the die set handling holes. Die handling holes shall be provided in both the upper and lower shoe. Tap size shall be chosen to insure adequate strength for lifting the entire die while bound by the tie straps. Handling holes shall not interfere with tie strap holes.

2.8 Provisions for the placement of safety blocks inside the die set must be made. Safety block areas within the die set must be kept clear and marked appropriately. A 4" x 4" block is used for press bed widths of 24" or less. A 6" x 6" block is used for press bed widths over 24".

2.9 Die stop blocks must be mounted in all dies unless otherwise specified. Long one piece stop blocks are to be avoided. Divide blocks so the lower stop block does not exceed the die level. Dimension stop blocks to allow the die to bottom out at the desired shut height position. A .025" deep slot shall be provided in each stop block to aid in die setup and trouble shooting.

2.10 The die shut height must be shown and appropriately dimensioned.

2.11 Include tie straps in design. Tie straps are to be attached to the die when it is in its rest position. Tie strap positions must not interfere with normal die handling holes.

2.12 Show valves, cylinders, switches, nozzle, etc. in their actual positions as mounted on the die. Indicate and label the physical routing of piping or hoses with center lines on assembly views. Provide appropriate schematics.

2.13 No develop dimensions are to remain on the drawings after the die is built. The designer must add the following note to the detail drawing: "Builder must supply final dimension".

H.3 GENERAL DIE FEATURES

3.1 Die Steels/Punch Steels and Retaining Blocks.

3.1.1 They are normally attached from their top face. On dies for soft aluminum parts, care must be taken to locate screws and dowels outside part areas on which surfaces cannot be marked. Blind dowel holes must be approved by the DHTS Manufacturing Design Coordinator.

3.1.2 Counter bored screw holes in die cutting steels must be dimensioned to a depth equal to screw head thickness, plus die life, plus .03. Exceptions must be approved by the DTS Manufacturing Design Coordinator.

3.1.3 Jack screw holes must be provided for easy removal of perishable punch or die steels.

3.1.4 Use removable straight (parting blade) type punches whenever practical.

3.1.5 Punch and die steels should be designed for wire E.D.M. construction whenever possible.

3.1.6 Design of all perishable steels must include consideration for maximized life, including slotting, reversing, multiple edges, etc.

3.1.7 Perishable steels shall be designed for fail-safe installation where ever possible.

3.2.8 Preferred die steel thickness for production dies is 1.50".

3.2 Punches

3.2.1 Use of ball lock punches is preferred. Ball lock punches shall conform to ANSI/ASME Standards.

3.3 Bushings

3.3.1 Use of headless press fit type die bushing is preferred. Bushings shall conform to ANSI/ASME Standards.

3.4 Pilots

3.4.1 Use of ball lock type pilots is preferred. Pilots shall conform to ANSI/ASME Standards.

3.4.2 Pilot diameters are normally .002 - .005" smaller than the pilot hole piercing.

3.4.3 Clearance holes for round pilots in die half are normally pilot diameter plus double stock thickness. All clearance holes must continue thru the die.

3.5 Strippers

3.5.1 Spring strippers are preferred.

3.5.2 Use either side keepers for stripper retention or spring spools for spring containment and stripper retention. Use urethane spacers sandwiched between the side keeper components to serve as silencers in dies running in excess of 80 s.p.m. The use of shoulder screws only for stripper retention is least preferred and usually used only in low volume dies.

3.5.3 In applications where the stock must be started at the extreme edge of the die, a means of preventing the stripper from tipping shall be designed and provided.

3.6 Spring Guards

3.6.1 Spring guards/cans shall be used to contain die springs in any location where broken spring pieces may be caught between die members.

3.6.2 Spring guards must be placed over any exposed springs where breakage or release of an entire spring or retaining stud could endanger personnel.

3.7 Slides

3.7.1 Use commercial components (i.e. Lamina) where possible.

3.7.2 Suitable lubrication, grooves, fittings, etc. must be included in the design.

3.7.3 A Spring slide return is allowed in single operation dies only. A Positive slide return must be used in transfer and progressive dies.

3.8 Kickers (Cam Driver)

3.8.1 Kickers may be constructed of hardened tool steel, or mild steel with hardened wear plates. Suitable lubrication provisions shall be made for wear surfaces.

3.9 Die Sets

3..9.1 No Die Sets with shanks are to be used.

3.9.2 Catalog die sets are used where applicable, however, many DTS applications require use of custom built sets due to specific requirements. DTS Manufacturing Design Coordinator will specify.

3.9.3 Use bronze plated de-mountable bushings with precision guide posts for die sets other than ball bearing type.

3.9.4 Four post die sets must have one post offset to prevent incorrect assembly.

3.9.5 Two post die sets having guide posts on the die center line, or positioned diagonally opposite, must have two different diameter posts to prevent incorrect assembly.

3.9.6 A metallic tag shall be permanently fixed to the lower shoe with the following data permanently etched or stamped within it:

- Number of part produced
- Tool number
- Stock width
- Pitch distance
- Shut height
- Tonnage required
- Upper shoe weight
- Total tool weight
- Stroke limits, min. and max
- Special bolster tool number

The Manufacturing Engineer responsible for the purchase and/or build of the tool shall supply any data as required to the tool supplier.

3.10 High Force, High Pressure Systems

The use of high force, high pressure systems is preferred over wire springs where initial high force material contact is required. The application is usually, but not limited to, material forming operations.

3.10.1 Self Contained Gas Springs: Because of the inability to monitor pressure decay, the use of self contained gas springs (drop in style) shall be used only in tools considered short run or low volume and only with DTS approval. Do not use in draw operations.

3.10.2 Nitrogen Gas Manifolds: May be designed as part of a die or as a separate manifold mounted to the die. Separate manifold systems are preferred over those built into die sets. Application is usually, but not limited to, in draw stations where pressures need to be controlled.

The designer must provide a complete detail drawing of the manifold so that manifold manufacturer can avoid holes or other die features.

3.10.3 Die-Draulic Oil Pressure Systems: Consider application only where the operating pressure must be released at the completion of the down stroke. This system may be incorporated into the die shoe or designed as a manifold mounted to the die. The designer must determine all the necessary operating requirements and provide a detail drawing. Die-Draulic Engineering is to be consulted for information regarding machining requirements, operation, installation and safety. Special air and wiring hook-up is required and necessary drawings must be supplied.

H.4 DESIGN REQUIREMENTS FOR SPECIFIC DIE TYPES

4.1 Progressive Dies

4.1.1 A strip layout shall be included as an element of the drawings.

4.1.2 Strip layout includes:

- **A.** Pilot hole locations.
- **B.** Dimensioned progression.
- **C.** Strip width and centerline.
- **D.** Stock thickness and material spec.
- **E.** A cross section of the part at each form station.
- **F.** Station description.
- **G.** For the purpose of record, show and dimension formed or drawn configurations required to produce part but do not appear on the final part itself.
- **H.** Strip start position

4.1.3 A fully dimensioned flat blank layout showing mismatches, pilot hole location bend allowance notes etc. shall be included either with strip layout or on an additional sheet.

4.2 Transfer Dies

4.2.1 A general arrangement drawing is required with each new transfer die system. This drawing is an outline view of the tooling involved. Include dies, bolster, ram adapters, riser, master die sets, transfer mechanism, transfer drive, transfer bars and fingers, press die space outline and any part removal devices.

4.2.2 A fully dimensioned flat blank layout is required.

4.2.3 A fully dimensioned drawing of the part as it is intended to appear leaving each station will be included as part of the die drawings. Unchanged portions of configurations need not be repeatedly dimensioned.

4.2.4 Die cross sections of each die station shall include views as follows:

- **A.** With the die fully closed.
- **B.** With the die closed to the point where the actual cutting or forming operation begins.
- **C.** With the die open to the point that all die elements have just cleared the part and transfer could begin.

4.2.5 Transfer finger positions must be shown in phantom to clarify freedom of interferences. Finger travel shall also be reference dimensioned.

4.3 Blanking and Cutting Dies

4.3.1 A fully dimensioned blank layout drawing shall be part of a blank die design.

4.4 Bending and Forming Dies

4.4.1 A fully dimensioned flat blank layout shall be provided. If the part requires a sequence of bends, a dimensioned layout of each operation must also be provided.

4.5 Draw and Redraw Dies

4.5.1 A dimensioned drawing of the part as it is intended to appear after each operation shall be provided with all draw and redraw die drawings. These drawings will include appropriately dimensioned cross sections.

4.5.2 On cup redraw dies, cross sectional die views will include full or half sections shown as follows:

- **A.** With the die closed to the point where reforming of the part begins.
- **B.** With the die fully closed.

H.5 SPECIAL PUNCHES AND DIE BUSHINGS

5.1 Qualifications for "Special Drawing Category"

A. Cannot be ordered from a manufacturers catalog without a drawing.

B. Are to be set up on the Buy-Card System.

C. Are to used in multiple tools as a common detail.

Note: If bushings and/or punches do not these criteria, they should be a regular detail of the die and not a special drawing.

H.6 WIRE E.D.M.

6.1 Layout

6.1.1 Show and use common datum points for mating details. The datum point can be the wire EDM start hole.

6.1.2 Show and dimension wire EDM start holes.