

BACHMAN MACHINE COMPANY

DIE SPECIFICATIONS

1. Scope

The purpose of this document is to ensure proper communication necessary to ensure mutual understanding of criteria used in construction of a Class “A” progressive die. It is understood that die making practices commensurate with first class dies will be used in unspecified matters.

The following general procedure is to be followed in the Die Design/Construction process:

- 1.1 Submit scrap strip/process strip for review and approval.
- 1.2 Submit 50% die designs for review, 2-3 days before T-1 design review meeting.
- 1.3 T-1 preliminary die design review. Builder must be present.
- 1.4 Submit 100% designs for final review and approval. Material may be ordered after 50% review, however some changes may be required after 100% design review.

2. Performance Requirements

- 2.1 Under normal conditions, the die shall be capable of the following performance requirements for a minimum 5-year period.
 - 2.1.1 The die shall be capable of producing _____ parts/yr., without requiring any major repairs over and above die maintenance.
 - 2.1.2 The die shall be capable of running _____ strokes/minute minimum.

3. Design and Construction

The following are standards considered to be necessary for construction of Class “A” progressive dies and are to be adhered to unless specifically waived in writing by the signator.

- 3.1 General Instructions: Die set is to be permanently marked, on the top side of the bottom shoe, with the following: job number, date of build, stock width, stock progression, builder's job number, total actual weight, top half actual weight, shut height, and “property of (customer)” specified. The property of tags will be supplied and shall be riveted to the front-center of the punch shoe. All dies will be stamped as to actual tonnage requirements. All Nitro pressures will be permanently marked on the topside of the bottom die shoe. The job number is to be painted on the front and back of the top and bottom shoe in bold letters/numbers. Paint die shoes red for G.M., gray for Ford, yellow for Chrysler, blue for Toyota, green for Isuzu, orange for Navistar, and black for other. Paint letters black for G.M., black for Ford, black for Chrysler, white for Toyota, white for Isuzu, black for Navistar and white for other.

- 3.2 Die set is to be (4) post precision ball bearing.
 - 3.2.1 All dies that exceed 90" in length must have heeled die sets. Heels must be welded to the die set and used replaceable wear plates. Any die that has a shave operation or any sector die must also utilize heeled die sets.
- 3.3 Stock feed is to be from right to left. The starting point shall be set with a spring-loaded pin that extends ½" above the feed line of the die and is visible to the operator.
- 3.4 Die clearance is to be per side.
- 3.5 Flattening and re-strike sections 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 for forming.
 - 3.5.1 All dies for the following tonnage will have minimum shoe thickness as listed:
 - 0-100 Ton 2" min.
 - 100-399 Ton 3" min.
 - 400-600 Ton 4" min.
 - 3.5.2 All dies containing a re-strike station must be supported by parallels with a minimum shoe thickness of 3.50". A part thickness of .190" and over shall require a minimum shoe thickness of 4.00".
 - 3.5.3 All dies containing coining or forming stations shall have a hardened plate under each station for support and may be inserted if necessary.
- 3.6 Only unaltered premium hardware is to be used and any weld must be approved by the project and tooling engineer in writing.
- 3.7 Part ejection is to be accomplished by free drop off the end or pushed through the die. Parts shall not eject with scrap. Parts that free drop will be free from obstructions. Parts that are pushed through the die shall have parallel clearance that is ¼" taller than the longest length of the part wherever possible (do not exceed feed height of press).
- 3.8 All scrap and slugs coming from the die must be capable of being moved out of the back of the die without interference from parallels, blocks, locating cones, nitro-dine units, or any other obstructions. BMC uses scrap transporters for scrap removal. Scrap coming out of a parallel is to be at least 1 ½" above the bottom of the parallel. Width between parallels should be nominal size (to the nearest inch) and common throughout a given die, if possible. Parallel height must exceed maximum scrap dimension by ¼" minimum (do not exceed feed height of press).
- 3.9 Die with push back in strip part designs are not acceptable.

- 3.10 All dies are to have a run stamp mounted at the front of the die that is easily changed in the press.
- 3.11 Four vertical stop blocks are to be permanently set to the proper shut heights and have a slot on the top surface that is stamped in it. Stop blocks are to be mounted over parallels wherever possible and stamped with the actual stop block height.
- 3.12 Provide heel blocks on die shoes to equalize forming pressure.
- 3.13 Strippers are to be spring loaded with guides. Use 4140 for strippers. They must have windows for access to retainers, run stamps, and pilots. They must also have keepers in lieu of spools, stripper bolts, etc. All springs are to have an external spring retainer (can), or equivalent. Springs are not to extend out through the top shoe. Should spring extend through the die shoe, then a ¼” plate is to be mounted to the die shoe to maintain spring pressure. This is a safety concern and will not be deviated from. All strippers are to have tapped handling holes and be a minimum of 1 ¼” thick.
 - 3.13.1 Provide pad balancer to aid in starting a new coil.
 - 3.13.2 All springs (lifter pin, guide rail, ejector, etc.) should be accessible without disassembly of die.
 - 3.13.3 All strippers to be drilled and tapped for removal with ½” NC eye bolts.
 - 3.13.4 Die springs are to be Dayton’s max-life, square wire springs.
- 3.14 Cam return springs must not extend beyond die shoe. Spring loaded strippers are to be used on all cams in lieu of urethane, rubber, etc.
 - 3.14.1 The use of air cylinders, for any reason, is prohibited.
- 3.15 Pilots are to be M-2 (H.S.S.) and hardened Rc 60-62. A double row is to be used wherever possible and maintained as long as possible.
- 3.16 All top cutting steels (outline punches) are to be hardened to Rc 60-62 double drawn and ground. Slug ejectors are mandatory except where steel strength and life could be affected.
- 3.17 Standard pierce punches are to be M-2 (H.S.S.) hardened to Rc 60-62 and ground with a mandatory slug ejector, except where punch strength and life could be affected. Wire E.D.M. “stick” punches having their shape burned through the retainer are recommended for all but the most basic shapes. All ball-lock punches are to be fool proofed and have a ½” min. shank diameter. The punch diameter must not exceed the shank diameter.
- 3.18 Punch retainers are to be jig ground (or wire EDM) with a ¼” min. thick hardened back-up plate and screwed to the bottom of the retainer (section).

- 3.19 All cutting sections are to be separate from any form steel. This is to eliminate the problem of regrinding forms when sharpening and shimming die steels.
- 3.20 Ejection pins to be on the top and bottom of the die at the part cut off station so that the part will not stick. Use a 1/4" diameter pin with approximately 1/4" of travel. Create a "tipping" effect.
- 3.21 All bottom cutting die steels are to be D-2 hardened to Rc 60-62 double drawn, ground with a minimum of 5/16" die life, and have a 1/4 degree min. ground taper relief. Insert cut-offs where possible. Thickness to be 1 1/2" min. for material up to .17 thick and 2" for material over .17 thick.
- 3.22 All forms are to be inserted and adjustable without disassembly of the die and adjustable within the press. All forms steels are to be D-2 hardened to Rc 60-62. One-piece form rings are not allowed.
- 3.23 All dies will use individual steels with the exception where weak die steels could be a factor. All pierced holes that use ball lock or stick burn punches will use standard cataloged die button if applicable.

DIE DESIGN AND COST WILL INCLUDE:

- 3.24 All details of the die shall be properly stamped with job number, the die shop's detail number, the material description and identifiable in reference to the design drawings. Round punches and buttons are to give the point and/or hole diameter callout. Spares to have proper identification also.
- 3.25 Jack screw holes will be provided in all details.
- 3.26 No detail shall have symmetrical mounting holes and dowels. No blind dowel holes are allowed. Strength and stresses must be considered when locating bolt and dowel holes.
 - 3.26.1 Use 5/16" diameter bolts as a minimum size throughout the die, whenever possible.
- 3.27 All trim line match points and cut-offs shall be away from critical areas of a part. Use offsets for mismatch to avoid blend conditions. In general, a .015" - .020" mismatch will be acceptable. This will be reviewed at Design Release (T-1). Exceptions shall be noted and finalized at the Design Release (T-1).
 - 3.27.1 Review stamping direction (and roll-off side) as specified on part print.
- 3.28 All bottom parallels are to have a 1/4" radius on both ends or a 45 degree angle cut into them.

- 3.29 Each part of a 2 out die must exit in separate directions. Each part of a “multi-out” die must have a run stamp and an adjacent identification stamp that will say “F” or “B” to tell if it is from the front or back of the die. Stamps to be supplied and be the same as the run stamp. They are also to be timed from mean stock thickness.
- 3.30 Nitrogen manifold(s) (Hyson or Forward) are to be used for all main strippers.
- 3.31 All self-contained drop-in nitrogen units are to be from Hyson or Kaller.
- 3.32 All special and standard punches are to be made at .001 under maximum hole size.

4. Die/Strip Size Requirements

- 4.1 Stripper balance posts/blocks are to include an M8 x 1.0 tapped hole for prox. sensor. The die set is to include a milled channel with covers, for sensor wiring. BMC will furnish sensors.
- 4.2 Top mounted parallels are to be on 6” centers with a minimum of four (4) 1 1/8” slotted feet that are 2” thick and on 6” centers. They are also to have clearance for 3” O.D. washers. Minimum of (6) parallels if the die exceeds 60” in length.
- 4.3 Bottom mounted parallels for bolting are to be on 6” centers with a minimum of four (4) 1 1/8” slotted feet that are 2” thick and on 6” centers. They are also to have clearance for 3” O.D. washers. Minimum of six (6) parallels for bolting if the die exceeds 60” in length. Provisions shall be made to allow tow motor access between two (2) parallels (6” forks). If not possible, blocks will be fastened to the die shoe to allow for tow motors to move the die.
 - 4.3.1 If the die exceeds 8,000 pounds, then provision will be made for the use of a 40,000 pound tow motor with 7 1/2” wide forks and 37” maximum opening (inside opening).
- 4.4 Dies with no parallels on top are to have a minimum of four (4) 1 1/8” slots in them that are 2” thick and 6” on centers. Minimum of six (6) 1 1/8” slots if the die exceeds 60” in length. They are also to have clearance cut for 3” O.D. washers.

5. Certification and Acceptance

- 5.1 Die design and T-1 sign-off are subject to approval before building commences. Upon completion of construction, (30) certified samples are to be supplied by the builder for inspection.
- 5.2 A complete dimensional sample inspection report shall be issued with the samples, by the Builder. Dimensions designated as critical shall be capable of 1.67 CPK or better.

5.3 Upon successful completion of critical dimension checks, an initial run of 500 pieces minimum shall be made under production conditions at the builder's facility. BMC representatives will be present during the run. A 30-piece sample will be selected for tool capability studies by the quality department. Authority to ship the tooling shall be contingent upon satisfactory completion of the initial run, the tool capability studies, and sign-off of T-2 checklist.

6. Spare/Detail Drawings

6.1 The seller shall furnish at the time of delivery one (1) set of the following:

6.1.2 Full detailed drawings of all sections of the die are to be provided. In general, this shall include: inserts, blank punches, die steels, retainers, rails, form steels, stripper windows, and form posts. Detail drawings shall also be supplied in AutoCAD format.

6.1.2.1 CAD file organization:

1. Files shall be labeled as job number, not the tool vendor's job number.
2. Files shall be labeled as follows: "job number_Description" i.e. 5354B_D10.igs=(5354B, Detail #10). 5354B_Die.igs (5354B Plan of Die).

6.1.3 Complete die drawing package.

7. Progress Report

7.1 Weekly progress reports shall be furnished from the start (Purchase Order awarded) to completion and approval of dies. Copies will be distributed to the Project Engineer and Tooling Engineer.

7.2 The progress report format shall be such that actual progress can be compared to projected completion dates on major tasks, i.e. Design completion, order steel, receive steel, build, etc.

7.3 The scheduled delivery is very critical and must be complete by the specified date.