The components of partnership.

Die Design Standards

6/28/2018

Revision 6/12/18: Added new section 9.13 Knockout Punches.

1.0 Purpose

The purpose of this standard is to establish and maintain a standard of quality and consistency in the concept, design, and build of production tooling for Mursix Corporation, while ensuring safety, serviceability, maintainability, and uniform tooling procedures. It is not intended to limit creativity in the design and build of tooling. This standard is applicable for all new production metal stamping die tooling purchased or manufactured for Mursix Corporation. It should be used as a guideline for the concept, design, and manufacture of such tooling.

2.0 Reference Documents

- Mursix Die Design Checklist
- Press Specifications
- Design Examples
  - 10.1 Dwelling Strippers
  - 10.2 Dwelling Stripper Spring Calculations.
  - 10.3 Rocker Form Punches.
  - 10.4 Quick Change Parallels

3.0 Safety Considerations

3.1. All tooling must meet OSHA, IOSHA and all other applicable local, state, and federal guidelines.

3.2. All tooling must be designed to incorporate ergonomic considerations for operation, changeover and maintenance.

4.0 General Requirements

4.1. These standards supersede like items from supplier provided standards.

4.2. These standards do not relieve the supplier and tool builder from the responsibility to produce parts to the Mursix Corporation quality and reliability requirements for the agreed upon tool life.

4.3. All tooling must meet the requirements defined in this document.

4.4. The Mursix Corporation must approve tooling standard changes deemed unnecessary due to quality, reliability, or cost issues.

4.5. These tooling standards may not apply to tooling that is built for the intent of producing prototype, or low volume single hit tooling.

4.6. The completed die will be inspected by a toolmaker from the Mursix Corporation toolroom prior to final payment.

4.7. Typical die feed is considered left to right.

4.8. Dies are to have quick die change plates or quick-change notches machined into the lower die shoe. Dies requiring parallels are to include 2 parallels with quick-change pins and or slots. See quick change parallel section.

4.9. Die inserts, punches and other inserts are to be removable while the tooling is in the press when possible.

5.0 Tool Concept and Design – General

5.1. Mursix Corporation practices a team approach to the design and build of all tooling. A core group of select employees known as the Design Review Team will meet with the supplier/tool builder during the conceptual, design, and build stages of the tool, unless Mursix Corporation deems it unnecessary.
5.2. The tool builder must furnish a strip layout and/or a conceptual design to Mursix Corporation for review by the Team before final design is started.
5.3. The tool builder is to submit a written document or CAD file with notation to Mursix Corporation, identifying all requested design changes. A final design review along with approved design CAD data will be required before manufacturing of the remaining components begins.
5.4. Mursix Corporation blank drawings are for reference only, unless otherwise noted. The tool builder is responsible for providing blank development and blank data.
5.5. All tool designs are to be formatted to a DWG or DXF format with DWG being the preferred format.
5.6. All details requiring 3D machining are to be formatted as STP (Step) or X_T (Parasolid) format.
5.7. A final design with all perishable details 100% detailed will be provided to Mursix Corporation.
5.8. All math data used to create replaceable details must be furnished to Mursix Corporation prior to final payment. The data must represent the details to the current tool revision and date consistent with the tool at PPAP run-off. The tool builder will be responsible for correct tool CAD data and will be held responsible for any incorrect components built from this data.

6.0 General Clearances

6.1. Punch and die clearance: 10% typical
6.2. Punch & punch retainer: .0002”/side
6.3. Punch heel and die steel: .0005”/side
6.4. Punch pad & punch pad insert: .0002”/side
6.5. Stripper clearance around punches: 5% material thickness.
6.6. Stripper clearance around punches .188 diameter & smaller: .002/side max.
6.7. Stripper clearance around pilots: .002”/side
6.8. Stripper & stripper inserts: .0002”/side
6.9. Stripper guide pins & stripper hole/bushing: .001 larger than guide pin.
6.10. Die steel holes/bushing for stripper guide pins: .001 larger than guide pin.
6.11. Die steel & die insert: .0002”/side
6.12. Slip Fit dowel holes to be +.001 of nominal dowel size.

7.0 Material Type/Heat Treatment

7.1. Die Chase: A2 / 52-54 Rc
7.2. Die Inserts: D2 / 60-62 Rc
7.3. Die Backup: A2 / 52-54 Rc
7.4. Stripper Plate or Face: A2 / 52-54 Rc or 4140 at design review.
7.5. Stripper Backup: A2 / 52-54 Rc
7.6. Punch Pad: A2 / 52-54 Rc
7.7. Punch Pad Backup: A2 / 40-50 Rc
7.8. Punches (cutting\forming\coin\draw): D2 / 60-62 Rc
7.9. Punch keepers (toe clamps): A2 / 40-50 Rc

8.0 Tool Identification

8.1. All dies must be tagged with the following three tags:

8.1.1. Weight tag to include:
- Weight of upper shoe
- Weight of lower shoe
- Total weight

8.1.2. Setup tag to include:
- Progression.
- Material code
- Part number

8.1.3. Die asset tag to include:
- Mursix/Customer asset information

9.0 Tool Build Requirements

9.1. <u>General Construction</u>

9.1.1. Tooling must be designed for accessibility, maintainability and error proofing.
9.1.2. Tooling that requires a changeover to produce more than one part number should be designed for simple, safe, and efficient in-press changeover, if possible.
9.1.3. Adequate windows in spring pads and strippers for removal, if ball lock punches are used.
9.1.4. Die buttons are required to have Dayton style slug control.
9.1.5. Dowels are required for all tooling.
9.1.6. Jack screw threads required in all inserts and steels that are dowelled or pocketed.
9.1.7. Jack screw threads that do not utilize a counter-bored hold down screw hole are to have the same thread size as that of the hold down screws.

9.1.8. Blind holes are not to be used for dowels, unless thru holes are not feasible due to accessibility issues.

9.1.9. All die steels should be removable from within the die while in the press, unless the part design determines otherwise.

9.1.10. Step dowels, plastic shims, and eccentric shims will not be accepted.

9.1.11. Tooling must be designed not to exceed 80% of rated or specified press tonnage.

9.1.12. The die must be transportable with the customers lift truck. See lift truck specification sheet.

9.1.13. All steels must be stamped /etched with the detail number, material designation. The stamp must be on a non-critical surface.

9.1.14. Steels should be constructed so that they cannot be interchanged, installed, or replaced backwards.

9.1.15. Punches with different point sizes or shapes should be on different shank sizes. Differing key flats may also be used.

9.1.16. Punch keepers (toe clamps) are to be .187 minimum thickness and use ¼" minimum hold down screw.

9.1.17. Break sharp edges of non-functional surfaces.

9.1.18. Cam springs, sensors, etc. that project beyond the edge of the die shoe must be properly guarded to prevent damage or injury. Anything that extends beyond the edge of the die shoes must be sufficiently guarded.

9.2. <u>Special Considerations and Characteristics</u>

9.2.1. Manifold systems must be guarded and protected from lift-truck forks.

9.2.2. Nitrogen/manifold system required pressure ratings must be stamped in PSI next to the appropriate manifold on the die face.

9.3. <u>Coatings</u>

9.3.1. Coatings will be reviewed/specified during design review of die. Recommended coatings are as follows: draw steels: Alcrona, form steels: Alcrona, and pierce/cutoff steels: Alcrona

9.3.2. Aluminum, brass and copper: TiCN

9.4. <u>Die Sets</u>

9.4.1. Die sets to be all steel with ball bearing style cages for most applications. Generally, four post sets are be used with one offset pin.

9.4.2. Die sets to use demountable bushings with press fit and/or demountable pins.

9.4.3. All dies will have four (4) tapped holes in each die shoe for lift rings. Holes are to be located so the upper die half hangs level without interfering with the clamp feet on the die shoes. Hole size will be reviewed at design review.

9.4.4. Upper shoe to have ¾-10 or 1-8 tapped holes in each end for roll-over pins. Holes to be located to balance weight of upper shoe.

9.4.5. Slug drop through must be adequate to prevent any slugs from hanging up in any portion of the die.

9.4.6. Slug clearance must be provided for all slugs and below pilot clearance holes in the die shoe and parallels.

9.4.7. Spring pockets must include vent holes through the bottom die shoes/parallels where possible.

9.4.8. Die sets are to be large enough to include sensor block and mounting hardware, including tubing.

9.5. Die Steels – Trim/Pierce

9.5.1. Typical Punch/die clearance will be 10% of material thickness. Special die clearance situations will be reviewed by the design review team.

9.5.2. Die life on cutting steels to be 1/8" minimum and 3/8" maximum. Material thickness should be considered.

9.5.3. Cutting steels to have ½ to ¾ degree standard back taper for slug clearance.

9.5.4. Lower die steels will be a minimum 1.000" thick, unless otherwise approved.

9.5.5. Trim/pierce steels are to be built as replaceable and completely detailed. CAD detail drawings are to be provided for future replacement or changes.

9.5.6. Steels should be sectioned between cutting edges, where possible, allowing for a complete wire cut pierce hole rather than sectioning on the cutting edges. It may be practical to section on the cut line where there are long straight cut edges or large cutouts. The physical size of die sections will be reviewed at the design review.

9.5.7. Die buttons with Dayton style slug retention feature are to be included in large wire cut sections where small hole piercing is also included in the steel.

9.5.8. Die steels to include jack screw threads.

9.5.9. Stock lifters are to be included in die steels where needed to lift the web over trim edges and openings.

9.5.10. Lifters completely contained in die inserts should bottom on the backside of the die steel, not in a counter bored hole. This allows for shimming of serviced die steels and not change the stopping height of lifters.

9.5.11. Wire burned steels are to be, at a minimum, double drawn in heat treat.

9.6. Die Buttons

9.6.1. Material type: M2. Coating XCN typical, XAN for HSLA stock.
9.6.2. Headless die buttons with side notch for keeper are preferred.
9.6.3. Any die buttons produced by wire burning will be etched with applicable detail numbers.
9.6.4. All math data used to create replaceable details must be furnished to the customer upon PPAP approval and prior to final payment. The data must represent the details to the latest tool revision consistent with the tool at PPAP run-off.
9.6.5. Die buttons are to use a Dayton style slug retention feature.
9.6.6. The standard button length should be equal to the thickness of the steel that contains the button, when possible.
9.6.7. The standard keying method for die buttons for slots and other shaped pierce holes is a full length flat (Dayton standard dimension) with a wire cut "D" shaped thru-hole in the steel.
9.6.8. Steels that include die buttons are to have hardened backing plates.
9.6.9. Die buttons will have dimensions/asset number etched on them.
9.6.10. Die buttons used for pilot holes should be headed or otherwise prevented from pulling in the case of a short feed, miss-hit, etc.

9.7. Die Steels – Form

9.7.1. All form steels must be made of D2 material, at a minimum.
9.7.2. Lower die steel mounting holes should be located away from areas where the steels will contact and form the part to avoid marking/deforming of the part. If this is not practical, it may be determined that the resulting marks would not be detrimental to the part.
9.7.3. The form steels (or inserts) must be keyed or otherwise supported.
9.7.4. Form steels are to include jack screw threads (when doweled or pocketed) or other provisions for removal.
9.7.5. Rocker style form inserts with adjustable cam driver are preferred. See "Rocker Forms" in the examples section or contact Mursix Corporation for more information.

9.8. Heel Blocks

9.8.1. Heel blocks/thrust blocks must be used if the process dictates.
9.8.2. Heel blocks must be of sufficient design to absorb any side load and must be keyed or supported and allow for adjustment.
9.8.3. Heel blocks are to be sufficiently engaged before any piercing or forming takes place in the die.
9.8.4. Heel blocks are to be of different material type than the detail they backup.

9.9. Lifters/Lift Bars

9.9.1. All lifters and lift bars should rise to the same elevation in the die and support the material sufficiently to eliminate any sagging.
9.9.2. Lifters to be contained from the top with keepers or shoulder screws when possible.
9.9.3. Lifters & Lift bars require guarding to prevent objects and debris from entering under them.
9.9.4. Rails which travel on multiple lifter pins must allow rail to travel in an uneven fashion. Rails bolted solid to lifter pins is not acceptable. The connection point must allow the rail to pivot.

9.10. Lower Form Pads

9.10.1. Lower spring/form pads require guarding to prevent objects and debris from entering under the pad. Lower spring pockets are to include drain holes 3/16 to ¼ inch diameter (1/4” preferred).
9.10.2. Form pads that include pilot clearance holes must be located and guided.
9.10.3. Pads that bottom must be hardened.
9.10.4. Form pads, fixed or spring loaded, are to be removable from the die while the tooling is in a press, if feasible.

9.11. Parallels

9.11.1. Review the clamping method and positioning at design review.
9.11.2. Clamping feet must be 2” tall for lower, 3” tall for upper, x 2 ½” minimum wide, the clamping slot must be 1 ¼” wide x 1 ½” deep to the centerline of the radius.
9.11.3. Two parallels are to include quick-change slots. See example drawings “Quick Change Parallels” section.
9.11.4. Avoid mounting of parallels below slug clearance holes. The parallel must include an angled clearance for the slug if a parallel must cross a portion of the slug clearance.
9.11.5. Parallel spacing and method will be reviewed at the design review. Generally, space the parallels (two locations) to allow for balanced lifting of the die on its center of gravity. Refer to the lift-truck specifications to determine the spacing required for the forks width and spread.
9.11.6. Holes and/or slots in parallels as required to allow for disassembly of die without removal of parallel is preferred.
9.11.7. Parallel placement must maintain die integrity. Lower parallels will be mounted by drilling/counter boring the die shoe and tapping the parallels. Upper parallels are not normally used but can be if required by design constrains.

9.11.8. Slugs must come out, front to back, between parallels for dies designed for presses larger than 100 ton. These larger presses may not have bolster openings for slug removal.

9.11.9. Parallels to be approved by the Mursix design review team.

9.12. <u>Pierce Punches</u>

9.12.1. All math data used to create replaceable details must be furnished to the customer upon PPAP approval and prior to final payment. The data must represent the details to the current tool revision and date consistent with the tool at PPAP run-off.

9.12.2. All purchased punches will have dimensions and asset number etched on them.

9.12.3. Punches are to have ejectors as applicable.

9.12.4. Round punches typical have no shear.

9.12.5. Material thickness rooftop shear is typical on other punches. Other shear shapes are acceptable if dictated by the design. Cutoff punches are typical flat (no shear). Shear to be reviewed by the Mursix design review team.

9.12.6. Punches are to enter the die steel approximately .06 plus any shear.

9.12.7. Different punch body diameters are to be used for different point diameters, sizes, shapes or lengths to avoid mixing of punches.

9.12.8. The standard keying method for shaped punches (headed) is a key flat through (full length) with a "D" shaped wire cut hole through the retainer.

9.12.9. All headed punches are to have removable insert in punch pad to allow for servicing the punch without removal of the entire punch pad. This insert must be shimmable to ¼" without interference with the stripper pad when die is closed.

9.12.10. Thicker head or use of Tuff Punches may be required. This will be determined at design review by the Mursix review team.

9.12.11. Round or shaped punches with a body larger than the pierced shape must be shimmable to ¼" without interference with the stripper pad when die is closed.

9.12.12. Pedestal style punches are not acceptable unless approved by the Mursix design review team.

9.12.13. A punch that cannot be held in by screws should be notched and held in by a keeper(s) that bolt to the face of the punch retainer. Clearance for the keeper/screw in back of the stripper should be considered.

9.12.14. If ball lock punches are required, use Heavy Duty punches with ejectors as applicable.

9.12.15. Any punches produced by wire burning will be etched with applicable detail numbers.

9.13. Knockout Punches

9.13.1. When a slug is blanked and replaced in the strip its subsequent Knockout punch size shall be .005" to .010" smaller than the profile (blanking) punch.

9.13.2. Partially pierced slugs, in other words, still attached to the strip in a particular place or places are sometimes necessary. Removal of these slugs requires a knockout punch that cuts only in the attached areas with standard die clearance. The remaining profile shape of the knockout punch shall be .005" to .010" smaller than the partial pierce punch. Appropriate mismatch undercuts shall be designed into the partial pierce punch where the knockout punch will later cut.

9.14. Pilots

9.14.1. Pilot pierce hole size to allow for standard/nominal pilot diameter. This allows straight body pilots to be used when necessary.

9.14.2. Pilot clearance holes must be thru-holes.

9.14.3. Pilot can be located in lower die sections if the process dictates.

9.14.4. Solid pilots mounted in punch pad against hardened back-up preferred.

9.14.5. Spring loaded pilots should be used in areas of weak die sections.

9.14.6. Different pilot body diameters are to be used for different point diameters, sizes, shapes or lengths to avoid mixing pilots.

9.15. Progressive Dies

9.15.1. All progressive dies are to have a minimum of one useable idle station when possible.

9.15.2. Spring-loaded progression start pin is required for all dies.

9.15.3. Parts and scrap must be separated. If both are cut at the end of the die, use chutes or separators. The part(s) being ejected must be controlled so they repeat in the same orientation and path.

9.16. Punch Pad & Pad Inserts

9.16.1. Punch pads must be hardened.

9.16.2. A hardened backing plate behind the entire punch pad is preferred.

9.16.3. For large punch pad the backing plate may be cut into smaller plates to aid in manufacturing.

9.16.4. Punch pad and pad inserts must include jack screw threads.

9.16.5. Punch pad inserts are to be error proofed for orientation.

9.16.6. Punch pad inserts utilizing different size punches are to be of different size so that inserts are not placed in wrong locations.

9.16.7. Punch pad inserts must allow shimming up to ¼” and not interfere with the stripper when die is closed.

9.17. Punch Steels – Form

9.17.1. The upper form steels (or form inserts) should be built and mounted to be adjustable to allow for stock variations, etc.
9.17.2. The standard material for form steels is D2 minimum.
9.17.3. When the form is not balanced over the steel, the steel should be keyed or otherwise supported by other steels, etc.
9.17.4. Mounting holes should be located away from areas where the steels will contact and form the part to avoid marking/deforming of the part. If this is not practical it may be determined that the resulting marks would not be detrimental to the part. Locate holes and edges so that material is not drawn over edges of mounting holes.
9.17.5. Use of a 90 degree wipe by form alone must be approved by Mursix design review team. Cam forms are acceptable, but Rocker style forms are preferred.
9.17.6. Movement of form’s center line in multiple progressions to achieve over-form is prohibited.
9.17.7. Rocker style form inserts with adjustable cam driver are preferred. See “Rocker Forms” in the examples section or contact Mursix Corporation for more information.
9.17.8. Wipe radius of form punch is to be 3 times material thickness when possible.

9.18. Punch Steels – Trim/Notch/Profile

9.18.1. Punches that notch through the edge of the stock require heeling and slug grippers in die steels. The punch may include the heel extension and clearance for slug grippers. Clearance depth should allow for ¼” shimming of punch. Typical heel clearance .0005.
9.18.2. Trim/notch/profile punches are to have ejectors (oil breakers) as applicable. If ejectors make the punches to weak or are otherwise not possible, other provisions such as shear angles on narrow punches must be included. Slug retention will be required on die steels for such punches. Mursix standard slug grippers are to be used where possible.

9.19. Sensors

9.19.1. Mursix Corporation will supply sensors.
9.19.2. At design review, the Mursix Review Team will advise on quantity, location, and sensor type.
9.19.3. The tool builder is responsible to build and install sensor brackets. Example bracket drawings will be provided upon request.

9.19.4. A short feed sensor should be mounted in the last station or as near to the end as possible. If required, a part-out sensor is to be included to detect when the part drops from the end of the die. The part(s) being ejected must be controlled so they repeat in the same orientation and path.

9.19.5. Sensors must be mounted in a manner that ensures proper operation and must be positioned to meet blueprint accuracy.

9.19.6. Where required, provisions must be made to minimize the effects of contaminants on sensor operation and accuracy (Drainage holes, air blow off, etc.).

9.19.7. Sensors must be mounted in a manner that prevents physical contact with the material being processed.

9.19.8. Sensors are to be located within the area of the die shoe if at all possible. Sensors that extend beyond the perimeter of the shoe must be protected. Mursix design team to review.

9.20. <u>Die Springs, Gas Springs and Spools</u>

9.20.1. Total deflection of die springs must not exceed the recommended percentage of the spring's free length. Annual part volume must be considered when determining deflection percentage.

9.20.2. Self-contained gas springs are preferred to be Dadco.

9.20.3. Standard pad retainer spools are the tapped style for easy removal of stripper pads in the press when needed.

9.20.4. Spools must have a provision to prevent rotation when removing or tightening the mounting screw.

9.20.5. Springs and nitrogen cylinders are to be retained in top.

9.20.6. Springs and nitrogen cylinders in lower are to be drained.

9.21. <u>Stop Blocks</u>

9.21.1. All dies are to have stop blocks. Stop blocks must include ground grooves 0.0500" deep x .37 minimum width for a lead check.

9.21.2. Stop blocks are to be mounted over parallels (top and/or bottom).

9.21.3. Four stop blocks are typical, if die size allows, and the location of the stop blocks must not interfere with the function or serviceability of the die.

9.21.4. Stop blocks are to be designed to meet upper shoe when die is closed. If upper stop blocks are used they must be mounted over the lower grooved blocks and designed to meet when the die is closed.

9.21.5. 2.5" diameter stop blocks are preferred. Dies under 48" long can use smaller diameters.

9.22. <u>Stock Guides</u>

9.22.1. All gages and stock guides must be made of hardened tool steels only. Breaking of all edges is required.
9.22.2. Entry stock guides will be designed with lead-in angles and a lip to control the leading edge of the coil.
9.22.3. Dowel holes in stock guides are to be .002 larger than dowel.

9.23. Stripper Pads/Upper Form Pads

9.23.1. Stripper pads used for forming and/or piloting/piercing, must be sufficiently guided and have hardened inserts for forming.
9.23.2. All wiping, flanging, and bending operations that require the use of pad(s) must have sufficient pre-load before the operation takes place.
9.23.3. All pads that bottom must be hardened.
9.23.4. Stripper pads that strip ball-lock punches must have windows for removal of ball-lock punches. Include jack screw threads in insert for removal in press.
9.23.5. Dwelling style strippers may be required for thin or soft materials. Or when material web may easily clinch onto pilots to prevent the web from lifting with the stripper pad. See example section "Dwelling Strippers".
9.23.6. When non-dwelling strippers are used, oil breakers to prevent the web from lifting with the pad may be required around the pilots to release the stock from the pilots beyond the pad travel.
9.23.7. Forming pads require oil breakers to prevent strip from sticking to pad.
9.23.8. Pads are to be split to smaller sizes for handling and removal in the press whenever possible. Pad steels should be split so that only one pad needs to be removed to remove any one retainer (Pad split lines do not cross retainers when practical).
9.23.9. Pads requiring a crane to lift should have ½-13 lift holes on the face of the pad.
9.23.10. Include pad levelers as required to balance pads for starting the strip. Pads may be balanced in areas over stock guides.
9.23.11. Levelers are to be .005 below stock thickness so that contact with stripper is not made under normal running conditions.
9.23.12. Misumi stripper guide pin style SGOH are preferred.
9.23.13. Stripper guide pins holes in die steels must be vented.

10.0 Design Examples

10.1. Dwelling Strippers

10.1.1. Dwelling strippers allow the straight of pilots to be pulled into the stripper as a die opens. The pilots are stripped completely out of the strip. This prevents the strip from sticking to the pilots and pulling the strip up out of the die. As the die is closing, this same dwelling action exposes or forces the straight of the pilots out of the stripper before contacting the strip. Follow the example drawings, steps 1 through 6 to see how dwelling strippers work.

10.1.2. It is important that the proper springs are used. The spring balance is what makes the stripper dwell.

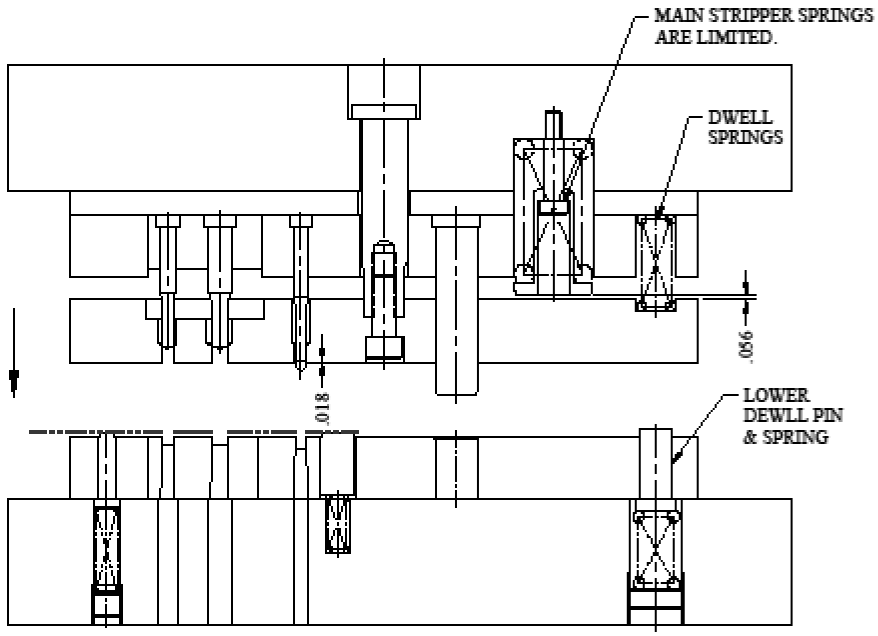
10.1.3. It is important that proper clearances in stripper allow it to move freely.

10.2. Dwelling Strippers Spring Calculations

10.2.1. First calculate the weight of the largest stripper plus any backing plates attached to it. Calculate the weight as a solid block (before machining). Next determine the upper dwelling springs to use; medium pressure springs nominally work best. The spring length must allow for the full travel without over traveling. Calculate the total preload force of these springs to approximately equal the weight of the solid stripper. This force will hold the stripper steady since the stripper will be somewhat less in weight once machined.

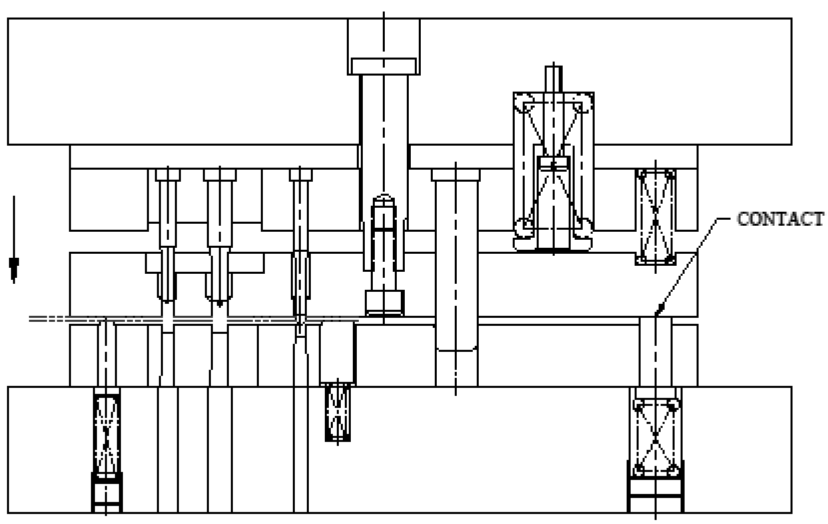
10.2.2. Calculate total preload force of the lower dwelling springs. Start by adding the weight of the stripper and the force of the upper dwell springs when dwelled (reference step 3 drawing example). Take this total weight and multiply it by 1.5. This is the approximate lower preload force required.

STEP 1 Press is closing. Stripper is ahead of the straight of pilot by .018.
.056 dwell gap between main stripper springs and stripper.



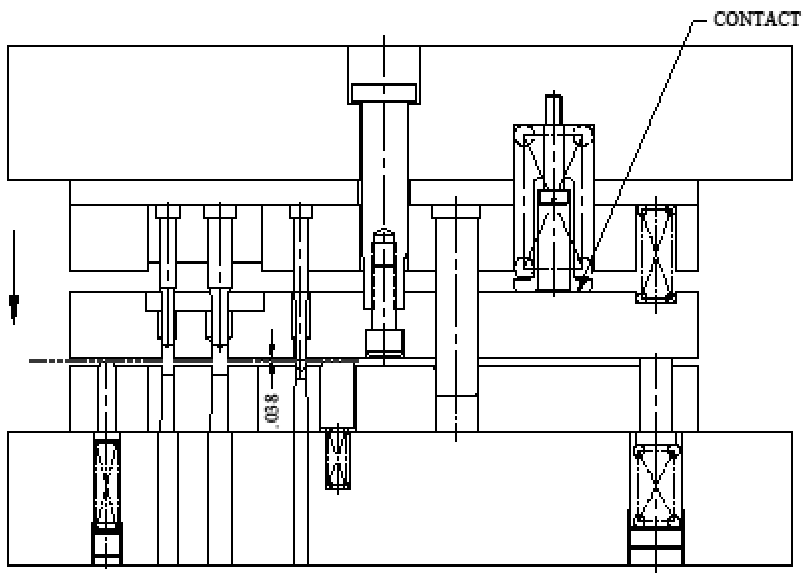
The dwell amount of .056 can be as needed. Material thickness needs to be considered. The .018 in this example can be as needed. Preload force of upper dwell springs need to be approximately equal to the weight of the stripper as if its solid (no holes or cut outs).

STEP 2 Press is closing. Stripper meets lower dwell pins.



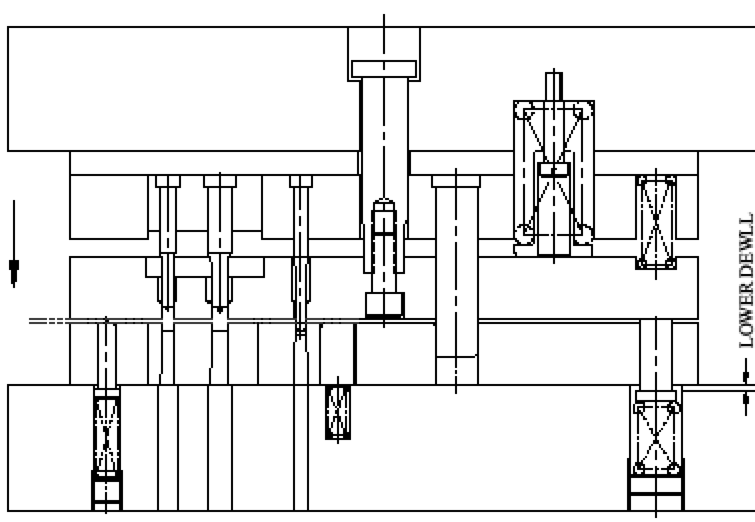
Lower dwell pin springs must have greater preload force, 1.5 times more than weight of stripper. Plus force of upper dwell springs when dwelled. See section on calculating dwelling stripper forces. Lower dwell pins may require gas springs for more travel.

STEP 3 Press is closing. Upper dwell springs compress until stripper meets main stripper springs. Straight of pilots are now .038 ahead of stripper.



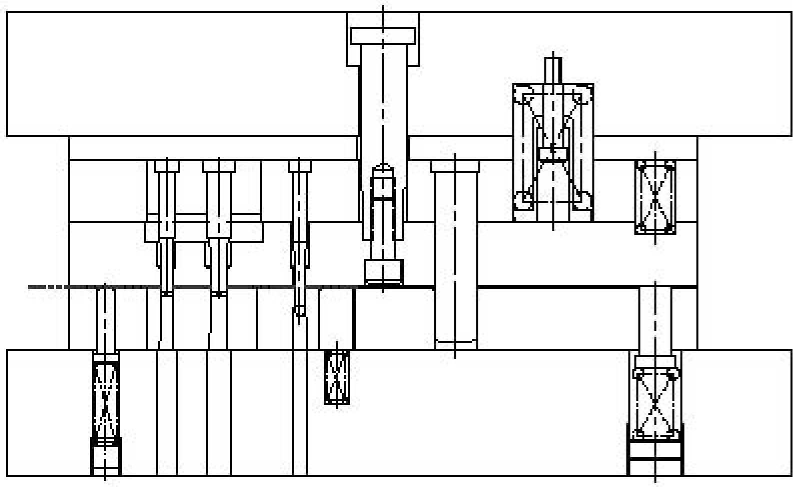
The stripper dwelled for .056. This causes the straight of pilots to be exposed. The pilots can now enter into the strip to locate it.

STEP 4 Press is closing. The main stripper springs compress lower dwell springs as it pushes on lower dwell pins. Strip is now trapped between stripper and die chase.



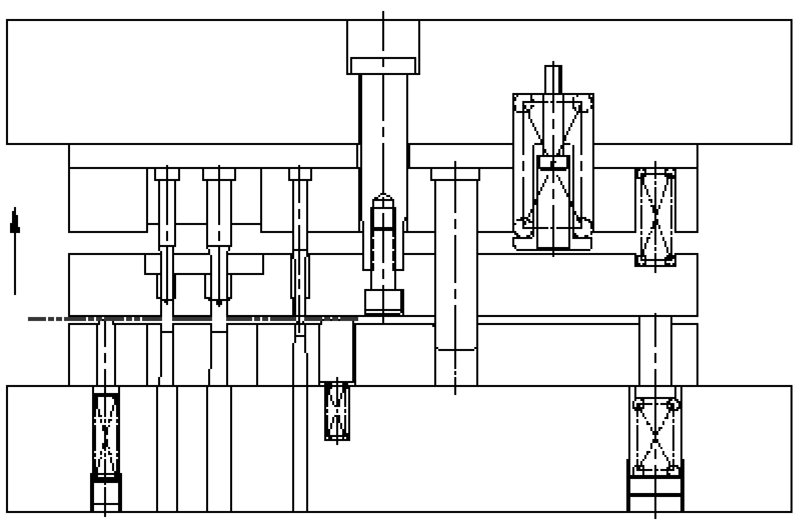
The main stripper springs must have preload force greater than the lower dwell spring force when compressed to their travel.

STEP 5 Press is closed.



Piercing/forming done. Press ready for return stroke.

STEP 6 Press is opening.



As die opens, the stripper travels past the pilots because it dwells when the lower pins reach their upward travel (no longer pushing up on stripper). Upper dwell springs and gravity holds the stripper in place as pilots go up. This strips the pilots out of the material as straight of pilot goes into the dwelled stripper. Material does not stick to pilots.

Example Spring Calculations

Stripper weight. 17.5 x 10.5 x 1.25 x .283 = 65.0#

Upper Dwell Spring

Spring: Dayton M62-250 rate: 73.0#/Inch Qty: 4

Preload: .23 X 73.0# x 4 = 67.16#

Dwell: .056 + .23 (preload) = .286 total travel.
.286 times 73.0# x 4 = 83.51# at dwell

Travel: .60 + .23 (preload) = .83 spring compression
.83 ÷ 2.5 (free length) = 33.2% (efficient operation range: 25-35%)

65.0# (stripper wgt.) + 83.51# (force at dwell) = 148.51#
148.51# times 1.5 = 222.77# goal for lower.

Lower Dwell Spring

Spring: Dayton H75-300 rate: 393.0#/Inch Qty: 4

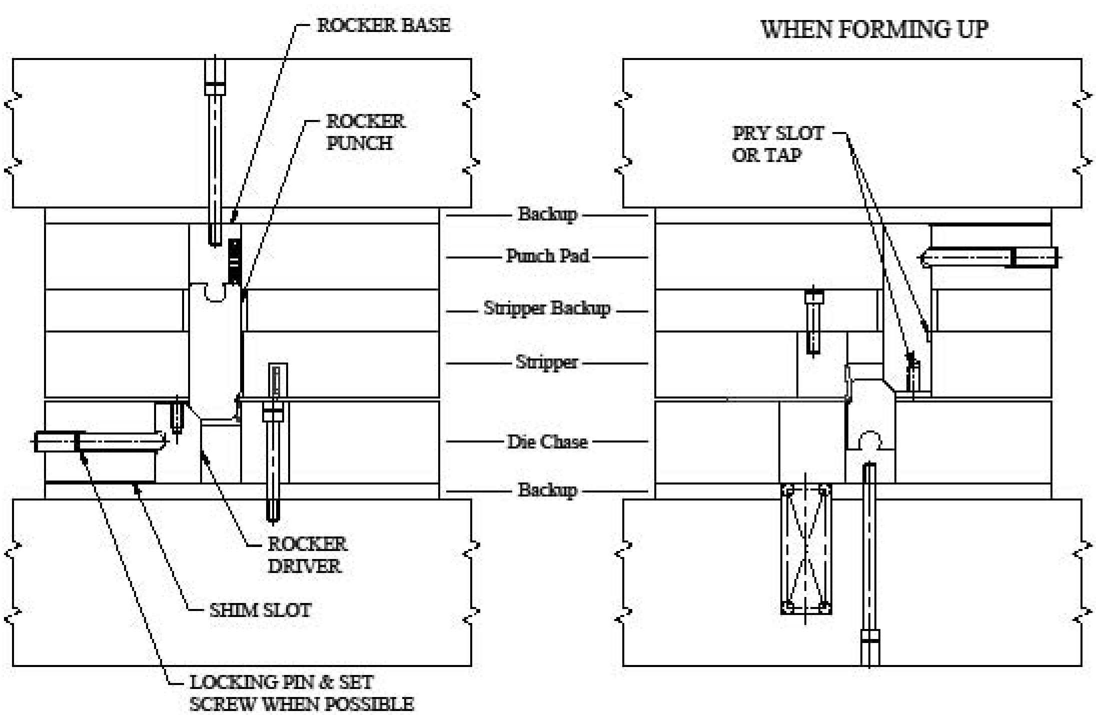
Preload: .14 x 393.0 x 4 = 220.1#

Travel: .375 + .14 (preload) = .515 total travel.
.515 ÷ 3.0 (free length) = 17.2% (efficient operation range: 15-20%)

The largest (heaviest) stripper is used first because generally the remaining strippers will work with the calculated springs. This may not always be the case. If you want less upper dwell force for a stripper and the same size diameter spring is used in other strippers, then use the same length as well. Use less preload to change the force. If the die is taken apart it could be easy to get springs in the wrong location if they are different lengths. You could also use for example 6 springs in one stripper and 4 in another to change preload force. Of course different diameters would foolproof the springs as well.

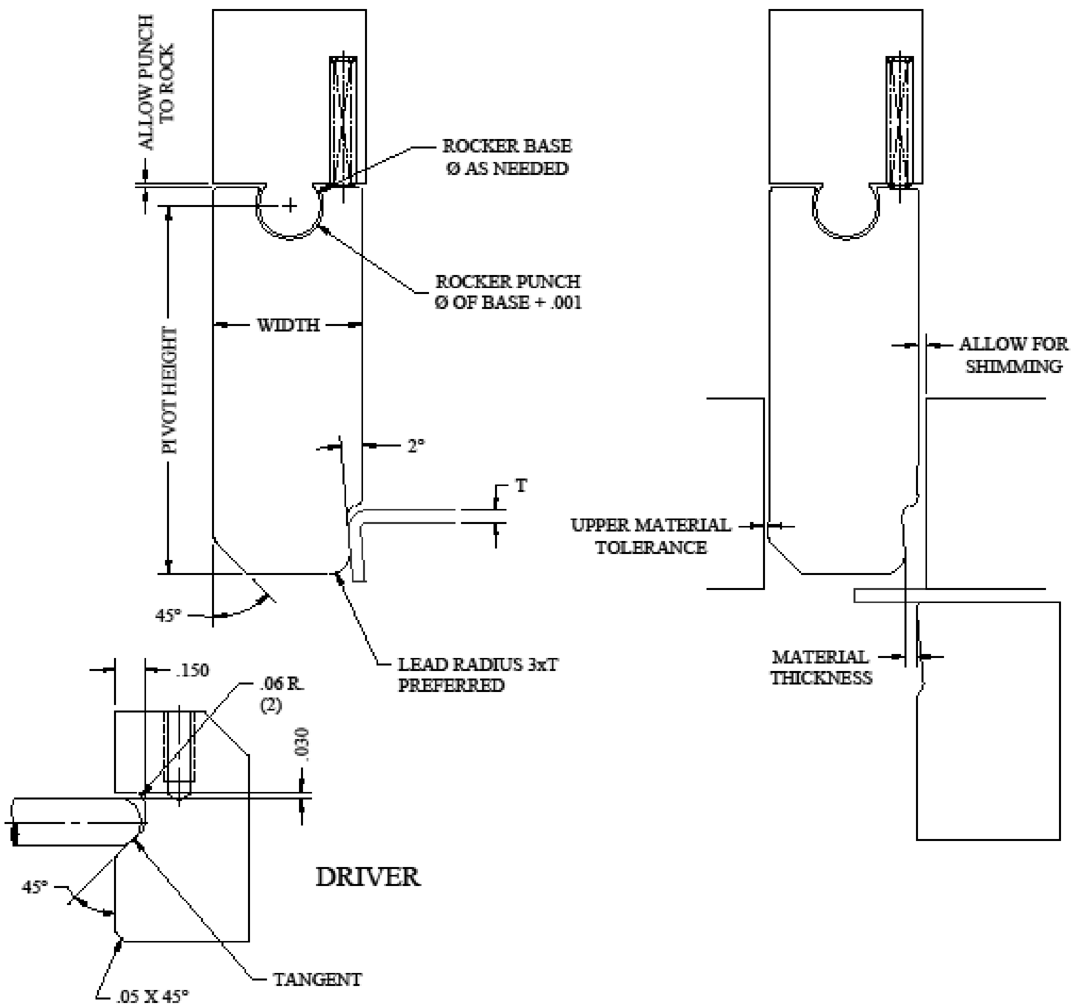
10.3. Rocker Form Punches

10.3.1. Rocker forms allow the punch's over-form to be changed by shimming the rocker's driver to adjust the part angle.
10.3.2. Rocker driver angle of 45 degrees is preferred. This allows for an easy calculation of a one to one move by the operator.
10.3.3. Drivers should have a pry slot or tapped hole to allow them to be pulled for adding shims, when possible.
10.3.4. A .250 diameter locking pin with a 5/16-18 set screw to hold the driver in location is preferred, when possible.
10.3.5. When a locking pin is used there needs to be a shim slot .03 deep coming to the outside to allow the operator to slide a shim under the driver after loosening the locking pin.
10.3.6. When locking pins are not feasible, a screw(s) holds the driver in and is pulled to put a shim under the driver. The direction of the screw should be accessible in the press, if possible.
10.3.7. The driver needs to be short enough to allow for shimming without coming above the die chase or below the stripper when forms are going up.
10.3.8. Rocker forms can be used when forming down as well as when forming up. The components are the same, just in a different direction.
10.3.9. Example CAD files of rocker form designs will be supplied upon request. Contact a Mursix Project Manager or Engineering Department.



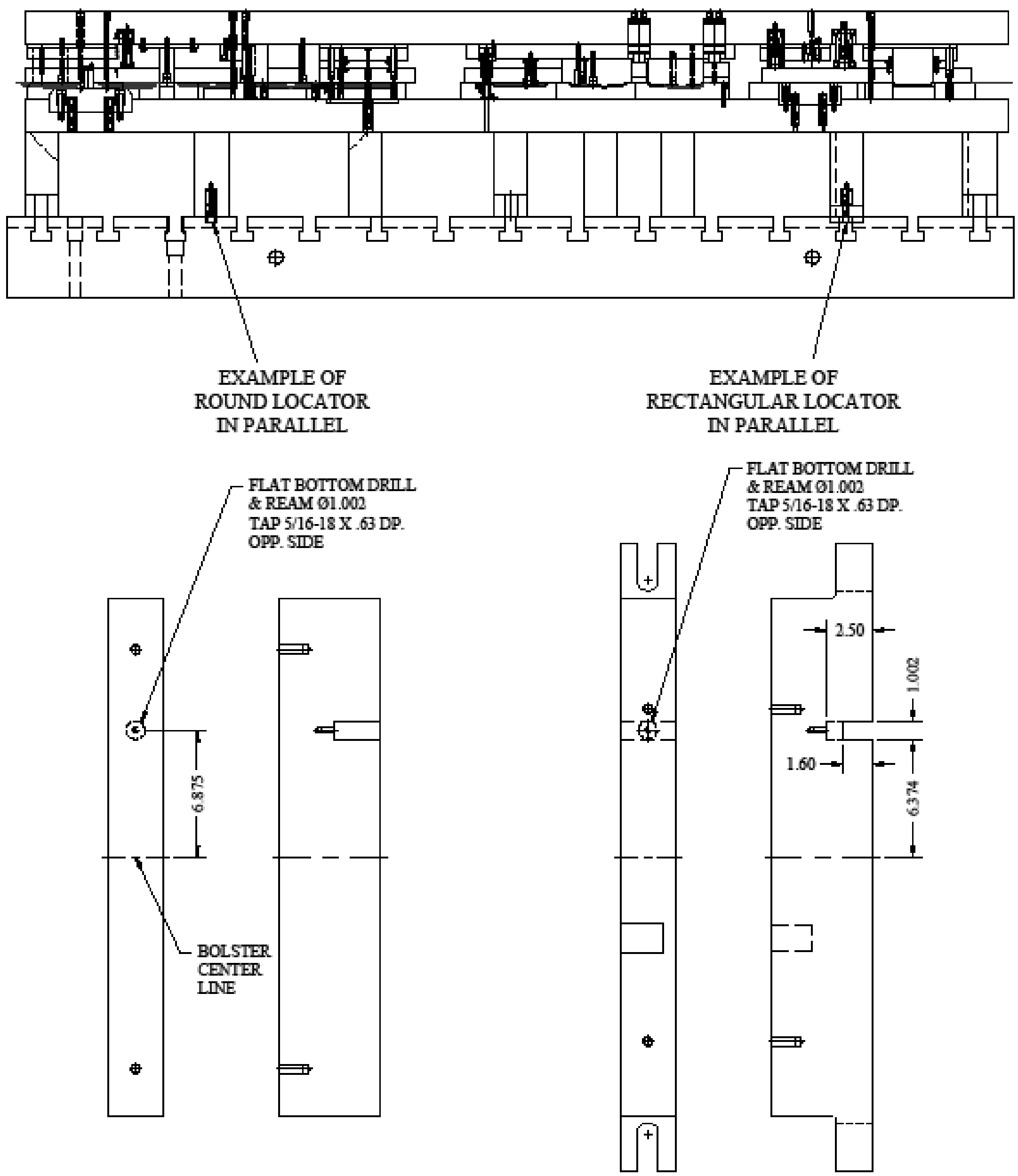
10.4. Rocker Geometry & Tolerances

10.4.1. Choose an appropriate diameter for the pivot of the rocker base. Make the pivot diameter of the rocker punch .001 larger than the diameter of the base pivot.
10.4.2. Design the rocker punch to be straight when die is closed. Start out with 2 degrees over form on the rocker punch.
10.4.3. Don't fit rocker punch to outside radius of part.
10.4.4. When die is closing, the rocker punch will rock back. Design this distance at mean material thickness.
10.4.5. The stripper opening limits the rocker punch rock back. With punch rocked back make opening at rock back position plus the upper tolerance of the material thickness.
10.4.6. The Pivot Height must be taller than the rocker punch Width. The taller the better. Minimum pivot height is 1.5 times the width.



10.5. Quick Change Parallels

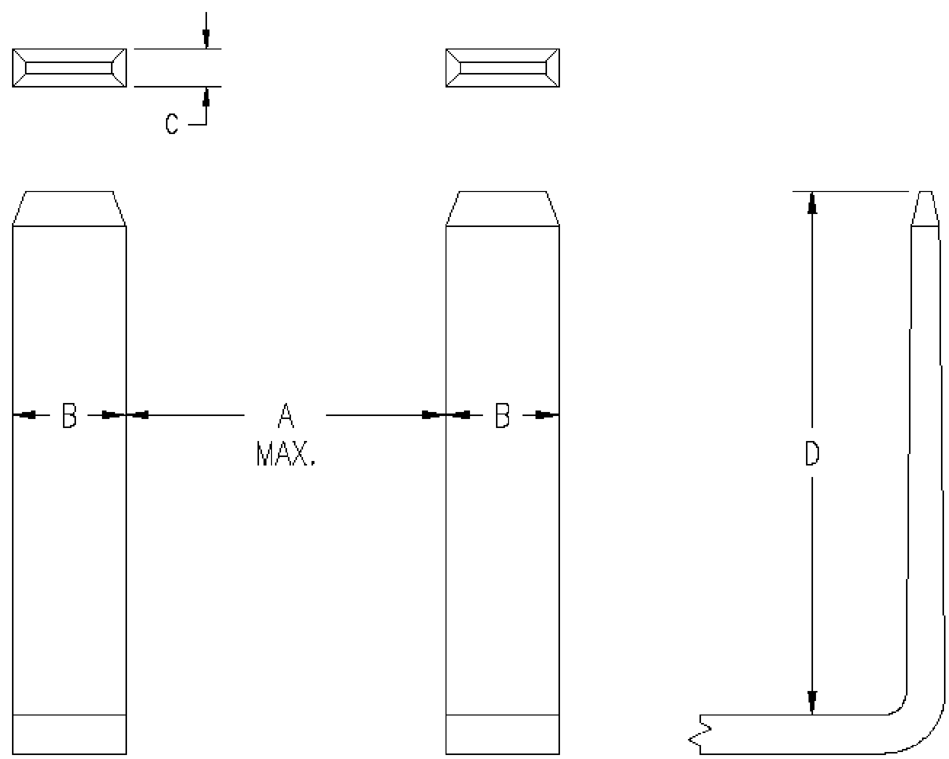
- 10.5.1. Quick change parallels use two types of locators, round or rectangular. The locators fit in a channel which is machined into the bolster running left and right.
- 10.5.2. Locators are machined into two of the die’s parallels. Choose the outer most parallels possible.
- 10.5.3. Round locators are standard except when their location coincides with one of the bolster T-slot running front to back.
- 10.5.4. Detailed drawings of locators provided upon request.
- 10.5.5. Use medium duty, blue Dayton style, die springs.



11.0 Lift-Truck Specifications

11.1. Forklift Capacity & Dimensions

11.1.1. When parallels are required choose a forklift of the proper capacity.
11.1.2. Design parallel locations that will allow the proper forklift to fit between parallels.
11.1.3. The fork locations must allow the die to be lifted in a balanced fashion.
11.1.4. Refer to the chart below for the forklift specifications.



Lift Capacity in Pounds	Dimension in Inches			
	A	B	C	D
3,000	22.0	4.0	2.0	42.0
6,850	31.0	6.0	2.0	48.0
8,250	24.0	5.0	2.0	45.0
15,000	42.0	6.0	2.5	60.0