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1. Introduction

These standards are intended to provide a reference for tool making sources for the design and built of the casting dies and trim dies. It is Jumanji Group’s goal to purchase tooling of the highest quality and with consistent design features incorporated. It is felt that the standardization of tool components and materials will benefit both Jumanji Group and the tool source.

Any deviation from these standards MUST be approved by Jumanji Group Tooling Engineer. Jumanji Group reserves the right to have any unapproved deviations from these standards corrected at no charge by the tool source.

Jumanji Group is available to provide all possible support to the tool shops in order to ensure the satisfactory outcome of each tooling program. Every effort will be made to supply whatever information is required in a timely manner.

These standards will be updated as improvements to the design and built process are developed. When updates are made, these will be provided to all of the recipients of the 1st Revision and they are to be implemented immediately. Tool shop input and suggestions are encouraged.

All requests for quote or tools built shall adhere to this set of standards. Refer to the engineer responsible for tool or quote with questions on any deviation from the standards.
2. Rails

2.1 Rails shall be constructed from 1020 Hot rolled steel or equivalent, ground top and bottom.

2.2 Width (fig. 18.1):
   • 3-1/2" (80 mm) for machine size 600T to 800T (minimum).
   • 4" (100 mm) for machine size 1000T and up (minimum).

2.3 Mounting bolts:
   • 3/4" (M20) SHCS for machine size 600T to 1000T.
   • 1" (M24) SHCS for machine size 1000T and up.
   • One SCHS for every 6" (150 mm) length.
   • Maximum bolt length 8" (200 mm).

2.4 Standard 1" x 1" x 1.25" (25 x 25 x 32 mm) clamp slots (fig. 18.2) on all rails.

2.5 Depth of ejector box deep enough for adequate plate travel, stroke to be defined by individual part.

2.6 Hoist holes are required for any rail over 40 lbs (20 Kg). Dependent upon attitude of die setting.

2.7 Top & bottom rails to extend entire width of die.

2.8 Rails shall be equipped with vents for leader pin bushing holes (fig. 18.2).

2.9 Side rails to be 3" (75 mm) minimum from top & bottom rails (fig. 18.2), so as to gain access for greasing.

2.10 Whenever possible, rails are to be designed to extend under the cavity area for maximum support (fig. 18.1).

2.11 If a back plate (or clamping plate) is required on the ejector half of the die, such in the case when using ejector sleeves, the rails will not have clamping slots. The clamping slots will be machined on the back plate. The rails will be bolted to the ejector holder and the back plate will be bolted to the rails, as shown on fig. 18.5.
3. **Ejector plates**

3.1 Backup plate shall be constructed from 4140 PH and retainer plate from Hot rolled 1020 steel or equivalent.

3.2 Thickness:
   - Machine size up to 800T: - 1" (25 mm) retainer plate
     - 1 1/2" (40 mm) backup plate
   - Machine size from 1000T and up: - 1 ½" (40 mm) retainer plate
     - 2 ½" (60 mm) backup plate
   - Wear plates shall be installed on any die for machine size of 1000T or above.

3.3 Mounting bolts:
   - In all cases, a minimum of two screws around each return pin, are included in the number of screws.
   - ½"-13 (M12) size screws for custom mold bases as required.

3.4 One ½"-13 (M12) minimum hoist hole in each plate over 40 lbs (20 Kg).

3.5 Clearly number ejector pin heads and corresponding retainer plate holes.

3.6 Ejector pin holes shall be keyed on contoured surfaces.

3.7 Clearance hole sizes will be 1/32" (0.5 mm) over the pin diameter.

3.8 Ejector guides (fig. 18.3): use DME or equivalent pins and bronze plated bushings. Use 4 guides in an ejector plate. Large plates may require 6 guides.

3.9 If ejector pins are necessary under slide pulls (hydraulic required), accommodation shall be made for a limit switch. Said switch shall be installed by Die Caster.

3.10 Hydraulic pull back (fig. 18.4):
   - Will be specified by the tool engineer if required.
   - For dies requiring hydraulic pull back, tool engineer to supply location of pull back and vendor to fabricate and attach pull back to rear of ejector plate.
   - Height from back of rails to back of ejector plate to be 4" (101.6 mm) when using hydraulic pull backs.
4. **Ejector pins**

4.1 Use DME type EX only.

4.2 Minimum of 4 times the pin diameter length of bearing surface in cavity.

4.3 Hole size must preclude flashing.

4.4 In final assembly, pins will be greased and able to move by hand.

4.5 Pins in contoured surfaces will be flush and keyed, not pinned, where specified.

4.6 Each overflow must have an ejector pin, unless otherwise specified. Ejector pins in overflows should be cut to be 1/8” (3 mm) below the surface. Pin contouring is not required for ejector pins in runner and overflows.

4.7 Oversized pins are not allowed.

4.8 Pins are not allowed under slides, unless specified by tooling engineer and accommodations are made for a limit switch on the ejector plate.

4.9 Ejector pin size on overflows and runner branches should be .250” (6 mm) diameter and .313” (8 mm) diameter for the main runner, unless otherwise specified by tooling engineer.

4.10 Minimum ejector pin size for part ejection will be 3/16” (4 mm), usually .250” (6 mm) diameter. They should conform the part print specification (if any) or to be specified as size and location by tooling engineer. For long 3/16” (4 mm) diameter pins, use sleeves mounted on the retainer plate.

5. **Support pillars**

5.1 Material: Hot Rolled 1020 steel or equivalent.

5.2 Preload length .002”/.003” (0.05/0.08 mm).

5.3 Pillars should be located as required and layout to be approved by the Tooling Engineer.

5.4 A minimum of 3” (80 mm) diameter, unless otherwise specified.

5.5 Avoid bumper pin holes and hydraulic ejection.

5.6 Support pillars should be bolted to the ejector holder block (fig. 18.4).
6. **Ejector plate stops**

6.1 Front stops are positive stops for the full forward ejector plate travel. They are located on the underside of the ejector holder block. Front stops are required only when the forward position of the ejector plates has to be controlled, to avoid damaging other mold components, such as waterlines (fig. 18.6).

6.2 Back stops, required to support the ejector plate in its retracted position, should be bolted, or part of the guided ejection - DEFAULT METHOD (fig. 18.3).

7. **Leader pins and bushings**

7.1 Leader pins and bushings to be DME or equivalent. Use only straight leader pins, no shoulder pins are allowed.

7.2 Pins are to be installed press fit in the stationary half (fig. 18.2). They should not be able to be moved freely by hand after assembly.

7.3 Turn 15° lead in on pins or machine a suitable leading (fig. 18.7).

7.4 Pins should be long enough to engage bushings before core and cavity engage.

7.5 Bushings to be installed .03 to .12 (1-3 mm) below P/L face (fig. 18.2).

7.6 If necessary, a backup bushing will be installed press fit, as shown in fig. 18.2.

7.7 Vents (dirt chute) to be cut in the ejector rails under each pin.

8. **Return pins**

8.1 At least 4 pins are required in a die guided on the holder, not on the insert steel, as shown on fig. 18.3. If the ejector plate size exceeds 24” x 24” (600 x 600 mm), consult with the Tooling Engineer regarding the number of return pins required.

8.2 Use DME standard return pins cut to length. Do not add bevel to the pin.

8.3 Return pins will be 1” (25 mm) diameter for machine sizes of 600T – 800T and 1 ¼” (32 mm) for 1000T die cast machines and above.

8.4 Preload pins double the amount of cover and ejector cavity preload (.004/.006”) (0.10/0.16 mm).
8.5 Return pin holes in the holder block or ejector insert will be .004" (0.10 mm) over the nominal pin diameter, with a working length of 2 times the pin diameter and then a clearance of 1/16" (1.50 mm) over the pin diameter.

9. Water lines and bubblers

9.1 Water lines shall be in all pieces of die steel that molten metal comes in contact with, if possible.

9.2 Tool engineer to specify quantity and location of waterlines. Lines and connectors shall accommodate ¼" NPT standard.

9.3 The minimum distance between a waterline surface and cavity, runner or overflow surface shall be .75" (20 mm) (fig. 18.6).

9.4 The minimum distance between a waterline surface and an ejector pin or core pin shall be .50" (12 mm) (fig. 18.6).

9.5 The distance from the top of the bubbler hole to the closest point on the cavity will not be less than 1" (25 mm) (fig. 18.6), unless approved by tool engineer.

9.6 Use DME (or equivalent) type bubbler junction (fig. 18.6).

9.7 Use DME specifications for clearance on brass tube length.

9.8 Bubbler will be installed behind the ejector plate, unless otherwise specified by tooling engineer. “IN” and “OUT” pipes will be run under the rails, through a milled slot, unless an easier route can be made.

9.9 A waterline layout (8 ½ x 11") (A4 format) is to be supplied for cover and ejector halves. This should be easy to read – remove all die details, keep only the outerline of the die and inserts. This layout is to indicate the IN and OUT of each water passage, waterline numbers, all bubblers and baffles and flow direction arrows. Die heater (hot oil) circuits must also be indicated and labeled. A copy of this MUST be included in each Core Pin Book. All lines to be permanently tagged.

9.10 All waterline components to be made out of brass.
10. **Holder blocks**

10.1 Material of holder blocks to be 4140 PH steel or equivalent.

10.2 Holder block thickness will be governed by insert thickness and machine requirements. Less than 3” (75 mm) of steel behind cavity needs approval from tool engineer.

10.3 A minimum of 4” (100 mm) P/L is required all around the die, from the edge of the inserts to the edge of the die.

10.4 Ejector pin clearance holes on the ejector holder:
   - Clearance 1/32” (1 mm) over ejector pin diameter.
   - Counter sink lead end of all holes thru back of holder block.

10.5 Pipe clearance:
   - 13/16” (20 mm) diameter clearance hole for all cooling pipes up to 3/8”.
   - Stamp circuit number next to each hole and "IN" or "OUT" for that circuit.

10.6 Vents ([fig. 18.15](#)):
   - Machine vents only on the ejector holder.
   - Vent must be open to atmosphere.
   - 0.025” (0.65 mm) to ¼” (6 mm) past insert edge, step to .015” (0.40 mm) to 2” (50 mm) from edge of die set, then .005” (0.15 mm) maximum to the edge of the die set.
   - For the vents directed sideways, towards the operator, bend vent min. 30° downwards.
   - All vents must be polished.

10.7 Pry bar slots on all four corners of one of the blocks, .25” (6 mm) deep minimum.

10.8 Standard 1” x 1” x 1.25” (25 x 25 x 32 mm) clamp slots on all four sides of the cover holder block ([fig. 18.2](#)).

10.9 Shot chamber hole on cover holder:
   - Clearance hole in the holder 1/32” (1 mm) plus outside diameter.
   - Machine 1/8” x 45° (3 x 45° mm) chamfer on the platen side of holder block.

10.10 Insert mounting bolts:
   - Counter bore so head is recessed into block.
   - Clearance 1/32”(1 mm) plus bolt diameter up to 5/8” (M16), clearance of up to 1/16” (1.5 mm) for bolts larger than 5/8” (M16).
   • Eye bolts - 1" (M24) – for blocks less than 1000 pounds (500 Kg).
   • Eye bolts - 1 1/4" (M30) - 1000 pounds to 2500 pounds (500 – 1000 Kg).
   • Eye bolts - 1 1/2" (M36) - 2500 pounds to 5000 pounds (1000 – 2000 Kg).
   • Eye bolts - tool engineer to specify on blocks above 5000 pounds (2000 Kg).
   • They should be of sufficient number and size to allow for safe handling and to be located to balance the die half.
   • The hoist holes should be made deep enough and with a counter bore, to allow the shoulder of eyebolt to sit (see fig. 18.8 and fig. 18.9 for recommended hoist hole sizes).

10.12 Insert knock-out holes:
   • 13/16" (22 mm) to accommodate a ¾" (20 mm) diameter rod.

10.13 Break all outside edges of holder blocks.
11. Cavity inserts

11.1 Material to be Premium H-13 steel.

11.2 Tool engineer to specify quantity and location of waterlines. Lines and connectors shall accommodate ¼" NPT standard.

11.3 Tool engineer shall specify quantity and location of hot oil lines. Lines and connectors shall accommodate 3/8" NPT standard.

11.4 All positive ejector pins (pins in the cavity impression) to be installed as per part drawing, or as specified by tool engineer.

11.5 Vents and overflows to be cut per die layout, specified by tool engineer.

11.6 Cavity bolts will be 8" – 10" (200 – 250 mm) apart. Use ½"-13 (M12) bolts for 600T – 800T machines, and 5/8"-11 (M16) for 800T and larger machines.

11.7 Insert to be proud of die shoe .002"/.003" (0.05/0.08 mm) (fig. 18.13).

11.8 Hoist holes will be used for inserts 40 pounds (20 Kg) or more. Use 5/8"-11 (M16) size for 800T and smaller machines, and ¾"-10 (M20) size for 1000T and larger machines.

11.9 1 ½ " (40 mm), or bigger, depending on the size of the block, bearing surface around outside of block and .020"/.030" (0.5-0.8 mm) step relief for balance of block thickness on three sides (bottom excluded) (fig. 18.13).

11.10 All cavity surfaces must be free of any machined marks, EDM surface finish and must be polished with a SPI-SPE No. 3 finish between 220 – 260, or tooling engineer to specify if otherwise.

11.11 Ejector pin holes to be reamed and lapped to size (jig boring preferred). Lapped diameter to be min 4 times the diameter deep and the remainder of the hole length to be pin diameter plus 1/32" clearance. There shall be a lead chamfer (from drill tip) at diameter transition. A .12 x 45° (3 x 45° mm) chamfer shall be at back of hole (bottom of cavity) for lead.

11.12 ID slot should be milled in the back of the insert. Stamp detail number, material and hardness.

11.13 Tooling holes (on the back face) must be used on all inserts. If the tooling holes are extending thru the parting line face, a blind pin must be placed in the holes, to cover them, or to be plugged with brass rod after final assembly.
12. **Runner block & shot block**

12.1 Material to be H-13 steel.

12.2 Shot block height is controlled by holder thickness and shot sleeve nose length.

12.3 Tool engineer will specify ejector pin locations and size.

12.4 Blocks preload will be equal to cavity inserts preload.

12.5 Shot hole diameter and tolerance to be specified by tool engineer. Jumanji Group shall identify a range of standards for shot hole diameters.

12.6 1 ½” (40 mm) bearing surface around outside of blocks and .020”/.030” (0.5-0.8 mm) step relief for balance of block thickness.

12.7 All runner surfaces must be free of any machined marks and must be polished with a SPI-SPE No. 3 finish between 220 – 260, or tooling engineer to specify if otherwise.

12.8 ID slot should be milled in the back of the insert. Stamp detail number, material and hardness.

12.9 Tool engineer to specify quantity and location of waterlines. Lines and connectors shall accommodate ¼” NPT standard.

13. **Slides**

13.1 Default should be mechanical, unless size and pull length dictate.

13.2 Mechanical slides (fig. 18.11):
   - Spring return is required on all top or side mounted slides.
   - Lock angle to be 5 degrees greater than cam pin angle.
   - Lock angle and holder thickness to be determined and calculated to withstand 10,000 Psi (700 bar) metal pressure.

13.3 Hydraulic slides (fig. 18.12):
   - Use Miller or Parker Hydraulic cylinders, unless other is specified by tool engineer.
   - Lock angle to be 10 degrees.
   - Cylinder to have min. 1/8” (3 mm) of travel left at full forward position for pressure, design dependent.
   - Hydraulic slides to have brackets and actuators installed for Allen-Bradley 802T limit switches.
Cylinder brackets should be made of 1020 Hot rolled steel or equivalent, screwed and doweled in position. Corners of all components to be chamfered.
Where possible avoid mounting cylinders directly to the holder, because of the heat transfer.

13.4 Portion of slide forming part detail (slide nose) to be separate from slide carrier (slides are always to be 2 piece assemblies). One-piece slide should be pre approved by the tooling engineer. Slide carrier should be pocketed to accept slide nose, to ensure positive location to the slide pocket in the die shoe/cavity. This detail to be bolted together from back side of slide carrier.

13.5 Portion of the slide forming the part detail (slide nose) has to shut-off well against the inserts or other slides. No gaps are allowed, because these can collect metal and prevent die closing. Slide pockets in the inserts have to be properly finished. No grinder marks are allowed on the slide pocket, on the slide nose or on any other moving part of the slide.

13.6 For both types of slides, mechanical or hydraulic, the lock (heel block) has to be pocketed in the holder block. No locks bolted to the side of the holder are allowed.

13.7 For large slides and special applications, Jumanji Group will review at time of design in regard to interlocking cores, blow back problems, etc.

13.8 All slides to have water-cooling passages, unless otherwise specified. All water hoses must be suitably routed to allow full slide movement without hose stretching of pinching.

13.9 Tooling engineer will advise if the slide must be designed and built with grease lines and fittings to lubricate wear plates and gibbs or guide bushings. Grease fittings will have to be located to be easily accessible for greasing in the DCM.

13.10 General rules for slide construction:
- Slide must move freely by hand after assembly.
- Keep ease of disassembly in mind during design.
- Outriggers and backplate will be able to be removed bolted together.
- Hoist holes where possible for any piece or assembly over 40 pounds (20 Kg).
- Gibs, bolted from rear of die shoe and wear plate to be used on all slide configurations (fig. 10.12). If the slide assembly is too large, or if tight positional tolerances are required from features formed by slides back to features formed in the die cavity, consider using Thompson rods and guide bushings instead of gibbs. Please consult Jumanji Group Tooling engineer on this issue.
14. Cores

14.1 All long and small cores that may break often, to be double set screwed behind head of pin, in the insert and access holes to be provided thru holders and ejector plates for core removal, if possible (fig. 18.16).

14.2 Polish well the forming potion of the core in the direction of the draw. No visible cutter marks are allowed.

14.3 Never modify the standard pin body diameter. If any adjustments are required when installing the core pin in the die, modify the hole on the insert, not the pin.

14.4 Clearly number pins on the head and corresponding cavity core hole.

14.5 Key cores to prevent turning, if required. Use flat on head of core.

14.6 Core pin holes shall be light press fits (LPF) for cores. Light press fit length shall be jig ground. Light press fit length shall extend from parting line surface for a distance of min. 1.5 times the body diameter of the core for holes under .25" (6 mm) diameter and for a distance at least equal to the body diameter of the core for holes over .25" (6 mm) diameter, then relieved 1/32" (1 mm) per diameter. There shall be a lead chamfer (from drill tip) at diameter transition.

14.7 Core pins that could be assembled in a wrong hole in the same piece of the die, because it has the same body diameter as another core, shall be fool-proofed by changing the head diameter thickness and/or diameter.

14.8 A core pin layout (8 ½ x 11) (A4 format) of the part must show each core pin position (including sliding cores and sleeves) and number each core pin. Core pin numbers should also indicate location ie: C1 (cover), E1 (ejector), SL1 (slide core), SB1 (sub core), SV1 (sleeve). That number will show on each core pin detail. Each core pin detail along with the core pin layouts will be supplied in a folder in book form. The cover will identify it as “Core Pin Book” with the part name and number shown. A copy of this is to be supplied when the die is shipped.
15. General rules for die construction

15.1 Unless otherwise specified, the tool shop will have feature tolerances that are 25% of the part tolerance.
   • General profile tolerance: ±.005"
   • Core pin position tolerance: ±.002” (unless the 25% tolerance requires the above to be held tighter)
   • All draft angles must be at maximum minus 1/2º and all radii at maximum minus .010” (as per part print). More draft on cover side and less draft on ejector side to minimize the use of undercuts.

15.2 Before first sampling, it is preferably to do a complete dimensional verification of die steel to part print + shrink. Results to be checked to math data / part print and GD&T information. Any feature that is dimensionally out of spec (based on the tolerances outlined above) shall be highlighted and reviewed with Jumanji Group’s tooling engineer prior to shipping. The tooling engineer will advise in advance if the dimensional verification of steel prior to the first sampling is required. If so, this must be allowed for when quoting cost and timing.

15.3 All the corrections after the first sampling are to be carried out at the vendors shop. The tool source is responsible for shipping of the tool to and from Jumanji Group. Jumanji Group will not pay shipping charges for die corrections.

15.4 The first sampling should be done prior to any texturing or coating.

15.5 The vendor is required to make corrections until the castings are acceptable to the customers for approval.

15.6 In the event that a change is required to correct a casting measurement and it is shown that the steel dimension is correct, this will be a chargeable change. This is to be discussed with Jumanji Group’s tooling engineer. Jumanji Group reserves the right to request dimensional corrections for any feature out of tolerance (based on above spec) at no charge.

15.7 It is Jumanji Group’s intention to only have to sample a die twice. The first sampling will be for shrinkage verification and any process related adjustments (the steel check should catch any dimensional problems prior to shipping). The second sampling should produce parts suitable for submission to our customer.

15.8 It will not be acceptable for shops to deliver dies knowing there are dimensional discrepancies that they plan to fix after the sampling. Every effort shall be made to deliver the die dimensionally correct.
15.9 **Build time and delivery dates are extremely important.** The tool source must make every effort to maintain the delivery date they committed to. In order to keep track of the tool progress, the tool source must supply Jumanji Group’s tooling engineer a timeline (Gant chart) within 2 weeks of receiving a P.O. This shall list major events in the tool build process and also must have a percentage complete column and a summary. An updated timeline is to be supplied to the tooling engineer every 2 weeks throughout the program with the percentage complete updated.

15.10 If at any time the program begins to fall behind schedule, the tool source should contact the Jumanji Group’s tooling engineer to re-assess the timing and the tool build plan. **Do not indicate the tool build is on schedule if it is not.** Jumanji Group needs as much time as possible to respond to tooling delays.

15.11 Service and repair of the die should always be considered when designing and building. Any items that are prone to wear or breakage should be easily removable for repair or replacement. The standard components listed in these pages should always be used. Any deviation must be approved by Jumanji Group tooling engineer.

15.12 The die must be designed and build to always provide acceptable steel conditions. Any poor steel conditions that exist because of the part design or die design should be brought to the attention of Jumanji Group engineering.

15.13 All holes drilled into H-13 cavity steel MUST be finished with a ball nose drill (to avoid a sharp corner with a drill point that could be the starting point for a crack).

15.14 **Absolutely NO welding on H-13 without prior approval from tooling engineer.** Any tool steel that has been welded without authorization will be replaced by the Tooling Vendor, free of charge. Any welding required on the die and approved by the tooling engineer must be guaranteed for the life of the tool.

15.15 Die must be greased at all fittings (high temperature grease only). All ejector pins and slide gib / wear plates to be lubricated with Die Slick prior to shipping.

15.16 All incoming drawings and CAD data must be identified and logged in with a date stamp. All obsolete files / drawings are to be marked as such and filed accordingly. A separate file for each program must be kept with all correspondence in it. **All drawings and all CAD files are the property of Jumanji Group and must be supplied upon request.**

15.17 **Shims are not allowed.** If corrections have to be done on the die, consult with the tooling engineer for the best acceptable method.

15.18 Corner radii shall fit within .010\" (0.25 mm).
15.19 Spot die within .005” (0.15 mm) including slides. Take digital photographs of blued-off cover and ejector dies. These to be supplied to Jumanji Group tooling engineer.

15.20 Construct tool to prevent incorrect assembly. Input from the tooling engineer required.

15.21 Identify all interchangeable components. (i.e. Core pins, inserts)

15.22 Leak test all waterlines. Waterline plugs to be made of brass.

15.23 Stamp each half of the die with (fig. 18.10):
   - Customer name
   - Part name
   - Part number
   - Die half weight
   - Tooling vendor I.D.

15.24 Offset one leader pin and bushing with minimum .25” (6 mm).

15.25 Mark “0” corner on all die plates.

15.26 Put logo (fig. 18.17), date stamp (fig 18.18), cavity number and part number in area specified by program engineer.

15.27 Date stamp to be on replaceable pin (DME – C type), location and size to be determined by the tool engineer.

15.28 Each die should have 2 self-storing safety straps – one on the operator side and one on the helper side. Paint straps red.

15.29 If any die components, like waterlines, oil lines, manifolds or hydraulic cylinders are extending thru the bottom side of the die, mould legs made of cold rolled steel should be fitted to the bottom side of the holder blocks and rails, to prevent damage if the die is stored standing up.

15.30 Tool source rating:
   Every tool source is rated on and the records kept of the following:
   1. FTC – First Time Capability. This is the percentage of dimensions “in spec” at the first and each subsequent sampling. This is recorded by die for each tool source.
   2. DELIVERY – Comparison of delivery committed to, actual delivery and legitimacy of delivery delays through a program.
   3. COST – This is the review of the initial cost, cost of engineering changes and the cost of the die progression work charged back to Jumanji Group.
   4. PROGRAM SUPPORT – The tool source involvement and commitment to making the tooling and the program succeed.
16. Trim Die: Design and build considerations

16.1 The design of the trim die should be concurrent with the design of the die casting die. It is desirable to have the trim die completely trim the casting and provide a clean part.

16.2 The trim die set should be a 2.0" (50 mm) thick base design, unless otherwise specified by the tool engineer and to have two ¾"-10 (M20) hoist holes per side, front and back, both halves of the die.

16.3 Stamp each half of the die (on the front face) with:
    - Customer name
    - Part name
    - Part number
    - Weight
    - Tooling vendor I.D.

16.4 Material of all shears to be 4140 PH steel, with cutting edges flame hardened at 46-48 Rc or A2 steel heat treat to 60 – 62 Rc.

16.5 Nest (and pressure pads – if any) to be made out of 4140 PH.

16.6 Use standards ‘CX’ DME pins for all punches, unless punches are too large, then use A2 steel, heat treat to 60 – 62 Rc.

16.7 All shear edges to have a 45° angle on them deep enough to accept the depth of gates and overflows, leave about .100" (2.5 mm) land.

16.8 All dowel pins in shear edges to have a slip fit. Put pry slots under shears, near the dowel pin holes, for easy removal. Absolutely no blind dowel pin holes any place on trim die!

16.9 There is to be no exposed springs on the die any place. Use spring guides (rods or cages) if spring is not guided by a hole on the top and bottom. The load on the die springs is recommended to be not more then 30%.

16.10 All components to be bolted from die face for easy removal. Split large shears into smaller sections, easier to handle.

16.11 Where possible provide for an easy replacement of punches.

16.12 All die components over 40 pounds (20 Kg) should have ⅜"-13 (M12) handling holes (see fig. 18.9 for recommended sizes).

16.13 The die should have at least 2 hard stops, on opposite corners of the die, for accurate closed position.
16.14 For transportation, the trim die should be equipped with at least 2 self storing safety straps to keep the 2 halves together.

16.15 The die should have at least 2" (50 mm) thick parallels under the bottom die set, with a clearance of 8” – 9” (200 – 230 mm) in between, for forklift rail access.

16.16 The tooling engineer will advise if automatic blow offs and scrap trays are required to help remove all trimmed flash and overflows.

16.17 If necessary, put on a gate support to hold casting in place.

16.18 All moving components (slides, guide pins, etc) should be greased.

16.19 Break all sharp corners (except cutting edges) to avoid injury, especially for the manually operated trim dies.
## 20. Material specifications

<table>
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<th>HARDNESS SPECIFICATION</th>
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<tr>
<td>Holder blocks</td>
<td>4140 PH</td>
<td>Rc 28 – 34</td>
</tr>
</tbody>
</table>
| Cover & ejector inserts**  | Premium H-13           | Small inserts: Rc 46 - 48  
|                            |                        | Medium inserts: Rc 44 – 46  
|                            |                        | Large inserts: Rc 42 – 44  |
| Runner block               | H-13                   | Rc 44 – 46             |
| Shot block                 | H-13                   | Rc 44 – 46             |
| Slides                     | Premium H-13           | Rc 44 – 46             |
| Cores                      | DME, CX series         | Rc 46 – 48             |
| Ejector plate              | 4140 PH                |                        |
| Retainer plate             | 1020 Hot rolled steel  |                        |
| Rails                      | 1020 Hot rolled steel  |                        |
| Support pillars            | 1020 Hot rolled steel  |                        |
| Leader pins & bushings     | DME (or equivalent)    |                        |
| Ejector pins               | DME, EX series         |                        |
| Return pins                | DME                    |                        |
| Stops                      | SAE 1020               |                        |
| Slide carrier              | SAE 8620               | Case harden           |
| Lock blocks                | H-13                   |                        |
| Date codes                 | DME, C series          |                        |
| Trim die shear edges       | 4140 PH                | Flame hardened cutting edges to 46 – 48 Rc  
|                            | A-2                    | Rc 60 – 62             |
| Trim die punches over ¾” (20 mm) nominal size | A-2 | Rc 60 – 62             |
| Trim die punches under ¾” (20 mm) nominal size | DME, CX series | Rc 46 – 48             |
| Trim die nest              | 4140 PH                |                        |
| Trim die pressure pad      | 4140 PH                |                        |
| Other trim die components  | Cold rolled steel       |                        |

* - These values are as a guideline only. Please consult with the Tooling Engineer for each case.  
** - Small: Small tools with minimum section variation  
    - Medium: Medium sized tools with moderate sections  
    - Large: Large complex tools with extreme sections
18. Appendix

**Fig. 18.1**: Back view of the ejector die: Rails layout.

**Fig. 18.2**: Assembly section thru a leader pin.

**Fig. 18.3**: Guided ejection (Default method) and return pin.

**Fig. 18.4**: Hydraulic pull back ejection.

**Fig. 18.5**: Die casting die with rails and back plate.

**Fig. 18.6**: Waterlines.

**Fig. 18.7**: Leader pin.

**Fig. 18.8**: Eyebolt position when handling the die components.

**Fig. 18.9**: Recommended hoist hole sizes.

**Fig. 18.10**: Die identification.

**Fig. 18.11**: Mechanical slide.

**Fig. 18.12**: Hydraulic slides.

**Fig. 18.13**: Insert preload.

**Fig. 18.14**: Runner gate land size.

**Fig. 18.15**: Overflows and vents.

**Fig. 18.16**: Core pins.

**Fig. 18.17**: Jumanji Group logo.

**Fig. 18.18**: Date wheel.
WHenever possible, Rails are to be designed to extend under the cavity area for maximum support.

- Min 3.00” (75 mm) - DIM UP TO BOOT
- Min 4.0” (100 mm) - DIM ABOVE BOOT
Assembly section thru a leader pin

Fig. 18.2

Clamp slot machined all around

Cover holder

Straight DME leader pin installed press fit on the cover holder

Bushings are installed .03 -.12" (1 – 3 mm) below the P/L

DME shoulder bushing

Ejector holder

Backup bushing (if necessary) installed press fit on the ejector holder

Vent cut on the rails

Rail

Clamp slot machined on all rails all around the die

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Guided ejection (Default method) and return pin

Fig. 18.3
Hydraulic pull back ejection

Fig. 18.4
Die casting die with rails and back plate

Fig. 18.5

- Cover holder
- Ejector holder
- Rail
- Clamp slots machined all around
- Back plate (Clamping plate)
- Ejector sleeve
- Ejector pin
- Ejector retainer plate
- Ejector backup plate
- Core pin
- Retainer plate

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The minimum distance between a waterline surface and cavity, runner or overflow surface shall be .75" (20 mm).

The minimum distance between a waterline surface and an ejector pin or core pin shall be .50" (12 mm).

The distance from the top of the bubbler hole to the closest point on the cavity will not be less than 1" (25 mm), unless approved by tool engineer.

Front stop
Travel
Bubbler (Cascade)

¼” NPT water pipes
Leader pin

Fig. 18.7

Grooves are optional

P Press Fit Diameter

.75 [20 mm]

15°
Eyebolt position when handling the die components

Fig. 18.8
### Recommended hoist hole sizes

<table>
<thead>
<tr>
<th>D1 Eyebolt size</th>
<th>ØD2</th>
<th>ØD3</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
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<tr>
<td><strong>INCH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2 - 13UNC</td>
<td>27/64</td>
<td>9/16</td>
<td>1.62</td>
<td>2</td>
<td>0.19</td>
</tr>
<tr>
<td>5/8 - 11UNC</td>
<td>17/32</td>
<td>11/16</td>
<td>1.88</td>
<td>2.25</td>
<td>0.25</td>
</tr>
<tr>
<td>3/4 - 10UNC</td>
<td>21/32</td>
<td>13/16</td>
<td>2.12</td>
<td>2.62</td>
<td>0.38</td>
</tr>
<tr>
<td>1 - 8UNC</td>
<td>7/8</td>
<td>1 1/16</td>
<td>2.88</td>
<td>3.38</td>
<td>0.38</td>
</tr>
<tr>
<td>1 1/4 - 7UNC</td>
<td>1 7/64</td>
<td>1 5/16</td>
<td>3.38</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>1 1/2 - 6UNC</td>
<td>1 11/32</td>
<td>1 9/16</td>
<td>3.88</td>
<td>4.5</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>METRIC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>10.2</td>
<td>14</td>
<td>40</td>
<td>48</td>
<td>5</td>
</tr>
<tr>
<td>M16</td>
<td>14</td>
<td>18</td>
<td>48</td>
<td>56</td>
<td>6</td>
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<tr>
<td>M20</td>
<td>17.5</td>
<td>22</td>
<td>54</td>
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<td>8</td>
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<td>M24</td>
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<td>10</td>
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<tr>
<td>M30</td>
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<td>86</td>
<td>100</td>
<td>12</td>
</tr>
<tr>
<td>M36</td>
<td>32</td>
<td>40</td>
<td>100</td>
<td>116</td>
<td>16</td>
</tr>
</tbody>
</table>

Fig. 18.9
Stamp (4 places):
CUSTOMER
PART NAME
PART NUMBER
WEIGHT (Lbs)
TOOLING VENDOR ID.

If the die is built with metric units, paint yellow or red (4 places):

METRIC
No exposed springs allowed.

Spring cage

Heel block
Look angle & holder thickness to be determined & calculated to withstand 10,000 Psi

Spring

Angle pin installed press fit on the cover holder

Cover holder
Hydraulic slides

Fig. 18.12

Brackets and actuators installed for Allen-Bradley 802T limit switches.
**Insert preload**

- .002 - .003”
  - [0.05 - 0.08 mm]

- .02 - .03”
  - [0.50 - 0.80 mm]

- 1.50
  - [40 mm]

---

**Fig. 18.13**

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Runner gate land size

Fig. 18.14

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Overflows and vents

Fig. 18.15
Core pins

Core pin

Set screw

Ejector holder

Ejector pin

Ejector retainer plate

Ejector backup plate

Access hole
✓ Engrave where indicated by the tooling engineer or marked on the part print.
✓ Engraving to be max. .015” (0.40 mm) raised on the part (deep on the insert).
Use DME C-type core pin.

- Engrave where indicated by the tooling engineer or marked on the part print.
- Engraving to be max. .015” (0.40 mm) raised on the part (deep on the core pin).