Quality Metalcraft

Die Standards

Medium to High Volume

More than 25,000 Pieces per year

Revision Log

Section	Page	Description

DIE DESIGN AND CONSTRUCTION INDEX

1 .0 GENERAL DIE CONSTRUCTION REQUIREMENT

1.01 The strip layout and preliminary die layout (plan view and side view) must be submitted for approval with the "QMC STRIP/PROCESS REVIEW DATA SHEET" which if approved will be signed as QMC's approval to start design before starting the actual design. Strip Layout will have a brief description of each stations process and required tonnage per operation.

1.02 Estimated tonnage requirements are to be submitted to the QMC Engineer for press selection. The QMC Engineer will make a press assignment based on the information in the Tool Design Checklist and communicate the press specifications to the Tool Vendor Dies are not to exceed 80% of the rated press tonnage throughout the press stroke curve. Speed of the press should be considered. When Material is greater than 4mm thickness countermeasures for reverse tonnage must be used.

1.03 All Die Designs are to be in "3D" and are to be submitted for review with the "QMC PRODUCTION DIE REVIEW FACT SHEET. "

1.04 Die Designs will be reviewed at 50% which is a complete die design all details are drawn in all bolt holes, nitrogen cylinders, scrap chutes, basically a 100% design that has not been approved.

1.05 Die Design review for 100% design approval will be a review of all changes requested during the 50% design review. Any and all concessions to the Die Standards must be discussed at this point and agreed upon. Vender should have the 100% Design Approval form filled out with all concessions documented prior to scheduling the meeting. Following review of all changes there is a potential for further changes to be made. If minor changes are made during this review QMC Engineer may not request further review of the tool, in this case Vendor will supply pictures of all changes requested showing before and after. Once all items are closed from 100% review, QMC will release tool for build with a signed Design Approval. If vendor moves forward without approval from QMC it is at Vendors risk, QMC is not responsible for any costs associated with Vendor proceeding forward without approval.

1.06 The designated QMC Engineer plus the assigned QMC team shall review the die design using but not limited to the following documents:

- RFQ
- PO
- Die Standards
- Die Design Checklist (IN PROCESS)
- Engineering File
- GDT

Note: All key characteristics and controls shall be shown on each drawing. Upon design approval the "DIE DESIGN REVIEW & SIGN OFF" must be submitted for thirty percent (30%) of release.

1.07 QMC shall provide to Vendor, production intent material based on Vendor supplied Strip Layout for:

- Prototype / Pre-Production parts
- 500 parts for sample submission
- 700 parts for die development
- QMC May elect to provide additional material based on part complexity, or Material specification. Vendor should request additional material at Kick-Off Meeting if they feel it will be needed.
- If the Vendor provides incorrect information to QMC for tryout material it will be the Vendors responsibility to replace the Material at their cost.
- All unused Tryout Material to be returned to QMC

1.08 If a Vendor requires purchasing additional material after tool has been kicked off to build it will be at the tool vendor's expense. All unused tryout material is to be returned to QMC.

1.09 Vendor must track material usage and report out during weekly program meeting.

1.10 Final Blank size must be reported at 60% of tool completion and submitted to the QMC Engineer. Final Blank size is to be compared to the quoted size to ensure meeting quoted material usage. Final material greater than quoted size will require approval from QMC.

1.11 QMC shall provide Math Data Within the time frame allocated in the program.

1.12 QMC shall provide a certified checking fixture prior to 60% completion of the die.

1.13 QMC shall provide GD&T to the Vendor with all Key Product Characteristics at Purchase Order release.

1.14 Welded sections are allowed for development only; all welded sections must be replaced before final payment will be released.

1.15 Steels performing severe draw or forming will be coated to improve production requirements. The Type of coating will be reviewed at Die Design.

1.16 All critical working surfaces are to be spotted in before coming to QMC. (Draw and/or binder pads, knockouts, form punches and restrike sections). Dies must be tried out in the same "type" (Mechanical/Hydraulic) of press as the production intent press.

1.17 Dies are to be designed to use no lubrication, other than mill oil that is natural to the coil.

1.18 Dies requiring lubrication other than mill oil must have the forming steels coated to improve formability. Type of coating to be decided during design review if possible, may be necessary to wait until build to see the severity of the form.

1.19 The vendor is to provide a complete listing of all purchased components- punches, buttons, springs, pilots, cams, spools, etc. on the Bill of Material. The list includes description, material, supplier and quantity. The data to reproduce these items must be included in the design package.

1.20 All tooling to be built using metric standards: (Guide pins, bushings, bolts, dowels, punches, buttons, springs, pilots, pilot retainers; wear plates, etc.). Standard die sets require approval by the QMC Engineer at time of purchase agreement.

1.21 All sensor applications will be considered at design stage (French Stop, End of Strip, Part Exit and Part Present.) All sensors are PNP type sensors.

1.22 The supplier is to provide a set of 3D drawings of final designs, and 2D detail drawings of components in electronic format at the end of construction to the QMC Engineer Manager. Data to be uploaded to QMC FTP site attention the QMC Engineer and CAD Email must be sent to the QMC team informing of the upload. Data will be stored on the Server in the Engineering Ops Folders.

1.23 All the designs are the property of QMC and are to be maintained by the supplier until the project is completed. The supplier must record all changes to the original die design and update drawings immediately upon approval. All Changes made during development must be updated into master designs. Details will be checked during Static Review of tool any deviation from designs will require SCAN or CMM layout of tool and updating of design.

1.24 All die detail drawings will contain the data at a minimum for the following:

- All perishable items.
- Die sections and punches.
- A plan View of the upper shoe.
- A plan view of the lower shoe.
- A complete cross-section through the die.
- A detailed road map that shows the hardness of dies steels and type of tool steel.

1.25 All parts having draws or by direction of the QMC Engineer shall require a circle grid analysis or ultrasound and a thin out diagram at 60% of tool build and at QMC's Home line. Requested assistance from the steel supplier through the QMC Engineer or Steel Purchasing Agent is recommended.

1.26 All formed parts require a computer simulation to determine the forming severity of the panel during design. Unless agreed upon at Kickoff Meeting that the requirement can be bypassed due to component complexity.

1.27 Knife-edge trim conditions are not permitted. Any part trim section > 20 degrees and up to 30 degrees require the approval of QMC Engineer. Any part trim section >30 degrees is not acceptable.

1.28 Status report will be required on all tools until time of shipment of tools to QMC. Weekly tooling status reports are to be sent to QMC Engineer and Program Management no later than Friday before the end of business. Status reports are to include progress of the tools on a percent of completion basis, and pictures updated weekly. Suppliers must use the status report form supplied.

1.29 All deviations from the QMC standards must be noted in the Design Approval documentation. Any changes from the Standard not noted on the Design approval sign off are subject to write up at Buyoff to be brought to the QMC standard at Suppliers expense.

1.30 Early Part Quality Levels may have specific customer requirements, but generally:

- 85% PIST Hard tool, Laser trim, nothing more than 1.5 X tolerance
- 90% PIST Hard Tool, Die trim, nothing more than 1.5 X tolerance
- 100% PIST Off Process

1.31 Percentage Complete will be reported by the assigned Engineer using the chart below:

- 5% Concept Received
- 10% Design Approved
- 15% Material Ordered
- 30% 3D Die Design complete
- 40% In Machining and Material @ Tool Shop
- 50% Draw/ First Form Complete
- 60% Tryout and Development
- 70% Machining Complete — Assembly and Tryout
- 80% Trim Line Development Done
- 90% Final Tryout and Finishing
- 95% 6 Pcs Study and 30 pc CPK complete
- 100% 500 Pcs Run-off Complete

2.0 GENERAL DIE CONSTRUCTION REQUIREMENTS

2.01 Steel or Cast die sets are permissible. Steel Die Sets Lower minimum Thickness 76mm Upper Minimum Thickness 70mm

2.02 All form and restrike dies with side thrust must be heeled in conjunction with Guide Pins and Bushings. Placement of Guide Pins in upper or lower to be discussed during design review.

2.03 All Dies that have thrust that cannot be controlled internally with the use of Heels require Bi-Directional Thrust Blocks.

2.04 Greaseless Bronze Wear plates are required on heel blocks.

2.05 Any die for material over 3mm thick must use Bi-Directional Thrust Blocks.

2.06 Transfer dies must have guide pins inside of transfer fingers in the return movement and in the upper die shoe.

2.07 All bushings are to be demountable, no press fit Guide Bushings.

2.08 Four (4) stop blocks are to be mounted inboard of guide pins and mounted over / under parallel support.

2.09 Stop blocks are to be Rectangular 2 inches wide minimum with 2 bolts. Provide .050" deep slot for lead check. Unless otherwise approved at design review with the QMC Engineer

2.10 Pull dowels are to be utilized; only METRIC fasteners and dowels shall be used in die construction. Blind dowels are not allowed.

2.11 All Details Require Jack Screws. Jack Screw tap should be the same as the mounting screws for the detail. For instance if the mounting bolts are 10mm counter bore, the Jack Screws will be 10mm tap. Jack screws are to be cleared from the face of the detail allowing 10-12 mm of threads at the bottom of the detail.

2.12 All parallels must be numbered; number to be stamped on parallel and die shoe. Numbering must be legible after die is painted.

2.13 Lower Mounting Parallels are to be doweled or keyed to the Lower Die Set.

2.14 Parallel Bolts, minimum bolt size is 24mm for lower parallels and mounting parallels.

2.15 All Handling holes must be labeled. For the Die lift points the size must be clearly visible through the paint on the tool. The use of paint to label is not acceptable as the paint will wear off over time. Use of a grinder is acceptable for labeling, must be legible.

2.16 All dies and master plates to be supplied with tapped Handling holes 2 times the Diameter of the thread. Chart below to be used to determine the Handling Hole size.

WEIGHT LIMIT	Handling Hole Size	MINIMUM TAP DEPTH
30LBS	M 16 X 2.0 X 60	32 OR THROUGH DETAIL
9259LBS	M 24 X 3.00 X 80	50 MM
15432LBS	M 30 X 3.50 X 120	60 MM
24250LBS	M 36 X 4.00 X 150	72 MM

2.1 Any Detail over 30 lbs. requires minimum of (4) 16mm handling holes. Handling holes must keep the detail balanced when lifted with crane.

2.17 All non-working edges are to be chamfered / broke for safety.

2.18 All Details require labeling for…MATERIAL TYPE, HARDNESS, LOCATION ON DIE, TYPE OF COATING, and DETAIL NUMER LISTED IN THE DIE DESIGNS. Location on the tool requirement is a number stamped on the detail and same number stamped on the die shoe across from the detail location. Labeling for details is either Machined in or Stamped.

2.19 Minimum Trim Punch Thickness is 6mm. Special circumstances will be considered but require approval by QMC Engineer and must be noted in the Design Sign off. In the event this will require increasing of the coil Width or Pitch QMC will meet to determine if the need is warranted.

2.20 All details will have at minimum (2) 10mm bolts. Button keeper keys are an exception to the standard and can use (1) 8mm bolt with (2) 8mm jack screws with the bolt in the center. All other deviations from this require Approval from QMC Engineer and must be noted in the design sign off.

2.21 Minimum Stripper Thickness is 38mm.

2.22 Ball Lock Punches required, any deviation must be approved by QMC Engineer and must be noted on the Design Sign Off.

2.23 Arial Cams are to be used only when it is not possible to pierce / trim in press direction or with a base mounted cam. Arial Cams Require QMC Engineer Approval to be noted on the Design Approval form. QMC PREFRENCE IS NO ARIAL CAMS.

2.24 All dies require sensors to be mounted and functional before runoff at QMC. Location and Sensor type to be determined during Die Design. Minimum requirement is an End Pitch sensor for Progressive tooling, and Blank Present sensor for Transfer Tooling.

2.25 Nitrogen Cylinders are required for all strippers. Springs can be used for lifters but must be fully contained in a pocket or spring guard. Only heavy duty springs are to be used.

2.26 Parts and Scrap cannot mix together; all scrap must fall under the tool and exit out of the die through use of our shaker systems. Scrap Openings must allow for the scrap to turn 360 degrees.

2.27 All trim steels that are split must be pocketed. Initial trim to the edge of the coil, trim steel must be pocketed.

2.28 No forming, trimming before the Hard stop.

2.29 All strips to start on the hard stop.

2.30 Start Line to be the hard stop in Progressive tools, coil / blank present sensor target in Transfer tools. Start line must be labeled and visible from the front side of the press. Start Line will be painted RED.

2.31 Pilots mounted in strippers are to be press fit AJACS Brand with a safety bolt to prevent the pilot from falling into the tool. No bolt in Pilots in windows permitted. Alternative to stripper mounted pilots is to use ballock pilots. www.**ajacs**.com

2.32 All pilots will have 2 screw-in extended length Misumi ejectors to prevent the strip from pulling on pilots.

2.33 All Progressive Dies will be required to run at or above 40 Strokes per Min. Transfer Dies will be determined during the Kinematic study. Any deviation from this requires QMC Approval.

2.35 Tool Runoffs time will allow for 8 hours in press to make adjustments to the tool. Transfer finger setup and adjustment will be done following part approval by quality. Setup of Transfer Fingers does not count towards Tool Runoff time allotment. If more time is needed to make adjustments to dies a runoff meeting will be held with the Vendor and QMC staff to determine the need and reason for more time to make adjustments. Depending on the determination QMC may quote additional tryout time to the Vendor. If it is determined the issues need to be fixed off site then tool shop will make arrangements to ship tool to the location of their choosing. If more press time is required at QMC to adjust the tools QMC reserves the right to quote the press time and may require making adjustments on 2nd, 3rd shift or the weekends.

2.36 Stamps are required in all tools. Size, Shape, and placement to be approved during design reviews. Julian date stamps will be on a removable holder mounted at the start of the die on sliding assembly. Operator will remove one bolt mounted to the end of the tool and slide out the stamp holder assembly for date change. Operator should not have to put hands inside of the tool to remove the stamp retainer.

2.37 Start of coil is to be “HANDS FREE” the utilization of lifters and guides should allow for strip to feed through the die with the feeder.

2.38 Form steels that are high wear are to be coated, type of coating to be approved by QMC. Type of coating to be listed on the BOM and inscribed on the detail that is coated.

2.39 All trim steels minimum of 50mm thick with 10mm die life. Taper Relief is required for all Trim steels, Bolt holes must allow for full die life to be utilized without having to hard mill. All holes required to mount the die steel must be at minimum 10mm away from the cutting edge.

2.40 Flat Head and Low Profile Headed Screws are not allowed for any detail including wear plates.

2.41 All bolts in Steel Die sets are to engage 1.5 times the diameter of the bolt. All Casted tools bolts are to engage 2 times the diameter of the bolt.

2.42 By-Pass Notches required on the part need to be submitted to QMC Engineer to review placement. A Power Point showing the size and location of all bypass notches needs to be submitted before Design Approval.

2.43 No Flat Head, Low Head, or Stripper Bolts allowed.

2.44 Lifter rails that come above the die plane must have anti rotation pins to prevent rail from rotating into the die if a guide pin comes out. Pin should be welded to the rail and not exit the die shoe when the rail is raised. A clearance hole drilled through the die shoe should be just larger than the pin but not contact the pin.

2.45 Lifter Rails utilizing guides with dowel pins should be pocketed and the dowels left out to allow for easy removal in the press.

3.0 HANDLING, STORAGE AND SAFETY

3.01 The location of handling holes and/or lifting lugs to be consistent from the center of gravity for all lifts. Handling holes must allow die to be flipped without interfering with the mounting parallels.

3.02 All components, extending outside the die set envelope must be guarded. (Prefer all components to be inside the die envelope). Guards must be strong enough to lift the tool.

3.03 Tandem and progressive dies to be designed for fork placement of die to press. Minimum fork access of 10" with a maximum spread of 48" from the inside edge of each pocket with the center of gravity in the middle of the spread. Die straps are required.

3.04 All hoses and Wires are to be guarded against damage during storage and the environment. Wiring should be machined into the working surface of the tool for easy routing of the wiring.

3.05 All dies must be prepared for lifting devices. The Thread must enter the die shoe 1.5 times the diameter of the bolt.

3.07 Any detail over 30lbs, strippers, and sections will be tapped M16 holes for handling.

3.08 Drain holes to be provided in upper and lower shoes to allow pooling water to drain during outdoor storage.

3.09 All scrap chutes and trays must be attached to dies for storage. Scrap chutes extending outside of the toolmust be hinged for storage.

3.10 Provide all Dies with a safety pad area.

- Locate Safety pads 100% under Press Ram, and over / under Parallels
- Safety Pad area to be painted Yellow with black hatching.
- Safety pad areas must be located in diagonally opposite corners; except for dies that run in front feed blanker (front left & front right corners).

Die Size	Safety Area Size	Location

<96”	4” x 4”	RF & LR
>96” <120”	6” x 6”	RF & LR
>120”	8” x 8”	All 4 Corners

4.0 PUNCHES, BUTTONS AND PILOTS

4.01 Clearance holes for pilots must extend through the die shoe to prevent slugging.

4.02 Buttons that extend through a detail must sit on a Hardened Backing plate.

4.03 All punches to be heavy duty ball lock. Prefer True Position or Dayton punches.

4.04 All pierced holes to have a die button or die section. If button will violate the 10mm to trim edge rule then button will be excluded and pierce hole will be machined into the die section.

4.05 No Headed Buttons without approval from QMC Engineer must be noted in the Design Sign Off.

4.06 Pilot Holes must be drilled through the die shoe and not be obstructed.

4.07 Pilots and locators to be doweled.

4.08 All punches, regardless of shape, to be sized so the finish hole is .002” (.05mm) under maximum tolerance on part print.

4.09 Minimum size of wire burn punches is 6mm.

4.11 All EDM punches require two 10mm bolts. Punches must be able to be removed in the press through the stripper.

4.12 All Punches require ejector pins

4.13 Riser plates used under punches must have separate mounting bolts and dowels from the punch retainer.

4.14 Punch retainers to be hardened.

4.15 All trim punches to be slip fit in retainers.

4.16 One Sided trims require Heel Blocks with Bronze wear plates. Heel Block pocketed into the die shoe or sub plate. No Steel on Steel Heels.

4.17 A spare set of ballock punches, buttons, and 2 pilots must be supplied at buyoff.

4.18 All dies built to run aluminum require coated punches. Coating recommendation to come from IonBond and agreed to before coating.

4.19 All Dies built to run Aluminum punch entry to be reduced to no more than 3mm.

5.0 DIE STEELS

5.01 All Details require labeling for…MATERIAL TYPE, HARDNESS, LOCATION ON DIE, TYPE OF COATING, and DETAIL NUMER LISTED IN THE DIE DESIGNS. Location on the tool requirement is a number stamped on the detail and same number stamped on the die shoe across from the detail location. Labeling for details is either Machined in or Stamped.

5.02 All interchangeable inserts are to be positively located and able to be interchanged in the press set-up.

5.03 All die sections to be drilled and counter bored for 10MM die life at a minimum.

5.04 No die section heavier than 30 lbs or longer than 10 inches.

5.05 All holes on the bottom side of details require champher.

5.06 Bolt holes must allow for full use of die life, counterbore must be at least 11mm below working surface to the head of bolts.

5.07 All non-working edges to be broken for Safety.

5.08 Minimum Trim steel thickness is 50mm.

5.09 Dowel Pins are to be slip fit in details and press fit in the Die Shoe, or Riser Plate.

5.10 Split Trim details or one sided trims pocketed into die shoe or sub plate. One sided trim Punches require Bronze heel block.

5.11 Trim Details cannot heel against form steels. If needed 2 step pocket to be used to prevent Thrust into Trim Sections.

6.0 PADS, STRIPPERS AND CAMS

6.01 Stripper Windows to be removable in press for all dies must be slip fit.

6.02 Windows are to be provided in strippers for access to all punches and pilots as needed for removal. Ensure there is adequate room in the stripper to allow for Punch removal.

6.03 All Strippers and Draw Pads require Stand offs (Kiss blocks) to be built to minimum stock thickness and to be adjustable in all 4 corners.

6.04 Bottoming pads to have hardened backup plates. All bottoming blocks must have 2 10MM bolts minimum.

6.05 All stripper plates to be guided with either approved pins & bushings or keepers.

6.06 All moving details must be guided (guides to be greaseless design) and must be retained by hardened keepers. N0 stripper bolts allowed!!

6.07 All pads to have 16mm material handling holes.

6.08 All moving pads to be guarded for operator safety.

6.09 Replaceable bottoming markers are to be used on all draw dies.

6.10 All cams must have grease less wear plates, NO STEEL ON STEEL CAMS allowed.

6.11 Replaceable wear plates to be used on all cam slides.

6.12 Cams must be heeled and keyed with all thrust supported. Heels should be 2 times longer than the height of the Cam

6.13 Cams must return by nitrogen cylinders, no springs, and have positive return fingers, ensure 2 10mm bolts are used for the return fingers.

6.14 Cam pierced holes must have removable slug deflectors where there is room to do so.

6.15 Aerial cams to have positive returns. Aerial Cams are to be used in a last case scenario. All Aerial Cams require Approval from QMC Engineer and must be noted on Design Sign Off form.

6.16 During design review if justified QMC Engineering may require Cam Returned Sensors. Request must be requested in Design review by QMC.

7.0 SPRINGS AND PRESSURE SYSTEMS

7.01 Springs are only allowed in stock lifters when approved by QMC Engineer, and be documented on the Design Approval.

7.02 All form and draw dies to be designated with self-contained nitrogen systems. All stages to have independent controls and plumbed together with a pressure gauge. Pressure Gage will be mounted on the front side of the tool, and be protected from damage while stored. Fill valve must be accessible for filling in press.

7.03 All nitrogen hoses and gages to be guarded against damage during use, storage and cleaning processes.

7.04 Gas pressure to be stamped on die shoe, and listed in the Buyoff Book provided at Runoff.

7.05 Manifold systems to be dedicated to a stripper or pressure pad, not spread over different areas of the die.

7.06 Nitrogen cylinders to be pocketed and screwed to the die shoe. All pockets to have drain hole.

7.07 All nitrogen piston rods must strike a flat surface.

7.08 When required to control pressures for different applications in the same die more than one control manifold may be required.

7.09 Only Kaller or Dadco Cyclinders allowed.

7.10 No preloading of Nitrogen Cylinders allowed. No more than 1mm gap between the Nitrogen cylinder and the detail.

7.11 No more than 1mm gap between the end of the Nitrogen Cyclinder and the Stripper Pad. Do not preload the cylinders.

8.0 PARTS AND SCRAP REMOVAL

8.01 Dies to be configured to keep parts and scrap separate.

8.02 Any scrap that must be removed at the start of the coil must be mounted to the front side of the tool. Scrap mounted to be painted RED and describe what station to remove from the tool. When designing the Die any partial part created, must not be able to be assembled. If possible, Start of the strip should land in scrap to allow first off to be a production worthy part.

8.03 Design of die should not limit tools ability to run at quoted rate. Care should be taken to limit feeding issues due to lift, or unbalanced strip.

8.04 Parallels must be cleared for slug drop. If a parallel must be cleared for a slug there is to be a tapered relief no ledges are allowed.

8.05 Set-up documentation is required. To include Tonnage Requirement, lead readings.

8.06 Parallels must not interfere with Pilot Holes.

8.07 All scrap removal is to be incorporated with QMC's Bolster layout and Press selection provided by QMC's Tool Engineer.

8.08 No more than 5 Slugs are allowed to remain in the die. Progressive / Transfer tools Scrap is to shed under the die onto Shaker trays.

8.09 All scrap must shed at a 30-degree angle or greater.

8.10 Air Blowers are not allowed for scrap or part removal.

8.11 All scrap chutes must be attached to the die for storage and painted yellow. Scrap Chutes that extend outside of the die must be hinged for storage.

8.12 All blank and trim dies require scrap cutters if scrap is longer than 12". Maximum scrap length is 12". Bypass scrap cutters are required.

8.13 When scrap falls under the tool the scrap opening must be large enough for the scrap to rotate 360 degrees without contacting the die.

9.0 SET-UP, TROUBLESHOOTING AND MAINTENANCE

9.01 Clamping locations are to be configured and allow direct bolting to designate JIC standard T-slot unless otherwise noted by the QMC Engineer. All mounting bolts to be accessible for impact wrench. Progressive and Transfer tools utilize the Hydraulic clamping on the press lines. Ensure adequate room to allow clamps to enter the slots.

9.02 Shut height and feed line to coincide with QMC press specifications.

9.03 Part Exit Chute to be 4 inches from end of die and 5 inches from Bolster for Progressive dies. Feed height will be adjusted as needed to achieve this.

9.04 QMC Cone locators must be installed on mounting parallels. Locator blocks must not interfere with slug removal. QMC utilizes shaker trays if needed use scrap chutes to funnel scrap away from the locator details.

9.05 Coil feed dies to have fixed rear and an adjustable front stock rails. Adjustable Rails to have minimum of 8mm of adjustment for coil width. Adjustable stock guide will be guided with a key to maintain stock guide alignment.

9.06 Buyoff Book must contain initial settings used for runoff to include lead readings and Tonnage required.

9.07 Spare Ballock and Buttons are required upon die delivery to QMC. High wear items may require spare components at the discretion of the QMC Engineer.

9.08 Preventive Maintenance Plan is required in the QMC Buyoff Book. To include recommended sharpening frequency, Nitro settings, and any other information that would help in the event of issues while running the tool.

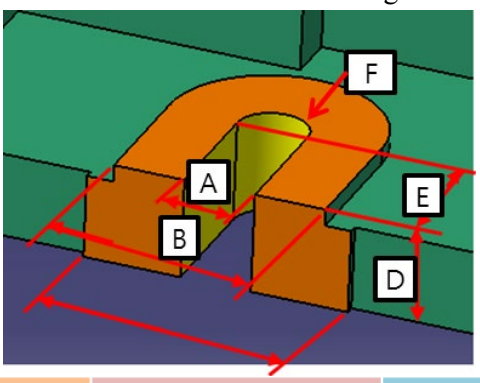
10.0 QUICK DIE CHANGE

10.01 All tooling to be constructed to the following specification to facilitate Q.D.C. QMC will install 3" thick Common Plate to all Progressive Dies.

Progressive Tooling

- Press 600 Ton
- Bolster Size 3658mm x 1524mm (144" x 60")

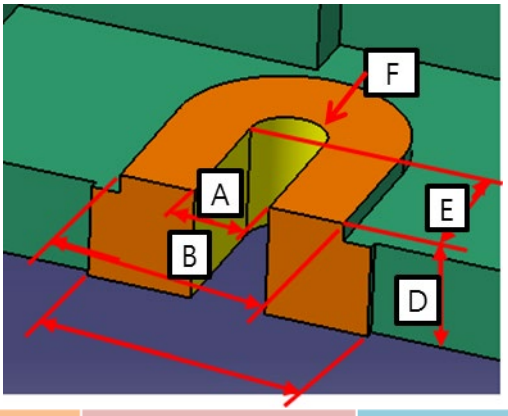
- Shut Height 711.2mm (28”)
- Feed Height 406mm (16”) can Increase to maintain part exit TBD.
- Part Exit 127mm from Bolster (5”) 127mm from end of Die (5”)
- Press Stroke 406mm (16”)
- Tie down Feet See Diagram Below



	LOWER	UPPER
A	32	32
B	130	130
D	51	51
E	40	40
F (RADIUS)	R16	R16

Transfer Tooling

- Press 2500 Ton
- Bolster Size 6096mm x 2438mm (240” x 96”)
- Shut Height 1321mm (52”) Note : Press is capable of 1524mm (60”)
- Pass Line 762mm (30”)
- Press Stroke 762mm (30”)
- Tie down Feet See Diagram Below



	LOWER	UPPER
A	32	32
B	150	150
D	76	76
E	40	40
F (RADIUS)	R16	R16

10.02 All Transfer and Progressive dies are to have the female of "cone" locators on the bottom, at each end of each die shoe that will be used for positive repetitive placement. These are mounted to the parallels and must not affect the alignment of the mounting slots of the press.

NOTE: Drawings will be provided as needed.

11.0 MARKING AND IDENTIFICATION

11.01 The following information to be stenciled on the Upper Die Shoe front and back.

- Operation Number and Name
- QMC Job Number **ALL 4 SIDES**
- Property of "Customer Name"
- Part Flow Arrow
- Upper die weight

11.02 The Following Information to be stenciled on the Lower Die Shoe front and back.

- Operation Number and Name
- QMC Job Number **ALL 4 SIDES**
- Property of "Customer Name"
- Part Flow Arrow
- Total Weight

11.03 The Following Information will be stamped or Machined on the Lower Die set in the Front.

NO ABREVIATIONS ALLOWED WHEN STAMPING CUSTOMER INFORMATION!

- Customer Asset Number / Tooling ID
- Property of "Customer Name"
- Customer Part Number
- Shut Height.
- Coil width
- Material thickness
- Progression
- QMC Job Number

11.02 Asset Tag Pictures must be supplied to QMC Tooling Engineer before shipping the tool.

11.04 Date stamp holder ARG 510 Footed to be on a removable slide assembly mounted to the entry side of the tool using (1) 10mm bolt on the outside of the tool. Date stamp must be able to remove in the press without having to put hands inside of tool.

Part numbers stamp to be included in all dies using Argon510 holder. (Unless other specific direction given by customer) for footed characters size preferred .09 but .18 is acceptable depending on the part requirements (Two line, 10 digit Characters). The stamp bottoming block must be replaceable, pocketed, and poke yoked so it cannot be installed in the wrong direction

11.05 Stamp not to impact hardened steel.

11.06 Dies colors can be directed by customer, by customer program or by QMC Tooling Engineer. Generally these are the colors for the listed customers:

- GM RAL 6010
- Chrysler RAL 5015

11.07 All guarding to be painted YELLOW RAL 1026

12.0 DIE PROTECTION

12.01 The purpose of Electronics in tooling is to provide a high level of die protection and control while giving the operator a vehicle for quick installation and problem solving.

12.02 Areas and/or conditions to be considered for sensor installation.

- Feed not initiated.
- Feed not complete.
- Part/Blank/Strip present.
- Part Exit.
- End of Strip.
- Secondary operation sensor.

12.03 Sensor type and placement to be determined during design review and die construction. But generally should be Turk # BI8U-EM18M-AP6X2-H1141/51589. If a smaller sensor is required Turk #BI4U-MT12E-AP6X2-H1141/51589 is acceptable.

12.04 Die sensor and die protection to be in place before tooling is shipped from the tool vendor.

12.06 All coil feed Transfer Dies to incorporate Blank Sensor Paddle, Progressive Dies to use End Pitch Paddle.

12.07 Line dies for robotic transfer and transfer press dies must have part present sensors in the cavity of all dies.

12.08 Progressive dies must incorporate an end of strip sensor. Part(s) exit sensor(s) as requested by QMC Engineer.

12.09 All blank feed dies must incorporate an electronic sensor for blank location and presence.

12.10 All coil feed transfer dies to incorporate a Feed Paddle Trigger with a prox. sensor.

13.0 TRANSFER TOOLING

13.01 All dies must have a common pass line. Parts are picked up and dropped off at the same height; and travel at the same level.

13.02 Pitch between dies must be common and fit the designated press. Unless otherwise directed in Die design

13.03 Transfer tooling must be timed out under one RAM before coming to QMC. If press availability is not available due to the size of a tool QMC will make accommodations for tool time out at the die shops expense, this time will not be counted towards Runoff allotted time at QMC. There are

no guaranties press time will be available during day shift, which could mean 2nd, 3rd shift, or on the weekends. Tool shop will receive a quote from QMC prior to scheduling.

13.04 Lower Dies to be milled for Q.D.C. (2) cone locators per Die section.

13.05 Dies must be built as separate stations capable of fitting in QMC Foundry Line with upper and lower clamping feet on 6" centers.

13.06 Cast or Plate dies are acceptable.

13.07 Tool Supplier must allow for time to have Kinematic studies completed. Tooling Supplier will work directly with Supplier chosen by QMC. All information transmitted between Tooling Supplier and Transfer Finger supplier to be copied to QMC Engineer and Program Management. In the event either the Tooling Supplier or Transfer Finger Supplier miss a date agreed to QMC Engineer and QMC Program Management are to be notified. Kinimatic studies must be green before QMC will sign off on Designs.

14.0 PROGRESSIVE TOOLING

14.01 All dies to be constructed with front and rear stock guides. The rear guides to be hardened and doweled. The front guides to be hardened and adjustable using a key to maintain parallelism with the rest of the stock guides. Adjustable front guide requires 10mm of adjustment.

14.02 Progressive dies to have a Hard Stop.

14.03 Before die design can start a strip layout, identifying the number of stations and their function, tonnage required per station in English Tons, shut height, feed line height, pitch from station to station, and the direction of exiting part must be reviewed and approved by QMC Tooling Engineer. If vendor deviates from the approved strip layout during design or build, he must request QMC Tooling Engineer for revision approval; any extra cost incurred from changes will be the vendor's expense. If changes are made, the strip layout, die designs and spare part drawings are to be updated immediately and submitted to the Tooling Engineer.

14.04 All scrap, slugs, to be under the die, no mixing of Finished Product and Scrap.

14.05 Design part out chutes to carry part or parts 4 inches from the furthest item on the exit end of the tool and a minimum of 10 inches from the Bolster.

14.06 Pilot punch and pilots are required on all dies. Minimum Pilot Diameter is 10mm. Any deviation from Pilot Diameter requirement requires QMC Engineer approval and must be noted on the Design Approval Form.

14.07 Any forming over a stripper requires the Stripper to be guided to control thrust. Guides cannot be steel on steel, they must have bronze wear plates. If forming over Stripper is needed, the stripper must be separate from any other operation in the tool.

14.08 All Dies that have thrust that cannot be controlled internally with the use of Heels require Bi-Directional Thrust Blocks.

14.09 Stock Guide Rails are to be hardened.

14.10 All guide rails to have top plate to prevent stock from going over the top of the guide rail.

14.11 All stock lifters and strip carriers to be guided.

14.12 Stock guide to extend 6" on lead end of die before any work is done to the strip.

14.13 Die must be designed for Q.D.C. plate with Cone alignment.

14.14 Stock and parts must feed through the die set freely without hang-ups, and with minimal bounce. Parts must exit the tool without hesitation.

15.0 BUY-OFF CRITERIA

15.01 At 60% completion of the program, the Vendor shall supply a first form sample to the Engineer.

15.02 At 70% of project completion, the Vendor shall complete a five (5) part dimensional inspection on all key product characteristics for product and process development. The Inspection Report shall be forwarded to the Tool Engineer for his review and evaluation.

15.03 At 90% of project completion, the Vendor shall complete a 5 (5) parts dimensional inspection on all key product characteristics for final product and process development. The Inspection Report shall be forwarded to the Tool Engineer for his review and evaluation.

- Gauge R&R to be confirmed by the Quality Engineer, from the samples.

15.04 All samples shall be taken off production tooling.

15.05 When first form material thin out is greater than 20% of steel or 12% of aluminum original material thickness, a circle grid analysis or ultrasound may be required completed and the data forwarded to the Tool Engineer for his review, evaluation and verification of material size and type to estimated standard. No thin-out greater than 30% is allowed.

15.06 Each part must be in tolerance to the part print.

15.07 A supplier's inability to provide the required production and/or inspection at his own location does not relieve him of such responsibility. If the supplier procures any necessary additional services to manufacture or inspect part, this will be at supplier cost.

15.08 After approval of Vendor parts at the Vendors facility (500 pcs Run) the Tool Engineer will schedule press tryout time in the assigned press (must be in designated press). Tool Engineer to verify availability of production material, dies, and check fixture. Part is to be verified from production process.

15.09 The final sample prior to shipping to QMC shall consist of a five (5) piece* full CMM layout and thirty (30) piece capability study from points given by QMC Quality Engineer.

15.10 The Vendor shall review all final inspection reports of key characteristics to ensure that parts produced from production tooling will process at a CPK of 1.33 (PPK of 1.67).

15.11 The Vendor shall indicate on the Inspection Form any element which is not in compliance and request (in writing) a deviation to the QMC Engineer prior to 70% of the tooling program.

15.12 Upon completion of 500 pcs run event; the Vendor shall forward the sample package to the QMC Engineer for review and approval. The sample package from the Vendor shall include the following items.

- Inspection Report — 5 pc Full Layout
- Inspection Report - Fixture Check (QMC Supplied)
- Capability Study (30) Pieces
- Gauge R&R (QMC Supplied)
- Grid Analysis (If Required)
- Asset Tag Pictures Close up picture of the tooling ID, Lower Tool, Upper tool, and Die closed.
- Approved Deviation request form.
- Die Maintenance Book and Designs
- A complete and updated set of prints (DWG file) and 3D in STP format be shipped with dies, and uploaded to the QMC Server Attn: Tooling Engineer, Data Cad. Must indicate in the email to be uploaded to Engineering Ops Folders.
- Any detail changes during debugging to be documented by a proper print change.
- All parts require a forming limit diagram and a thin out diagram. Request assistance from the steel supplier through the QMC steel purchasing.
- Note:* QMC requires that all layouts are completed on a CMM machine by a qualified CMM Layout Technician.
- The last web on all progressive dies and one part from each station on all dies must accompany the die when delivered to the manufacturing facility.
- Tooling will be installed in the assigned QMC press and a 300-pc sample will be completed.
- The Tool Vendor will have qualified personnel at tool runoff in QMC Facility.
- The tool must demonstrate process stability, dimensional accuracy and perform at the specified run at rate when operating in QMC's production environment for a continuous 300 pcs sample run. Interruption to the run or failure to demonstrate the tool performance will result in a rescheduled event.
- Dynamic Review at QMC to be completed with Vendor and QMC Engineer

- Static Review at QMC to be completed with Vendor and QMC Engineer
- If the Plant Manager is not satisfied with the operation of the tool under correct working conditions i.e. - correct material, press, error proofing, lube, conveyor, air supply, etc., The Plant Manager shall advise the Tool Engineer and the Vendor of existing conditions (in writing within 5 days) and request a corrective action (in writing) by the Vendor within three (3) days.
- On completion of 300pcs run event; QMC shall forward a package to the Tooling Vendor with approvals or documented open issues. The package from QMC shall include the following items.
- Approved "Tool Shop Capability Run" form
- Approved Capability Study (30) Pieces
- A list of open concerns (If Required)
- Approved Deviations from Design Review

16.0 SHIPPING

16.1 All Dies will be shipped into QMC on Flatbed Truck. No Shipping Containers will be unloaded.

16.2 All Dies are to be uncrated before arriving at QMC. Sample Parts can remain in the crating but must be labeled with the "0 DOLLAR PO" number, and the QMC Part Number. Check Fixtures shipped in Crates must be transferred to a pallet.

16.3 A 24 hour notice via email must be sent to QMC Engineer before truck arrives at QMC.

16.4 Supplier must inspect the incoming tools / Check Fixtures for damage within 24 hours of arrival. If the tools are not inspected and there is damage to the tools it is the Vendors responsibility to repair.

17.0 PROJECT BOOK

17.01 The Die Project Book that must be completed prior to buy off of tooling by the tooling vendor. The Die Project Book will consist of the following (in the order written):

Cover Page — Picture of the Part and QMC / Customer Part Number

Binder End — Picture of the Part and QMC / Customer Part Number

Section 1 — Product Specification

Part Print

Customer Quality Plan

Section 2 — Product Certification

	Layout report
	Capability Studies
	Material Certification
	Forming Analysis
Section 3	Design Approval Form with all deviations accepted by QMC Engineer.
	Bypass Notch Power Point
	Machining Milestone Form Signed By QMC.
	Tool Design (copy on CD)
	Tool Construction Signoff Sheet
Section 4	Process
	Process Flow
	Material Signoff sheet
	Installation procedure and Setup instructions.
Section 5	Perishable stock list
Section 6	Preventative Maintenance Plan

17.02 The tooling vendor shall supply two (2) project books to the QMC Engineer (Plant Copy, and QMC Engineering Copy). An Electronic Version of the Buyoff Book to be loaded to the QMC FTP site attention QMC Engineer, and CAD. TO BE UPLOADED TO ENGINEERING OPS FOLDERS MUST BE NOTED ON THE EMAIL.

18.0 PURCHASING AND QUOTING

18.1 All Dies quoted to QMC must specify where the tool will be machined and assembled.

18.2 Upon receipt of Purchase Order and acceptance, Supplier Must verify all information contained in the Purchase order is correct including payment terms.

18.3 Must include proposed process when quoting.

18.4 QMC may request strip layout before sourcing of the work.

18.5 Vendor must specify where tools will be tried out (ie. Internally at the Tool Vendors facility, or at a 3rd party press)