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DOCUMENT TITLE

Die Standards and Purchasing Manual

PURPOSE

Establish Standards for dies produced at Orchid Monroe, LLC and procurement guidelines for dies purchased from Suppliers

REVISION HISTORY

Revision	Change Description	Effective Date
0	Original Draft	03/10/2007
1	Revision with updates including partial reformatting	07/01/13

APPROVALS:

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DIE STANDARDS
AND
PURCHASING MANUAL

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SECTION 1 – INTRODUCTION

This Die Standards and Purchasing Procedure contains all of the required procedures, guidelines and specifications to be used by any potential supplier(s) for all Stamping Related Tooling and Dies to be used within Orchid Monroe.

This procedure is the sole property of Orchid Monroe and is intended for the expressed use of Orchid Monroe die build sources. Any reproduction for distribution outside of those facilities is prohibited.

Anything not covered in this procedure must have prior authorization from Orchid Monroe before design or construction may commence.

This procedure supersedes any and all previous procedures.

Chip Forrest, Engineering Manager

Belinda Pratt, Materials Manager

Tim Tabor, General Manager

Dan Hafer, Tooling Manager

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SECTION 2 – QUOTATION REQUIREMENTS

- 2.1 All design, capital/tooling and build costs to be quoted separately in accordance with Die Estimate Detail Report (see Exhibit 1)
- 2.2 Quotation shall include estimated build hours, design hours, supplier shop composite rate and hourly rate for engineering changes.
- 2.3 Inspection forms, furnished by Orchid Monroe shall accompany all sample submitted parts. One sample part must be 100% laid out. Thirty pieces, minimum required for samples with 100% PIST achieved for all dimensions with a CP/CPK value of at least 1.67 on all Special Characteristics.
- 2.4 A representative of Orchid Monroe shall be present when the sample and final runs are made.
- 2.5 Weekly progress reports are to be received at Orchid Monroe by the close of business each Wednesday in the prescribed format (see Appendix A).
- 2.6 Each supplier shall supply, per size, one additional set of all special punches, pilots and die buttons. The supplier shall also provide a separate quotation sheet listing all perishable tooling.
- 2.7 The finished dies must produce parts within all specific print tolerances, at the specified production rate and must achieve a CP/CPK value of at least 1.33 in our press equipment and processes.
- 2.8 All aids, original designs, tooling and fixtures become the sole property of Orchid Monroe upon issue of the final P.O. for tooling.
- 2.9 All design, capital/tooling and build costs to be quoted separately in accordance with Die Estimate Detail Report (see Exhibit 1)

Exhibit 1: Die Estimate Detail Report (diematrix.dieplanners.com)

Die Estimate Detail Report			
Company Name: Orchid Monroe		Phone:	
Address:		Fax:	
..		Email:	
Die Operation Name	[OM-USA] A,ix-001-Hydro Core Lamination - 7/10/2013		
Customer	Amjet		
Part Name	Hydro Core Lamination		
Part Number	963504		
Part Revision	A		
Summary Estimate Labor	Operation Hours	Operations Cost	Ops %
Design	45.7	\$2,283.87	5.00 %
Die Sets & Options	8.0	\$400.00	0.88 %
Die Buildups	0.0	\$0.00	0.00 %
Strippers & Pressure Pads	15.8	\$790.00	1.73 %
Punches, Dies & Retainers	283.9	\$14,195.00	31.08 %
Cams & Slides	0.0	\$0.00	0.00 %
Stock Control Details	25.0	\$1,250.00	2.74 %
Die Sensors & Automation	3.0	\$150.00	0.33 %
Wire EDM	459.1	\$22,954.28	50.25 %
Die Surface Machining	0.0	\$0.00	0.00 %
Free Form Items	0.0	\$0.00	0.00 %
Debugging	73.1	\$3,654.19	8.00 %
Inspection & Approval	0.0	\$0.00	0.00 %
Total	913.5	\$45,677.33	100.0 %
Summary Estimate Materials	Materials & Subcontract		Matl %
Die Sets & Options	\$6,775.90		16.80 %
Die Buildups	\$0.00		0.00 %
Die Plates	\$1,847.60		4.58 %
Strippers & Pressure Pads	\$2,817.55		6.99 %
Punches, Dies & Retainers	\$15,190.00		37.67 %
Cams & Slides	\$0.00		0.00 %
Stock Control Details	\$775.00		1.92 %
Die Sensors & Automation	\$150.00		0.37 %
Tool Steels	\$6,764.97		16.78 %
Coatings	\$0.00		0.00 %
Free Form Items	\$6,000.00		14.88 %
Inspection & Approval	\$0.00		0.00 %
Total	\$40,321.01		100.0 %
Summary		Cost	Percent of Cost
Material		\$40,321.01	46.89 %
Labor		\$45,677.33	53.11 %
Profit		\$0.00	0.00 %
Calibration		\$0.00	0.00 %
Total Estimated Cost		\$85,998.35	100 %
Delivery Weeks		24.0	

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SECTION 3 – DESIGN

- 3.1 An approved purchase order from Orchid Monroe is required before beginning any design work (see 075P0013 and 094P0002)
- 3.2 The Orchid Monroe Tooling Manager or his representative must review and sign-off on the strip layout or process flow chart prior to the start of the design phase.
- 3.3 At 50% of completion and again at 100% of completion, the supplier is to submit one complete set of prints for approval and appropriate sign-off. The Tooling Manager or his representative will review and return the signed drawings upon approval. The supplier is to submit drawings for final approval at 100% completion of the tool prior to the tool build.
- 3.4 The original drawings and/or CAD files are the sole property of Orchid Monroe and are to be kept current and a copy in good condition is to be provided to the Orchid Monroe receiving location prior to the approval of final invoices.
- 3.5 When the die design is supplied by Orchid Monroe or a representative thereof and there is any question regarding the ability of the die to produce the part(s) to print, or to the ability of the tool to function in a trouble free manner, the Tooling Manager or his representative shall be contacted prior to the start of build.
- 3.6 Each special punch, die button, retainer or other replaceable detail is to be drawn separately, the design provided on CAD file, and paper drawings.
- 3.7 The design is to be detailed and should include the total weight of the upper die section, lower die section and total die weight. In addition, the total estimated tonnage required to produce production parts should be included.
- 3.8 Windows are to be provided in pads for access to each pierce punch and pilot. Where windows are not practical, clearance holes for the body size of the punch or pilot with a depressor hole are to be incorporated.
- 3.9 The changeover details storage area is to be shown on the die drawings.
- 3.10 The method and direction for feeding and removing parts from the die and provisions for scrap ejection are critical in the die design. Ergonomics, convenience, quick die change and safety are all to be given equal consideration during the die design phase.

**Orchid Monroe
Tooling Quotation Worksheet
Approved Supplier List**

Preferred Supplier	Secondary Supplier	Specific Items or Details
Danly Die Sets	Superior Die Sets	Pins Bushings
Vista Carbide	Innovative/Carbide	Carbide Preforms
Raymond	Danly	Die Springs
Milltown Specialties	Leech	Perforators, Bushings, Pilots
Advantage Engineering	Faith Machine	Chutes
Porter Punch	Moeller	TiN Coated Punches
L & H Carbide		Large Subcontracted Dies

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SECTION 5 – SAFETY

All dies are to be built in compliance with the FEDERAL OCCUPATIONAL and HEALTH ACT of 1970. All dies must be built to eliminate the need to the operator to place his hands or fingers within the point of operation.

- 5.1 Location of Cam Drivers: If cam drivers must be located near the operator, provisions must be made to mount guards around the cams. The driver should not pull out of the guard and the guard itself cannot create any pinch point.
- 5.2 Die lubrication requirements and safe application of lubrication must be considered to be on the Orchid Monroe approved supplier list for lubricants.
- 5.3 Design of the die will minimize the need for operators to place their hands between die pinch points and the point of operation.
- 5.4 Sufficient clearance must be provided for free shedding of die scrap and trimmings to a safe area.
- 5.5 Clearance and ease of removal of all die slugs will be incorporated into the die design.
- 5.6 Guide pins, stop blocks and load balancing blocks must be located away from the operator's area and as inaccessible as possible.
- 5.7 If cam drivers can be reached by the operator, guards must be capable of containing the spring(s) in case of failure.
- 5.8 All exposed springs must be guarded and all guards must be capable of containing any spring(s) in case of failure.
- 5.9 Auxiliary devices must be located to eliminate the possibility of being damaged during die setting and normal operation of the die.
- 5.10 All dies must have a designated flat area (minimum of two) to support a safety block for die repair while the die is in the press.
- 5.11 Escaping air must be minimized and vented away from the operator. When using air blow-off devices they must be located in such a manner as to blow air away from the operator and positioned in such a manner as to reduce noise.
- 5.12 Air devices must be engineered in such a manner as to use the minimum required force for scrap or part removal from the die.
- 5.13 Only approved air devices may be considered within the design of the die.
- 5.14 All die guarding must comply with the Occupational Safety and Health ACT (OSHA) requirements.
- 5.15 All springs must be canned or guarded ó NO EXPOSED SPRINGS

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SECTION 6 - GENERAL SPECIFICATION – DIE SETS

- 6.1 Use standard die shoe steel, two, three or four-pin die sets, unless the size and design dictates the use of castings.
- 6.2 Offset one pin or vary the diameter of one pin to prevent reversing of the die set.
- 6.3 Air vents must be provided at all guide bushings.
- 6.4 The foot-print of the die set must be in relation to the height.
- 6.5 A minimum of two 2-inch wall thickness is required at pins and bushings on sets 24x36 and larger.
- 6.6 A minimum of one inch of space is required around the perimeter of die steels.
- 6.7 All dies must be stamped with the following information:
 - 6.7.1. Part number (on punch and die sets)
 - 6.7.2. Part name (on punch and die sets)
 - 6.7.3. Tool Number
 - 6.7.4. Customer Name
 - 6.7.5. Shut-Height
 - 6.7.6. Stock Width
 - 6.7.7. Multiple
 - 6.7.8. Punch set weight
 - 6.7.9. Die set weight
 - 6.7.10. Calculated working tonnage
 - 6.7.11. Centerline of die set
- 6.8 On all die sets provide two tapped holes on the sides of the punch section to provide for die maintenance and removal of the top section. Tap size to be:
- 6.9 Each die is to be painted with the customer name and tool number on the front surface (facing the operator) of the die. The coloration is to be determined by the customer.

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SECTION 7 – DIES

- 7.1 Each die is to have clamping slots or holes in upper and lower die shoes or parallels in line with die slots to suit the designated press (JIC). Parallels, if used must have an appropriate clamping surface. Bridge clamping (hair pinning) is not acceptable.
- 7.2 Stop blocks are to be mounted over parallels if parallels are required.
- 7.3 Trim and form steel material is to be suitable for the job as required with the Tooling Engineer's or a representative's approval. All trim steels are to have proper back stepping.
- 7.4 Each steel is to be provided with a jackscrew, holes or pull dowels for removal.
- 7.5 Slug ejectors are to be provided on each notch and pierce punch where practical.
- 7.6 Each inserted type pierce and notch punch must have a hardened back-up plate and must be provided with adjustment for sharpening.
- 7.7 Progressive dies are to have a hardened front guide, self-adjustable (spring loaded) to accept material within normal mill tolerances and be provided with an easy method of skeleton removal during coil changes.
- 7.8 A positive stripper plate is to be screwed and doweled separately from the die steel it covers.
- 7.9 Progressive dies are to be provided with chutes to assist in leading material into stock guides and die sections.
- 7.10 Die buttons are to be used for piercing where possible; Shouldered buttons are not acceptable.
- 7.11 Pierce dies or pierce stations for material over .125" shall have hardened back-up plates behind each punch and bottom retainer. Hardened plates are to be under each bottoming pad.
- 7.12 Changeover locations are to be STAMPED on each die and sections.
- 7.13 Each die steel is to be STAMPED with the appropriate detail number, tool number, type of steel and heat treating specification on a non-functional surface and located in an area that will not be ground away.
- 7.14 The welding of steel tool sections is to be kept to a minimum.
- 7.15 Dies that are designed to be ran together in the same press must have the same shut height and be mounted on a common plate if under 10,000 lbs.
- 7.16 Screws and shoulder screws that are subject to vibration and abuse are to be NYLOCK coated or equivalent to assure they remain tight.
- 7.17 On dies requiring the air blow-off of parts or scrap, a 1/4" NPT hole is to be provided for a quick connect hose fitting.
- 7.18 Dies are to be arranged so that finished parts and scrap are clearly separated.
- 7.19 Pre-load of die springs is not to be compressed to more than 15% on heavy-duty springs and 25% on all other springs. Springs are to be chrome vanadium only.

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- 7.20 Each spring or nitrodyne pocket in the die shoe is to have a drain hole.
- 7.21 Keepers are to be used when practical. Shoulder screws used on pads must be removable in press.
- 7.22 Oil breaks are to be used where applicable.
- 7.23 Stock lifters or spring pins are to be used to properly locate stock in progressive dies.
- 7.24 Notching, forming and cut-off sections are to be properly heeled and keyed as required. Chamfered rails and lifters are to be provided for ease of progressing the stock through the die.
- 7.25 Scrap cutters are to be utilized where practical (12ö maximum).
- 7.26 Pitch notches and die protection will be incorporated all progressive dies.
- 7.27 Slides, pad keepers, wear plates and heeling surfaces will include grooves for lubrication and the necessary means to lubricate these areas.
- 7.28 Slide surfaces are to be hardened and/or equivalent standard wear plate utilized; a means of adjusting for wear must be provided.
- 7.29 Nitrogen pads are to be clear of the keeper or spool by 1/8ö pad travel surface.
- 7.30 Form steel stations are to be supported over parallels.
- 7.31 Heel punch holder and die against unbalanced thrust(s).
- 7.32 There will be a minimum of two screws or dowels per section or gage with proper counter bore clearance.
- 7.33 Parts and/or a strip to be shipped with the die following the Tooling Engineerø or a representativeø approval.
- 7.34 Sharp edges are to be removed in non-functional areas.
- 7.35 Blind dowel holes are not acceptable.
- 7.36 Shear and punch stepping is to be provided to reduce noise and tonnage.
- 7.37 8-10% per side die clearance is to be used on all cutting and piercing of mild steel, except for the non-closed trim areas and very low or high tensile materials.
- 7.38 Hole sizes are to be provided at the maximum blueprint dimension minus .05mm unless print shows tolerance.
- 7.39 Minimum 37mm x 85mm stop blocks are to be provided at four places, if possible, with a 1.3mm x 12mm wide lead slot. Stop blocks are to be clear by .025mm with die fully loaded at bottom of press stroke (STAMP same information on blocks). .
- 7.40 All trial material to be supplied by Orchid Monroe or their representative.

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- 7.41 Pad balance blocks are to be used where practical.
- 7.42 Feed level and die shut heights must comply with Orchid Monroe specifications.
- 7.43 Die set chamfer: Upper and Lower die shoes of all medium or large die sets are to have a 45 degree chamfer on the outside edges.
- 7.44 Heel Blocks: Heels are to located away from the operator work area whenever possible.
- 7.45 Scrap Cutters: Shall be arranged to eliminate all stiletto or needle type material trimmings.
- 7.46 Safe Removal of Scrap: Dies are to be designed to shed all scrap, with no handling required by the operator within the die area. In no case should the operator be required to reach through metal trimmings to load or unload a part or through the point of operation to remove scrap.
- 7.47 Slug Removal: Adequate clearance is to be provided for slug removal. If slugs cannot be shed out the side of the die or through the bolster, the die must be designed to permit visual inspection by the operator for proper scrap and slug removal. Each successive slug hole diameter should be 1/8" larger than the one above.
- 7.48 Automated Component Removal: When dies are designed for mechanical handling equipment, consideration must be given to the loading and unloading of these dies by an operator in the event of equipment breakdown or service production.
- 7.49 Hydraulic Devices: Should be located away from the operator side of the die. Whenever possible, these devices should be designed into a casting or behind risers to protect the operator from possible line or cylinder failure. All hydraulic lines should be connected to the die opposite the side of the operator.
- 7.50 Pneumatic Devices: Are to be placed in the same locations as that described for Hydraulic Devices above. Air blow-offs are to be avoided.
- 7.51 Noise Abatement: Whenever possible, muffler silencers should be used on the exhaust of pneumatic devices.
- 7.52 Solid striking surfaces within the die are to be avoided or the impact force is to be distributed to minimize noise. Sound absorbing coatings and sandwich construction are recommended.
- 7.53 Chutes shall be designed and installed to eliminate or minimize noise levels. Sound absorbing coatings and sandwich construction are recommended.

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SECTION 8 – UNLOADING DEVICES

Each operation requires some in-depth analysis to determine the appropriate method of part and/or scrap removal. There are several possible methods of removing parts and scrap from dies. Length, width and stability of the part, plus operational clearances many times determine the correct method for parts ejection.

- 8.1 Spring Loaded Latch Type Ejector: This type of device can be used to lift a part off lower die member and push or eject the part out of the die.
- 8.2 Air Blow-off: This is a method used to eject stamped parts while the coil is fed under the finished part. This device can sometimes be used at the last station of a progressive die to eject a finished part. The die must be designed to return the part to the feed height level. The usage of this type of method requires a thorough investigation of the safety implications involved including noise levels, air blast and ejected parts quality. Air blow off is to be avoided whenever possible.

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SECTION 9 – STRIP LAYOUT

- 9.1 Show all calculated pressure requirements for each station.
 - 9.1.1 Draw pressure (if applicable)
 - 9.1.2 Blanking pressure
 - 9.1.3 Lift rail and lifter pressure including pad pressure requirements to overcome same.
- 9.2 Identify calculated tonnage requirements by station and identify tonnage requirements in proportion to the bottom of the stroke (graphical form).
- 9.3 Identify source requirements for pressure.
 - 9.3.1 Springs
 - 9.3.2 Air
 - 9.3.3 Nitro-dyne
 - 9.3.4 Ni-dro
- 9.4 Finalized strip layouts must be approved by the Tooling Engineer or his representative prior to release for design. Strip layout to show the outline of the bed or bolster, distance between press uprights, openings in press uprights and feed direction.

APPENDIX A – Instructions for Completing Form 094F0005

Orchid Monroe Tooling Quotation Sheet Stamping Dies

Orchid Part Number:	(1)	Supplier Name:	(6)
Detail Part Number:	(2)	Address:	(7)
Revision Letter:	(3)	City, State and Zip:	(8)
Part Description:	(4)	Contact Name:	(9)
Category:	(5)	Tel:	(10)

Tool Type:	(15)	Supplier Quotation No:	(11)
Stock Width:	(16)	Supplier Quotation Date:	(12)
Multiple:	(17)	Estimated Dated of Delivery:	(13)
Piece Sets per Stroke:	(18)	Page No: of Pages	(14)
Estimated Required Tonnage:	(19)		
Feed Direction:	(20)		

Material Type:	(21)
Gauge Tolerance:	(22)

Tool Material Type:	(23)
Die Size (Front to Back):	(24)
Die Size (Left to Right):	(25)
Die Size (Top to Bottom):	(26)
Die Weight (Top)	(27)
Die Weight (Top)	(28)
Die Weight (Total):	(29)

<i>Total Cost Estimate</i>	<i>\$/Hr</i>	<i>Hours</i>	<i>Total</i>	<i>\$/Hr</i>	<i>Hours</i>	<i>Total</i>	<i>\$/Hr</i>	<i>Hours</i>	<i>Total</i>
CAD Design:	(30)								
CAD Data:	(31)								
Die Development:	(32)								
Model (Non CAD Only):	(33)								
Mold/ Cast:	(34)								
CNC Mfg:	(35)								
C-Mill:	(36)								
Build:	(37)								
CMM Certification:	(38)								
Try-out (Supplier Location):	(39)								
Try-out (Orchid Location):	(40)								
Purchase Materials:	(41)								
Misc Costs (Add Comments):	(42)								
Freight:	(43)								
Total Tooling Cost:	(44)								

Total Quotation Cost: (45)

Comments: (46)

Quoted By: (47)
Quotation Date: (48)

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Instruction Sheet for Tool Quotation Worksheet 094F00

- (1) Orchid Monroe indicates the customer part number related to the stamped part.
- (2) Indicate any detailed part number specific to the stamped part.
- (3) Indicate the last engineering change consistent with the stamped part.
- (4) Part description indicates the type of part produced.
- (5) Category indicates the reason for the part.
- (6) Supplier Name: Official Company Name of Supplier.
- (7) Company address of Supplier location
- (8) City, State and Zip code of Supplier location
- (9) Name of individual who can be reached with questions related to quotation within suppliers location.
- (10) Supplier or contact individuals telephone number including area code and country code if applicable.
- (11) Internal tracking number used by supplier location.
- (12) Date of supplier quotation.
- (13) Estimated date tool will be delivered to Orchid Monroe or desired location.
- (14) Current page and total number of pages for this quotation.
- (15) Indicate the type of tooling, progressive stamping die, blanking die, etc.
- (16) Indicate the width of the slit material required for the production of the stamped part(s) (.0000)
- (17) Indicate the multiple or feed length required for the production of the stamped part(s) (.0000)
- (18) Indicate the total number of pieces or piece sets per stroke.
- (19) Estimated tonnage required for the production of the part(s).
- (20) Indicate the direction of feed required for the tool (L to R) or (R to L).
- (21) Indicate the required gauge and material required to produce the stamped part(s).
- (22) Indicate any gauge tolerance(s) that are required to produce the stamped part(s).
- (23) Indicate the type and grade of material used to build the tool.
- (24) Indicate the die measurement (in inches) front to back of the die footprint.
- (25) Indicate the die measurement (in inches) left to right of the die footprint.
- (26) Indicate the die measurement in the closed position top to bottom.
- (27) Indicate the total weight (in lbs) of the top section of the die.
- (28) Indicate the total weight (in lbs) of the bottom section of the die.
- (29) Indicate the total weight (in lbs) the complete die.
- (30) CAD designs if applicable- if purchased please note in comments.
- (31) CAD please identify all costs required to produce machining program.
- (32) Indicate all costs related to binder development.
- (33) Indicate any modeling charges relative to the tool design and/or build.
- (34) Indicate any casting or molding charges relative to the design and/or build.
- (35) Cost associated with CNC Mfg of the die details
- (36) Cost associated with die detail milling
- (37) Identify all other labor, material, etc., Costs associated with the build of the tool.
- (38) Identify all costs associated with certification of piece parts.
- (39) Identify all costs associated with die try-out at supplier location.
- (40) Identify all costs associated with die try-out at Orchid Monroe location.
- (41) Identify all major material cost components.
- (42) Identify any costs not covered above.
- (43) Delivery charges of shipping completed tool to Orchid Monroe location.
- (44) Total Hours and US Dollars for tooling quotation.
- (45) Grand Total and US Dollars for tooling quotation.
- (46) List any comments, notes, concerns and considerations not covered above or pertinent to the build of the tool.
- (47) Name of individual responsible for quotation (suppliers representative)
- (48) Date of Quotation.