



**Lockheed Martin Aeronautics Company**  
**Supplier Tooling Manual**  
**(Tool Manufacturing Specification - Material Control - 015)**  
**TMS-MC-015**

**Applicable to**  
**FORT WORTH – MARIETTA - PALMDALE**  
**Sites**  
**To the extent specified herein**

**REVISION 28**

CONTROLLED AND APPROVED BY:

**Lockheed Martin Aeronautics Company**  
**Supplier Quality Management**

**June 2013**

\* REVISED

\*\* ADDED

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## **PART I**

### **AIRCRAFT ITEMS AND TOOLING - SELLER REQUIREMENTS**

#### **1.0 SCOPE**

\*





\*\*2.9.6 The following are additional types of Control Tools;

- COMG – Component Master Gage
- FCGA – Facility Gage
- MSFM/TOFM - For contour only. Lines on MSFM/TOFM shall be for reference only and Seller may revise or add these lines to satisfy their production tool requirements without prior written authorization from Buyer.
- MSGA – Master Gage, not to be used for Production “Part” validation
- MSPE – Master Plate
- PDSE – Production Samples (Tube)
- TOGA – Tooling Gage
- TOSE – Tooling Sample (Welded Tubes/Ducts)

Any tool identified by this PO and provided as a control tool

2.10 Manufacturing Engineering Data Model (“MEDM”) – An electronic Computer Aided Three-Dimensional Interactive Application (“CATIA”) model used to fabricate designed or non-designed tools. The MEDM may contain contour, reference lines, attach pattern, periphery, tooling holes, text, etc. in any combination for tool fabrication and/or the tool design. The MEDM may contain specific inspection points designated by Buyer’s Integrated Product Team (“IPT”). The inspection point coordinates can be recorded electronically and can be displayed on a paper plot of the MEDM. A Coordinate Measuring Machine (“CMM”) or other inspection device control program may be created from the MEDMs containing inspection point information defined by Buyer.

\*2.11 “Production/Project Tools” means jigs, fixtures, dies, and other tools made for use in manufacturing items in a production environment.

2.11.1 “Convenience Tools” are typically Production Tools and are Buyer Furnished for the convenience of the Seller with an option to use for this PO. However, this type tool can also be a Tooling Tool to be used at the Seller’s convenience for tool coordination or production tool manufacturing. Seller shall validate condition and accuracy of such tools prior to use.

2.12 Electronic Supplier Problem and Resolution (“e-SPaR”) - This online system is available on the Buyer’s Supply Chain Management Homepage at <http://www.lockheedmartin.com/aeronautics/materialmanagement> and is the approved system for Seller to





considered tooling used as a MOA and is subject to Periodic Inspection and Verification (PI/V) per Part I, section 11.

\*\*2.17 Key Characteristic (KC) is an attribute or feature whose variation has a significant effect on product fit, form, function, performance, service life or producability, that requires specific actions for the purpose of controlling variation.

### **3.0 INTERCHANGEABLE- REPLACEABLE (“I/R”)**

\* 3.1 Seller shall comply with I/R requirements imposed by this PO or IWTA and shall place all production tools that controls an I/R feature into a periodic recall cycle as specified in this Manual. This is applicable to Buyer Furnished or Seller Owned tooling. Part IV of this Manual provides I/R and “To Match” coordination requirements.

3.2 “Interchangeable Items” – are completely finished and have designed/controlled features which allow them to be installed, removed, or replaced without alteration, misalignment, or damage to installed or adjoining Items. Interchangeable Items require only attaching means (bolts, nuts, screws, pins, etc.) to install. Interchangeable Items do not require any fabrication operations such as cutting, filing, drilling, hammering or forcing at the point of installation.

3.3 “Repla filing, drilling,

Tool Code

Purchase Order number (or other authorization) under which the tool was furnished to or fabricated by Seller

The Government or Commercial prime contract number indicated in this PO and, if applicable, type of Item (e.g., ST, STE, SE, MTE, etc.)

Serial number of the shipping document for tools received by Seller from Buyer or authorized party and all packing sheet information.

Tool location within "Seller's" facility, Sub-Tier Seller's facility, rework, progressive inspection, calibration, maintenance and acceptance dates

Copy of the completed Certified Property List CPL Form 11300 provided by Buyer (See Reporting Requirements in 6.0).

Indication that tool is accountable to Buyer

Authority for disposition of tools which are no longer in Seller's possession

5.2 Seller, on a current basis, shall maintain tool designs, sketches, photographs, and schematic drawings used in the fabrication, testing, or calibration of tooling. Seller shall show tool manufacturing tolerances on the tool design. Seller shall provide Buyer disposition for this data, as requested, at the same time disposition for related tooling is given.

5.3 Prior to any tool fabrication, Seller shall notify Buyer assigned Quality Representative, submit a copy of Seller's tool designs or concepts for Seller-owned and supplemental tools, including casting and forging tools, to Buyer for review and approval of concept for applicable tooling. If Buyer deems it necessary, Buyer, through its program Manufacturing Engineering, will provide concept or design changes to Seller.

## **\*\*6.0 REPORTING REQUIREMENTS**

6.1 In addition to FAR mandated inventory/survey requirements, Seller shall list tools authorized by this PO on Buyer's Certified Property List (CPL) Form 11300, which is available on the Buyer's Supply Chain Management Homepage at <http://www.ate-0u>

\*6.2 Certain types of tooling, as mutually determined by Seller and Buyer, are exempted from CPL reporting requirements. One example of exemption would be unique forging die tooling and potential Protected Seller designs and manufacturing processes. Refer to paragraphs 5.1 through 5.3 for inventory/record requirements.

## **7.0 CONTROL OF BUYER-FURNISHED TOOLS**

7.1 Seller shall acknowledge receipt of all tools, including ST, SE, MTE and STE, by the signature of an authorized representative of Seller on the CPL and return as requested by Buyer. Federal Acquisitions Regulation, FAR Part 45, 45.506, provides Sellers with specific instructions, as applicable to this PO.

7.1.1 Seller's Quality Management System (QMS) shall provide calibration or testing procedures capable of verifying configuration control of Seller-owned or Buyer-furnished Tooling, SE, MTE and STE.

7.1.2 Seller's QMS shall include identification and configuration control procedures for Buyer Furnished ST.

7.1.3 Seller shall provide verification of compliance upon request from Buyer or Buyer representative.

7.1.4 Seller shall control tool traceability by ensuring all tool identification labels, plaques and removable details of tool are stored, handled, used and transported appropriately to prevent loss of any items associated with Buyer Furnished Tooling.

\*7.2 Upon receipt of sealed tool containers, Seller shall notify Buyer's Representative to break the seal of the container and visually inspect the tool and contents for completeness and/or damage. Sealed containers indicate that the tool is a "Control Tool

repaired tool is coordinated to designated control media. Additional I/R and non-I/R repair, preservation and coordination guidance are provided, but not limited to, Part IV of this Manual.

7.3.3 Seller shall initiate a SATR to receive Buyer authorization for rework and/or repair of Buyer-furnished ST.

7.4 Seller shall maintain Buyer Furnished tooling in a usable condition capable of producing the original, or any subsequent Item configuration, including spares, unless changes made by Buyer's engineering are retroactive to the original point of effectivity of Item. Seller shall accomplish this by fabricating other Control Media for its use, or from Buyer-furnished Control Media.

7.5 When Buyer authorizes rework and/or modification and when a tool is capable of producing earlier configurations, Seller shall re-identify the tool to the new configuration Item number. When Buyer-authorized rework and/or modification will render a tool incapable of producing earlier configurations without extensive alteration, Seller shall notify Buyer prior to continuing any rework and request additional specific instructions for tool rework, or for potentially manufacturing new additional tooling.

\*\*7.6 Seller shall request from Buyer, Form 11539 Loss, Theft, Damage & Destruction, (LTDD) when Government Property is lost, stolen, damaged, or destroyed and shall complete the Form along with any supporting documentation.

\*7.7 Seller shall submit an e-SPaR with itemized listing of any Lost, Damaged, or Destroyed ("LTDD") U.S. Government Tooling to Buyer. Seller shall also include the following information on the e-SPaR submission for LTDD tooling:

- A narrative description of the incident and corrective action taken to prevent recurrence
- Original Purchase Order number
- Original Purchase Order line Item number
- Original tool number – where applicable or for replacement of ST only
- Original Tool Code – where applicable or for replacement of ST only
- Original tool asset number (barcode number) – where applicable or for replacement of ST only

## 8.0 TOOL QUALITY CODE CATEGORIES

8.1 Seller shall fabricate all tools to the quality code stated in this PO. If no quality code is imposed or "Buyer Accept at Source" is not stated in this PO, Seller fabricated tools shall be quality Code 2 below and shall be identified as defined in Part II, paragraph 2.1.

8.1.1 Seller shall coordinate manufacturing of such tools with Buyer's Assigned Quality Representative to establish applicable points of validation, inspection, coordination or verification, if any.

8.2 "Code 1" – These tools are made of the best and most durable practical materials available. They are capable of producing Items with critical tolerances at an accelerated production rate without addition or changes in construction. However, duplicate tools may be required by Buyer in some cases.

8.3 "Code 2" – Incomplete and/or low production rate quality tools that can be revised at a later date to meet the needs of an accelerated production program (capable of being reworked to Code 1 tools). Combined operational tools comparable to Code 1 tools used for performing multiple operations. Tools that can be revised by separating them into Items or sections to make one or more Code 1 tools if required by production scheduling.

8.4 "Code 3" – Permanent type tools made from moderately priced materials and used for low production rates or a limited number of ship requirements. These tools must be capable of holding blueprint





11.1.1 Seller shall place all Buyer-furnished or Seller-owned Inspection Gages or Check Fixtures into a PI/V recall cycle, if such tools are used as the only means of acceptance for such features.

An example of such tool would be an inspection/check gage that is used to validate contour, holes, cut-outs, etc., and is the sole source of validating that feature.

11.1.2 Seller shall place all tooling that controls I/R into a PI/V recall cycle.

11.1.3 Seller shall utilize the coordination tolerances provided in Part IV of this Manual and PM-4053 or applicable coordination tolerance between tools specified by Buyer's Tool Design.

\* 11.1.4 Seller shall place all tooling used as a media of acceptance that establish features with an engineering or tooling tolerance of +/- .XXX (.010) or tighter tolerance into a PI/V recall cycle.

**Note: If tool design of "selected tooling" includes sheet with specific PI/V requirements, the features specified on the sheet shall be re-verified on an annual basis, including all other features established by the tool that are not verified by physical inspection or other measurement methods.**

\*11.1.5 Seller shall place all tooling, designated by this PO to take precedence over engineering, into a PI/V recall cycle, and all critical features or Key Characteristics (KC's) established by a tool shall be re-verified on an annual basis to maintain configuration control. See Part IV for precedence over engineering statements.

11.1.6 Seller shall verify any feature(s) of a tool, upon request by Buyer's representative, to Tool



11.3.1 Sellers working under an IWTA shall use Request for Engineering Action (REA) System, only if applicable.

11.3.2 Sellers working under an IWTA shall be responsible for control, preservation, PIV and maintenance as defined in this manual and PM-4053 as applicable to Seller's Quality Management System and IWTA.

11.4 Seller shall place all "Inactive" tooling used as

- Buyer or Seller Tool Code, if available
- Buyer-assigned part number
- = Next PI/V recall date
- = Quality acceptance verification
- Control Media used, if applicable, shall be recorded in the PI/V record
- History of previous PI/V
- Date of PI/V
- PI/V check sheet (if applicable)
- Inactive tools, if applicable

12.2 Upon Buyer or Buyer Representative's request, Seller shall present the PI/V record.

12.3 Seller shall update or revise the data in its PI/V record to meet the requirements of 12.1 on the next PI/V cycle of each tool.

### **13.0 BUYER FURNISHED TOOLING AND SELLER TO SELLER TRANSFER OF TOOLS**

13.1 Sellers authorized by Buyer to ship tools to another Seller shall ship tools according to Buyer's authorization and Part I, section 10.0 of this Manual.

\* 13.2 Sellers authorized by Buyer to receive tools from another Seller shall re-verify Buyer transferred or Buyer Furnished tooling per tool type requirements in Part IV of this Manual.

### **14.0 LOCKHEED MARTIN SUBCONTRACT SOURCE BOOK**

14.1 Subcontract Source Books (SSB) are unique and are only applicable to LM Aero-Marietta's C-130 Program if specified by this PO and Buyer's Statement of Work (SOW). Otherwise, the TMS Manual is fully imposed and shall take precedence when discrepancies exist between this Manual and the SSB, when Quality Appendix QX or QI is imposed, referenced, or declared by this PO.

14.2 Any deviation or exceptions shall be authorized only by C-130 Program Management and shall be

## PART II

### MANUFACTURED SPECIAL TOOLING - SELLER REQUIREMENTS

**1.0 GENERAL** – Part II of this Manual is applicable to all domestic and international Sellers that manufacture, rework, or repair ST, and is in addition to requirements defined in Part I.

1.1 Buyer's tool design and manufacturing specifications are defined in PM-4053. Only Sellers authorized by PO to perform manufacturing, rework, or repair are granted access to this Protected Data website. Seller shall contact its Buyer for access authorization. See Part I, section 2.15.

#### **\*2.0 NON-RECURRING TOOL MANUFACTURING**

2.1 Parts Manufacturing Seller's authorized to manufacture tooling that facilitate delivery of items to Buyer shall permanently identify all such tools as specified in PO Appendix T. If specific identification and ownership requirements are not defined by this PO, then Seller shall submit an e-SPaR to Buyer requesting assigned Asset number(s) and identify such tools per the following examples;

- a. Buyer Part Number/Dash Number: Example – 16B1944-29, 5HF45776-103, 2WSJ12345A1
- b. Buyer Asset Number: Example - D123456, M081234, or as directed by this PO.
- c. Ownership: Lockheed Martin or U.S. Government (as applicable) by this PO.

\*Note: If authorized tool consist of multiple loose items, details or supplemental tools, Seller shall identify such items with the same asset number followed by appropriate "Part 1 of X", etc. to minimize separation and loss of details.

2.2.1 Seller owned tools shall be identified per Seller's tool identification procedure.

2.2. All Special Tooling covered by this PO, whether furnished to Seller or acquired or manufactured by Seller or its Subcontractor(s), is the property of the Buyer or the U.S. Government and shall not be used in the production, manufacture, or design of any article for any other use, unless the Buyer consents in writing. Buyer shall not consent to the use of Government-owned Special Tooling without prior written U.S. Government consent.

\*2.3. Careful consideration should be used in determining NR tool types for this PO. Special Tooling should be limited to Quality Code 2 through 5 as defined in Part I, section 8.0, as Low Dollar, Non-Critical, Non-Complex, Non-I/R, or Non-LM Aero Designed, to minimize any potential manufacturing risk.

\*\*2.4 Parts Manufacturing Sellers authorized to manufacture tooling, shall notify Buyer's Quality Representative to determine appropriate level of Buyer representative oversight throughout manufacturing and acceptance.

**Complex/Controls Configuration** Example of a complex tool would be a tool used to establish a feature, e.g., Holes, I/R Holes, or surface or close tolerance dimensions. Example of a Control Tool would be a tool used for coordinating other tools that are used in the manufacturing process or a tool used directly as a Gage or Inspection media. Supplier shall coordinate manufacturing of such tools with Buyer's Quality Representative to determine appropriate level of oversight required during manufacturing and or Final Acceptance, if necessary, and such tools shall be placed into a



specifically identified for inclusion in Buyer's BTP, into the PIL, but is not required to log one (1) and two (2) place dimensions, (1 place for metric) in the PIL.

3.6 Seller shall include a statement in the PIL to document inspection and acceptance of all one and two place dimensions (1 place for metric).

3.7 Seller shall document tooling anomalies, requests for deviation or waiver, and other non-conformances, if any, identified during or subsequent to Seller's tool manufacturing and acceptance process by submitting a SATR.

3.8 Seller shall plan the following criteria as inspection points and milestones that Seller shall present or provide as verification to Buyer's Representative prior to final acceptance, final approval or final certification, or as otherwise specified by this PO. The following criteria are not all inclusive and shall be reviewed and discussed between Seller's and Buyer's representatives upon Seller's receipt of this PO.

- Verify closure of all SATR's and E-SPaR's
- Verify 95% Tool Design approval from Buyer, if applicable
- Verify Tool Plaque is stamped in the correct blocks releasing the tool for Trial Run or Production use per PM-4053
- Verify Special Processes, if applicable, are performed per PM-4053, i.e., NDI, Heat Treat, etc.
- Verify paint application per PM-4053
- Verify flow-down of requirements to sub-tier suppliers, if any, per Appendix QX
- Verify the applicability of a "Delta" FAI or Fit Check requirement for all rework or repair authorizations
- Verify coordination of tool, if applicable, to Control Tools per Tool Design and PM-4053
- Verify all inspection data, electronic and mechanical, have been documented and prepared for shipment with tool, if applicable
- Verify Tool identification is per this PO and/or PM-4053 as applicable
- Verify ownership marking is per this PO and/or PM-4053 as applicable
- Verify loose details are stored and shored per PM-4053
- Verify loose details are identified per program requirements per PM-4053
- Verify I/R markings are per PM-4053 and that Tool Design clearly identifies I/R features and flag notes are used for identifying these features per this Manual in Part II, section 8.0 for production tools
- Verify I/R identification on tool contains mandatory I/R statement per PM-4053
- Verify if PI/V identification is noted on tool plaque, if applicable
- Verify Heat Thermal Survey applicability per PM-4053
- Verify material certifications and Certificates of Conformance (C of C)
- Verify Progressive Inspection Logs have been completed as required in this Manual
- Verify applicable leak checks have been performed per PM-4053, as applicable
- Verify fiberglass plies and resin are per PM-4053 requirements, if applicable
- Verify potting compounds are used for bushing placement per PM-4053, if applicable
- Verify all potted bushings coordinate to coordinating tool per PM-4053
- Verify all hole and drill bushing identification is per Tool Design
- Verify Shipping/Storage container per Tool Design and PM-4053, if applicable
- Verify Shipping documents are correct per this Manual and Buyer's Shipping Requirement PM-5010, or as specified by Buyer in this PO
- Verify tool protection requirements have been accomplished per PM-4053 for shipment to final designation, e.g., Overseas, Domestic.

3.9 Seller shall stamp the DS228 Tool Identification Plaque as defined in PM-4053 for tool identification by placing Seller's quality stamp and date in the Trial Run block if Trial Run Type I, II or III are specified on this PO. If Trial Run Type IV is specified on this PO, Seller shall place "N/A" in the Trial Run block and place Seller's quality stamp and date in the Production block. Tool identification plaque requirements are



7.2 Seller shall notify Buyer if discrepancies exist between Tool and Tool Design as required in Part I, section 2.13.

## 8.0 INTERCHANGEABLE-REPLACEABLE (“I/R”) DESIGN AND MANUFACTURING

8.1 Seller shall design and manufacture **all** tooling containing I/R features as defined in PM-4053.

8.2 Seller of Buyer authorized “design and build” tooling shall design I/R tools as illustrated in Figure 1 and PM-4053 **Section 2.4**.

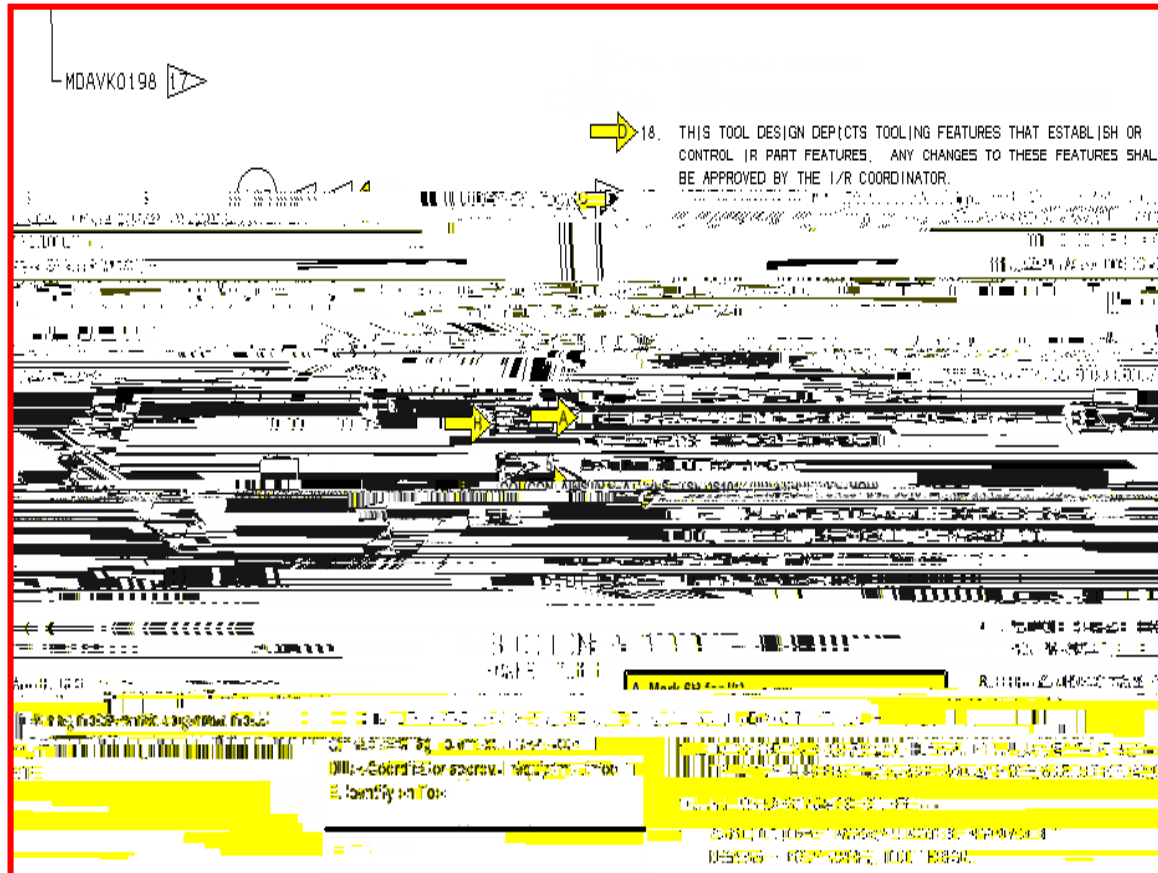


Figure 1. I-R Tool Design Requirements

## 9.0 NON INTERCHEABLE OR REPLACEABLE (I/R), DESIGN AND MANUFACTURING

9.1 Seller shall receive written authorization to design and manufacture tools, once submittal of design, sketch, drawing, concept or schematics have been approved by Buyer’s program personnel.

9.2 Seller shall notify Buyer’s Quality Representative when written authorization has been received. Seller’s Buyer Quality Representative shall jointly develop an applicable validation process of all special processes, critical dimensions, leak checks, or any unique point in the manufacturing process.

**END PART II**

## **PART III**

### **INTERNATIONAL SELLER REQUIREMENTS**

#### **1.0 GENERAL**

1.1 Part III is applicable to programs in which Buyer furnishes Seller with Items and/or material to support Buyer's BTP, and is in addition to the requirements of Part I and Part II of this manual.

1.2 Fabrication requirements of ST, STE, and MKT by Seller or Seller's sub-tiers to produce Buyer-designed controlled Items and aircraft modifications, as specifically contracted by this PO, are defined in Part II of this Manual and controlled by PM-4053, Section 10.0.

#### **2.0 CONTROL OF SE, MTE AND STE**

2.1



3.2 Seller shall return to Buyer the stamped and signed Tool Rework Form document and CPL upon completion of Buyer authorized rework or repair per PM-4053, section 10.0.

**4.0 TOOLING PRACTICES FOR BUYER-FURNISHED TOOLS – Category**

**8.0 TOOLING USE AND TOLERANCE REQUIREMENTS** – Seller shall comply with the tool usage and tolerance requirements as defined in PM-4053, unless unique requirements are otherwise specified on the Statement of Work (“SOW”), BTP, or this PO.

**9.0 QUALITY ASSURANCE REQUIREMENTS OF SELLER-OWNED OR SELLER-FABRICATED PRODUCTION TOOLING**

9.1 Seller shall submit applicable data of all Seller-fabricated or Seller-owned production tooling to Buyer’s Program Management for review and approval prior to release of tool for trial run or First Article Inspection (“FAI”). Such data may include, but is not limited to, engineering data, drawings, designs, Master Layouts (“MEL”), etc. In addition, Seller shall use data generated by Trial Run to satisfy Buyer’s FAI requirement, if witnessed by Buyer’s Representative or designated alternate.

9.2 Seller shall inspect all Seller-fabricated production tooling, which has been manufactured utilizing Buyer-furnished Control Media, by utilizing applicable tooling tolerances defined in PM-4053.

9.3 Seller shall inspect or re-verify subsequent parts produced utilizing Seller-fabricated production tooling to the criteria defined in PM-4053.

9.4 Seller shall ensure each Item manufactured with Seller-fabricated ST and STE is identified in a conspicuous place with the current part number and dash number, Tool Code, any peculiar tool number, the “Also Use” current part number (if applicable), and/or Engineering Change Notice (“ECN”). Seller shall identify STE and MKT as “Property of USGOVT” and ST as “Property of Seller”, or as directed by this PO.

**END OF PART III**

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## PART IV APPENDICES

Engineering Drawings for the features they represent. Production tooling produced and coordinated to such Master Control Tooling serves as the primary means for creating and accepting controlled product features. Reference PM-4053, section 3.1.3.5.

2.3 "For C-130 and C-5 programs, the furnished Special (Project) Tools shall be considered the Engineering definition of the features they control unless otherwise noted in this PO. If through investigation, any such tool feature is found to produce results non-conforming to Engineering Drawing specifications, then the same must be reviewed for corrective action as necessary, unless it is created by program Master Control Tooling". Reference PM-4053, section 3.1.3.5

2.4 Order of Precedence for Manufacture of the P-3/CP-140 ASLEP Kit (LG05ER0167) provides direction for the implementation and management of variation between Engineering Drawings and Tooling (Control Media) for the P-3/CP-140 aircraft. Specifically, this document provides direction for policies and processes to resolve dimensional conflicts between Engineering Drawings and accountable Special (Project) Tools for all P-3 and P-3 derivative programs, including CP-140. This document is applicable to P-3/CP-140 ASLEP kit manufacturing at all LM Aero facilities and suppliers. Reference PM-4053, section 3.1.3.6.

### **3.0 PRESERVATION OF BUYER-FURNISHED TOOLS**

\*3.1 To ensure the preservation of Buyer-furnished tools, Seller shall:

Provide adequate storage space to ensure Buyer Furnished tooling is not abused, stacked, constrained, or uncontrolled in a manner that may contribute to a loss of configuration.

Maintain all Buyer-furnished tools in a rust-free and/or non-contaminated condition before shipping, storing, or placing into production.

Use and store inside a building and handle with care at all times all fiberglass and composite tooling to prevent accidental damage to critical points, surfaces, holes, etc.

For fiberglass and composite tools stored in a controlled area other than 75 degrees +/- 10 degrees, Seller shall protect such tools from excessive adverse conditions of heat, cold, sunlight, and moisture. In addition, when fiberglass and composite tools are subject to temperatures outside these limits, use such tools only after a period of temperature stabilization.

Ensure a period of 24 hours stabilization for each 10 degree change from 75 degrees which is these limitk22.53n.apgentatiopam.2(.).8.3ssedure 802.3(72 h)6.4(ou)5.-3.2(611 -1.149 TD10 Tc0 Tw( )Tj/TT9 1 T







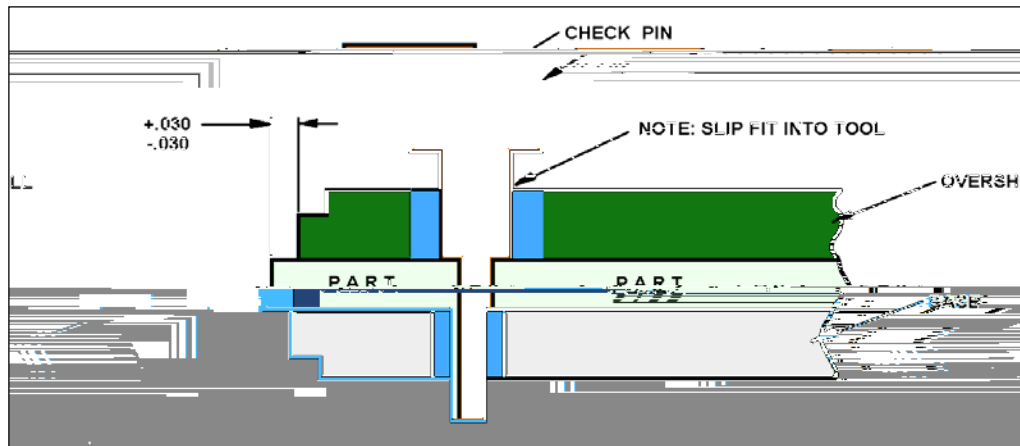


Figure 3. DOUBLE RAIL (REPLACEABLE, AND NON I/R, NET OR WITH EXCESS)

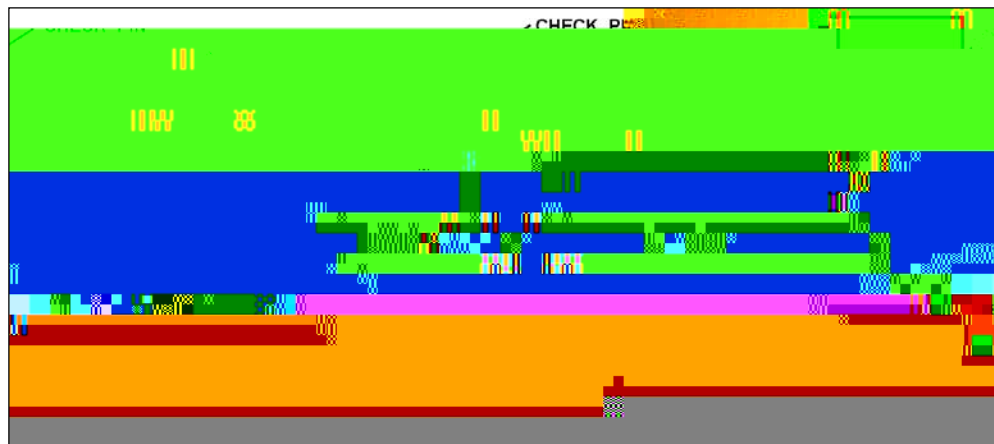


Figure 4. SINGLE RAIL SETBACK TYPE (REPLACEABLE, AND NON I/R, NET OR WITH EXCESS)

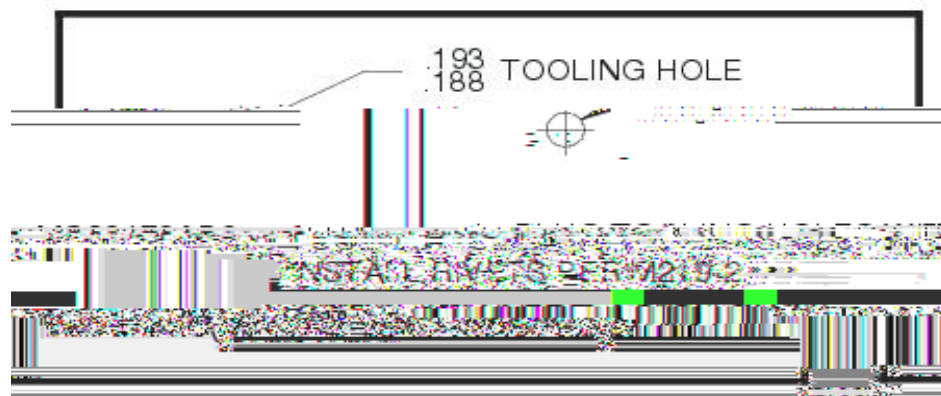
\*\* 4.2 Holes and MYLAR or Flat Pattern Plots Used For Coordination and Production Acceptance,

Produced tooling holes in Production Items shall have a hole size tolerance of  $+.005/-0.000$  and are located within one-half of such tolerance.

Fort Worth programs generally require Tool Holes to be  $.187$  and Marietta programs require a Tool Hole size of  $.250$ . See PM-4053 section 3.4 and 4.3.

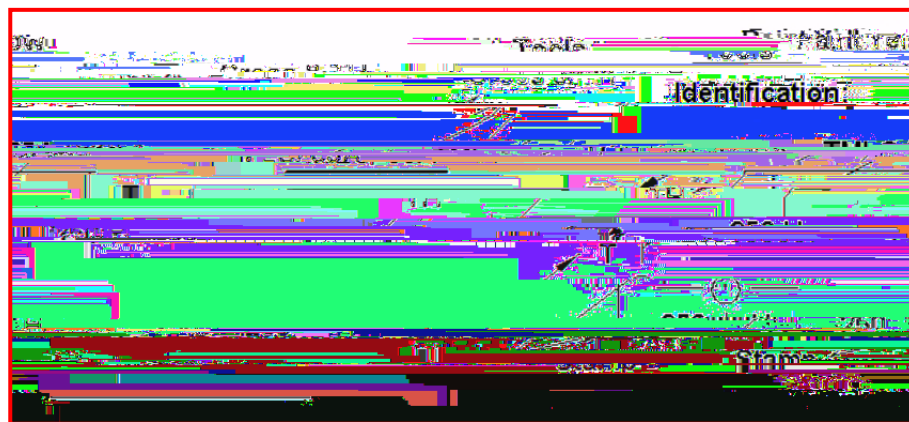
Locate and identify tooling holes on Item(s), as directed by Buyer. When Seller must plug tooling holes, Seller shall provide a general note to that effect as illustrated below.





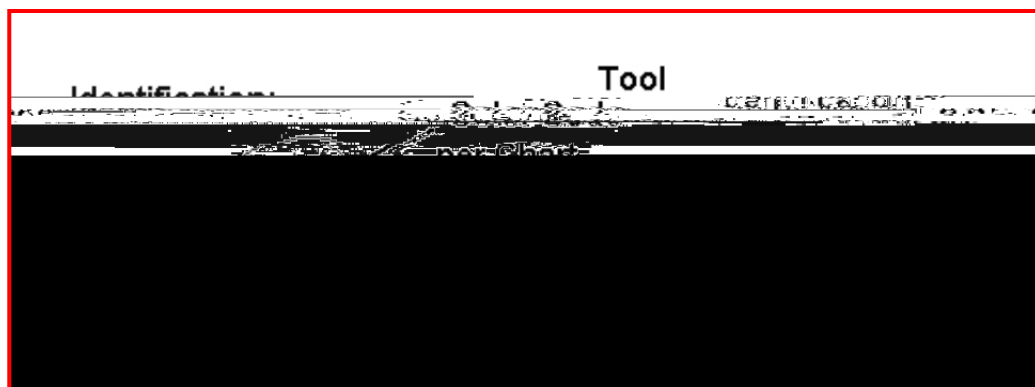
**Figure 5. Plugged Tool Hole Example**

\*\* 4.2.1 “Tool Holes” are holes used to locate parts through a sequence of fabrication operations or to locate parts in an assembly tool. These holes are drilled in the part by use of drill bushings.



**Figure 6. Typical Tooling Hole and Identification of Tooling Holes**

\*\* 4.2.2 “Pin Holes” are used in sheet metal parts for the purpose of locating part to perform necessary operations. Normally these holes are in a “tab” or in the excess area of a part. Size is “F” (.257) diameter unless otherwise specified.



**Figure 7. Typical Pin Hole and Identification of Pin Holes**

\*\*4.2.3 "Construction Holes" are holes placed in the tool for construction and/or inspection of the tool. These holes must be "soft plugged" in any tool which will be used for a drilling operation, before released for production use. Identified by painting green. Per Color Code Chart in PM-4053, section 4.3.

4.3 Mylar's or any Buyer furnished Engineering Plot shall be utilized as directed by this PO, and tolerances shall be measured from the center of the plotted line the entire circumference of the part or feature within the part. Tolerance shall be the width of the line, regardless of line width for non-I/R tooling. Line width is usually .020 in width. I/R tooling tolerance shall be as noted on Tool Design or Engineering Drawing.

4.3.1. With this method of inspection, set the contour first with specified restraint in the established plane, if necessary, and then verify the Edge of Part (EOP) or feature to furnished Mylar or Plot.

4.3.2. The Plotted Line is the total tolerance for Non-I/R parts.

### \*5.0 STANDARD I/R IDENTIFICATION AND REWORK

5.1 Seller shall manufacture, rework, or repair I/R production tooling, only from Buyer Furnished control media, e.g., Control Tools and Electronic Data, and identify all production tooling establishing an I/R feature of a deliverable Item to Buyer as follows:

I/R shall be fabricated per applicable program I/R program document for production tools  
All I/R identification shall be applied using "Krylon #2101- Cherry Red" Paint  
All applicable holes, cut-outs, perimeters, etc., of production tools shall be identified with a ¼" band of the specified paint for all programs except F-35 program, which requires a 1/8" band.

Tooling for the C-130, C-5, and P-3 programs is excluded from the requirement to paint I-R "features" RED for identification purposes, but shall require the DS-1017 Label for Fort Worth Tools or a GMN001, GMN002, or a GMN003 Label for Marietta Tools as specified, and the features shall be identified on the assembly engineering drawing.

The paint shall not be applied to mating, locating, or surfaces subject to wear.

A note applied to tool stating: "This Tool contains Interchangeable and/or Replaceable (I-R) Features" in ½" high letters or as practical. Note should be clearly visible to anyone using the tool.

Use of the I/R Identification Label is acceptable as illustrated in Figure 8.



Figure 8. I/R Identification Label

5.2 In addition to the above identification, fiberglass Router Fixtures and Drill Fixtures shall have a special router guide surface which provides a visual indication of wear. The wear indicator consists of a groove cut into the I/R perimeter of the tool at a specified width and depth per illustration in Figure 9.

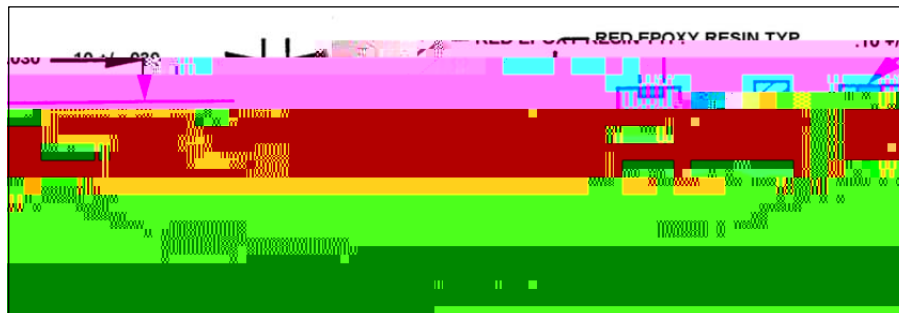
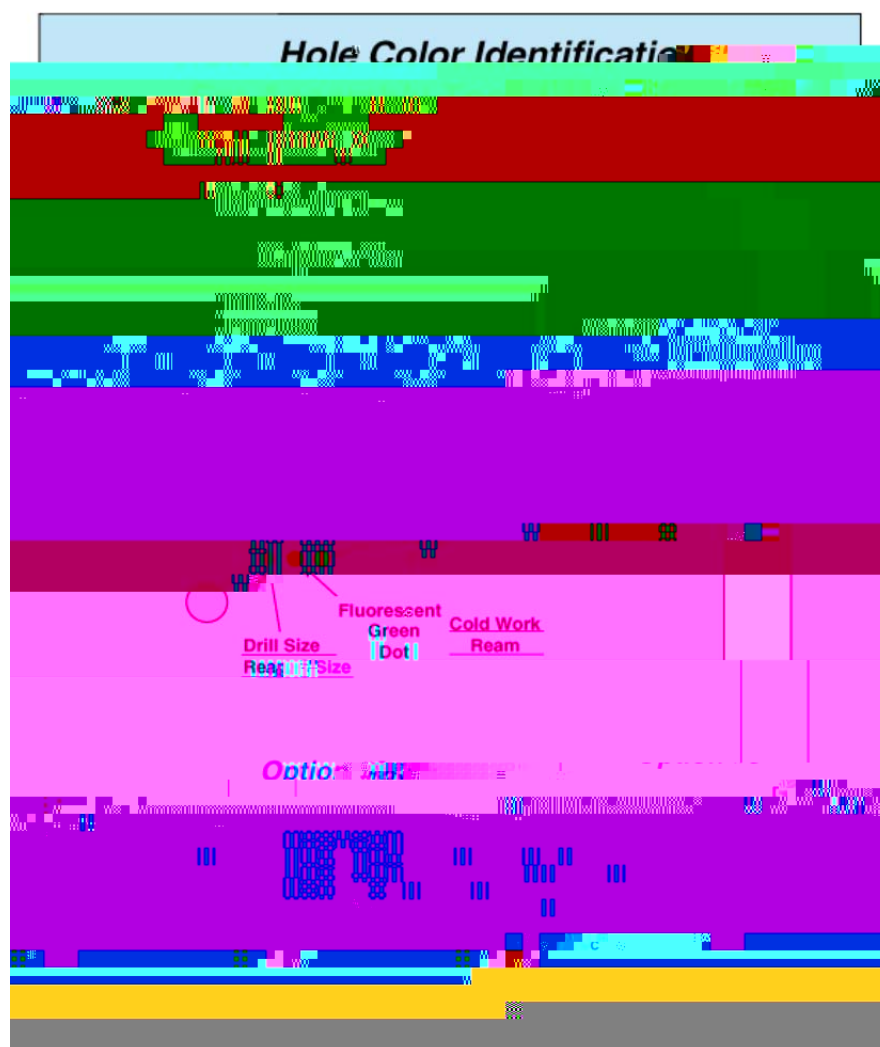


Figure 9. Example of I/R Wear Groove Indicators

5.3 Seller shall identify F-35 I/R Holes with a 1/8" band of red paint around each hole or group of holes as illustrated in Figure 10 and Figure 11.



\*Figure 10. I/R Hole identification Options (All Fort Worth, Marietta: F-35 only)

**Figure 11. I/R Hole Identification Example Only**

5.4 Unique Tolerances for Legacy Program Tool Holes and Excess Material as specified below.

Non-Designed C-130 and P-3 tools that are controlled by Tooling Tools, shall have a hole

- 5.10 For Bushing Installation – During the manufacture of new tools and reworks, Seller shall utilize tooling pins with  $+0.0000/-0.0002$  tolerance to install all tooling bushings (ref.: Table 2.0 and Table 3.0, Transfer of hole pattern).
- 5.11 For Inspection of Control Tool Bushing Wear – Seller shall inspect control tool bushings to ensure the maximum wear is limited in accordance with Table 1.0 and Table 2.0. Seller shall not use any control tools where bushing wear exceeds the maximum wear tolerance of  $+0.0010$  on the inside diameter.
- 5.12 For tool inspection requirements of I/R tool coordination (applicable to new make, rework, and coordination orders), Seller shall only utilize check pins which are AISI01 tool steel with a heat treat callout of RC 55-65 for pins with a diameter of  $.2500$  or larger, and a RC 38-48 for pins with diameters smaller than  $.2500$ .
- \*\* 5.13 I/R features shall be identified on the Tool Design with flag notes. For I/R tools designed after 01/01/2006, the I/R features will be shown or referenced on the last sheet of the Tool Design to facilitate tool fabrication, rework, and Periodic Inspection/Verification (PI/V). For the C-130, C-5, and P-3 Programs, I/R features that are controlled by the tool will be identified by the Production Design Outline (PDO) and will not be identified on the Tool Design.

#### **Table 2.0 Coordination Check of Control Tools**

#### **Table 2.0 Coordination Check of Production Tools**

**[Table 1437 7C2nthe C-1T0 -/TT4 -1.149420.4-7.67 .83re-.002)T/T**

**Table 2.0 Coordination Check of Production Tools**

HOLES UNDER .250	STRAIGHT PINS	HOLES .250 AND OVER
Nominal +.0001/+.0004 Nominal +.0000/-0.0002 Nominal +.0001/+.0004	Transfer of Hole Pattern (New Make) C/T Bushing I.D. Tolerance Pin Tolerance P/T Bushing I.D. Tolerance  Coordination Check of Control Tools to Prod. Tools	
Nominal +.0001/+.0010 Nominal -.0020/-0.0025	Bushing I.D. Tolerance Pin Tolerance	

5.14 Seller shall utilize step pins, as illustrated in Table 3.0, to perform a verification check of production items to production tools. Seller shall ensure the check-pin diameter is made to the low engineering range of the hole diameter being checked with the pin diameter tolerance as shown in Table 3.0.

**Table 3.0 COORDINATION CHECK OF PRODUCTION TOOLS**

HOLES UNDER .250	STEP PINS	HOLES .250 AND OVER
Nominal $+0.0001/+0.0010$ Nominal $+0.0000/-0.0002$ Nominal $+0.0000/-0.0030$ .0005 Max	Coordination of Production Parts to Production Tools (Using Step Pins)  P/T Bushing I/D Tolerance Lg. Dia. Pin in Tool Sm. Dia. Pin in Part Concentricity	Nominal $+0.0001/+0.0010$ Nominal $+0.0000/-0.0002$ Nominal $+0.0000/-0.0030$ .0005 Max

C/T - CONTROL TOOL	I/D - INSIDE DIAMETER
P/T - PRODUCTION TOOL	O/D - OUTSIDE DIAMETER

\*5.15 Seller shall verify I/R tooling tolerances are as follows:

Master Tooling is net (nominal).

Master Tooling to Production Tooling for contour shall be  $\pm .015$  over 80% of gauging surface and  $\pm .020$  over 20% of the surface per PM-4053. I/R Production Tool Design will specify features that are coordinated to Master Tooling. All other Tool Design specifications are to be maintained per I/R Tool Design.

Production Tool to production Item for edge and/or cutout trim is  $\pm .010$ , except replaceable edges, net or with excess, which shall be  $\pm .030$ , unless otherwise stated on the engineering drawings.

Production Tool to production Item tolerance for contour is  $.000$  to  $+0.020$ .

Note: This tolerance is a tooling application which recognizes the engineering drawing tolerance of  $\pm .010$ , unless otherwise specified, for sheet metal Item contour relative to Item being placed against a solid tool surface for checking. The tooling application also recognizes restraint in the tool, in accordance with the engineering drawing.

Indenture tool development does not exceed  $\pm .005$  total back to the master.

Buyer-furnished Master Control Tooling is not used for production purposes, i.e., Item verification, trimming, drilling, and forming.

5.16 Seller shall verify non-I/R tooling perimeter, holes, and contour tolerances are as follows:

Non I-R Tooling Tools are net to engineering, unless otherwise identified on tool, i.e., excess on a tooling sample. Excess tolerance shall be per PM-4053 specification or as Buyer authorized through this PO to allow deviation from standard tolerance.

Surface tolerance from tooling tool to controlled production tooling is  $\pm .015$ " tolerance allowable over 80% of the gauging surface, and  $\pm .020$ " over 20% of the gauging surface as illustrated in Figure 12.

Tolerance from controlled production tooling to production Item equals  $\pm$  the engineering drawing tolerance, for edge and/or cutout trim and holes.

Controlled production tool to production Item tolerance for contour is .000 to +.020.

### **Figure 12. Production Tool to Control Tool**

5.17 Seller shall verify Seller-developed tools yield an Item not to exceed +/- .010 variance from applicable Master Control Tooling or Buyer Furnished Tool for the purpose of Seller development or production tool manufacturing.

5.18 Seller shall verify coordinated tool holes are direct pinning without undue interference.

5.19 I/R Tooling tolerance examples:

**+/- .005 (MASTER TOOL TO PROD. TOOL)**

**+/- .010 (PROD. TOOL TO PROD. ITEM)**

## **6.0 "TO MATCH" HOLE PATTERNS AND OTHER I/R FEATURES**

6.1 The term "To Match", when specified on Buyer engineering drawings relative to hole locations, indicates that the dimensions including tolerances





- MM/13E (Master Model) (MAR)
- MSFM (Master Form)
- MSTP (Master Template)
- MTT/33A (Master Tooling Template) (MAR)
- PM/20E (Plaster/Plastic Model) (MAR)
- TOFA (Tooling Form)
- TOFB (Tooling Form)
- TOFM (Tooling Form)
- TOPA (Tooling Pattern)
- TOSE (Tooling Sample)
- TOTP (Tooling Template)

7.5 Shipping containers for Control Tools shipped to International Coproduce or overseas shipment shall be Type I or Type II-3 or Plastic SDS997 containers when appropriate for smaller tools per PM-4053,



- = Visually inspect the jig upon receipt for obvious signs of damage sustained during shipment. All discrepancies or damage shall be documented and submitted to Buyer for rework/repair disposition, via Supplier Aircraft Tooling Report (SATR).

Continue to locate the jig into position, if applicable, taking care to secure areas of the rough structure and avoid contact with locating features. Verify that the jig rests on all jack screws and jig feet provided.

Rough level the jig using a conventional optical level and the leveling buttons located along

