



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

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APPLICABLE DOCUMENTS

PM-4053 TOOLING MANUAL – Access limited due to Protected Data contained therein. Sellers contracted to fabricate or rework Special Tooling shall contact Buyer to submit access request.

PM-4053 contains complete Lockheed Martin Aeronautics Buyer's design, manufacturing and preservation requirements that are only briefly described or illustrated in this Manual. Seller shall refer to PM-4053 for complete specifications when this TMS Manual is imposed on a Purchase Order. See Part I, section 1.0.

PURCHASE ORDER QUALITY APPENDIX "QX" – LM Aero Buyer quality requirements

PURCHASE ORDER QUALITY APPENDIX "QI" – Intra-Lockheed Martin Work Transfer Agreement (IWTA) Quality Requirements applicable to specific Lockheed Martin sites.

PO APPENDIX T – Special Tooling Identification requirements for Non-Recurring (NR) Tools.

FEDERAL ACQUISITION REGULATION – FAR Subpart 2.101 Definitions "Special Tooling"

FEDERAL ACQUISITION REGULATION – FAR 52.245-1 Government Property

PART I

AIRCRAFT ITEMS AND TOOLING - SELLER REQUIREMENTS

1.0 SCOPE

* 1.1 This Tooling Manual ("Manual") is applicable in its entirety when this Purchase Order contains Quality Appendix QX or QI as specified by this Purchase Order. Any deviations from the requirements contained herein shall only be authorized by Buyer and with approval from respective management. This Manual contains the contractual requirements to properly control and maintain Seller Owned and Buyer furnished Tooling in conjunction with all Applicable Documents listed or referenced in this Manual. The term Buyer furnished tooling comprises Special Tooling ("ST"), Support Equipment ("SE"), Manufacturing Support Equipment ("MSE"), Special Test Equipment ("STE") and Manufacturing Test Equipment ("MTE") for Buyer; as such terms are hereinafter defined, used to produce Items for Buyer. "Buyer's assigned quality representative" shall mean the assigned Lockheed Martin Quality Representative responsible for on-site oversight of deliverable items, tool manufacturing, rework, repair, in-process acceptance and final acceptance of authorized task.

*1.2 This Manual contains general and specific requirements that are applicable to airframe structural components as specified in this Purchase Order ("PO") and other applicable documents. This manual is not applicable to Sellers of aircraft systems components that are subject to Automated Test Procedures (ATP). Tooling Manual PM-4053 takes precedence over all manufacturing and preservation requirements when conflicts exist between this Manual and PM-4053, if any. Right of access to PM-4053 is not necessary for all Sellers.

*1.2.1 Seller shall consult with Buyer and Quality Representative to determine validity for access capability, based upon PO requirements. Only Sellers contracted to perform airframe tooling task on a continual basis shall be granted access. Buyer may choose to forward hard copies of applicable sections from PM-4053 in lieu of granting access.

**1.2.2 Seller shall perform authorized Tool manufacturing, rework, alter, or repairs per this PO and this Manual.

*1.2.3 The terms "Item" or its plural "Items", "PO", "Seller", and "Buyer" as used herein, have the same meaning as the terms "Work", "Contract", "SELLER", and "LOCKHEED MARTIN", respectively.

**1.2.4 Sellers granted access shall enter PM-4053 on the Supply Chain Management Home Page at <http://www.lockheedmartin.com/aeronautics/materialmanagement>, under Quality Requirements, Control Specs.

* 1.3 Seller shall immediately notify Buyer's assigned quality representative if and when Buyer authorizes the manufacture, rework or repair of any Special Tooling to support delivery of Items as specified in this PO. Buyer's assigned quality representative shall determine the level of Buyer representative oversight required for in-process verification and or final acceptance of any such manufacturing, rework or repair of all Tooling utilized in the manufacturing process for any deliverable Item. See Part II for Tool Manufacturing Requirements.

1.4 Intra-Lockheed Martin Work Transfer Agreement (IWTA): The performing business unit (Seller) shall be responsible for establishing and maintaining requirements, procedure and process that ensures configuration control is maintained throughout the duration of this IWTA.

****1.5** Seller shall manufacture, maintain and control tooling to the following requirements and other requirements contained herein to control such tooling used to produce and maintain aircraft and aircraft components;

- Property Records of Buyer Furnished tooling accurately maintained and identified.
- Configuration of tooling must be maintained and documented.
- Design and use of tooling must meet applicable Health and Safety requirements.
- Tooling must be verified to design requirements, if any, prior to production use.
- Non-conforming tooling must be controlled to prevent use without authorization.
- Corrective action for non-conforming tooling must be completed in order to determine root cause of non-conformance.
- Unauthorized alteration of tooling is not allowed.
- Maintain records to provide evidence that the tooling meets applicable requirements.
- Tooling must be properly stored in order to prevent damage.
- Tooling with no manufacturing requirements (inactive) shall be processed for disposition through Buyer, if applicable.

1.6 Seller's quality management system shall ensure all SE, MSE, STE and MTE utilized for acceptance or validation of deliverable items to Buyer are calibrated and evidence of such calibration is maintained.

1.7 For the purpose of this Manual, "Parts Manufacturer Seller" is defined as a Seller that manufactures parts, components, assemblies or items that are deliverable to the Buyer, LM Aero site, or facility.

1.8 For the purpose of this Manual "Tool Manufacturer Seller" is defined as a Seller that manufactures aircraft tooling "only" that is deliverable to LM Aero sites, facilities, or as directed by PO.

2.0 TOOLING DEFINITIONS

2.1. ST means all jigs, dies, fixtures, molds, patterns, taps, gages or other equipment and manufacturing aids, and replacements which are of such a specialized nature that without substantial modification or alteration, their use is limited to the development or production of particular supplies or Items thereof, or the performance of particular services. Reference FAR Subpart 2.101.

*2.1.2 "Rework" - is determined to require rework if such tool fails to produce an acceptable feature due to an out of tolerance condition or Buyer authorizes a modification to alter configuration.

*2.1.3 "Repair" - is determined to require repair if such tool it is broken, missing details or mechanisms do not function properly.

*2.1.4 "Non-Recurring Tools (NR) or Non-Recurring Engineering Tools" (NRE) - are defined as tools authorized by Buyer to facilitate manufacturing or delivery of Buyer items at a Parts Manufacturer Seller and shall be considered as Buyer Furnished Tooling when Buyer assigns an asset number for traceability. Access to PM-4053 is not granted for NR or NRE Tool manufacturing.

2.2 Modification Kit Tool ("MKT") is categorized as ST and is used to update or modify aircraft assemblies and structures.

2.3 "Tooling Tools" means all gages used by Seller to control the fabrication or coordination of production tooling, holes, Interchangeable-Replaceable (I/R) features, critical mating points and surfaces or contours it represents. Tooling Tools are for tooling purposes only and shall not be used for production purposes.

* 2.4 "Buyer Furnished Tooling" means tooling that is either provided by Buyer or authorized by PO to be manufactured at Seller's facility to support Buyer's PO. Tooling that is authorized by PO to support delivery of items other than Tooling shall be considered Non-Recurring Tooling and shall be manufactured per this Manual in Part II, section 2.0, Non-Recurring Tool Manufacturing.

*2.5 "Seller-Owned Tooling" means all ST and Tooling Tools owned by Seller and used in the process of fabricating, inspecting, assembling and coordinating of particular Items and/or tools as described in paragraphs 2.1 and 2.3. Seller-Owned ST is not to be confused with any form of Buyer Furnished Tooling. This is a tool owned by Seller and not owned by Lockheed Martin or Government agency.

2.6 STE means either single or multipurpose integrated test Items engineered, designed, fabricated or modified to accomplish special purpose testing. STE consists of Items that are interconnected and interdependent so as to become a new functional entity for special testing purposes. STE excludes:

- Consumable property
- ST
- Facility Items (except necessary improvements for installing STE)
- Plant equipment Items used for general plant testing purposes

* 2.7 MSE is used in manufacturing operations to support, manufacturing, test or to prove the functional operation of any end Item of Government Property.

2.8 MSE consists of the following types of Items and shall be considered United States ("U.S.") Government property:

2.8.1 SE required to make an Item operational in its intended environment. SE includes the following:

- Common and Standard SE – For use on more than one type Item
- Peculiar or Non-Standard SE – For use on a peculiar or specific Item

2.8.2 MTE required for use in manufacturing operations to conduct tests and/or prove the functional operation of a specific Item. MTE is peculiar to manufacturing in that it is not normally used by Buyer to support the Item in an operational environment.

*2.9 "Control Media" and "Control Tools" mean either electronic media or physical tools that control configuration and typically are not used for production purposes. Such tools control I/R, Non-I/R features and are categorized, but not limited to the following:

2.9.1 "Master Tooling" – Master tool gages used to establish dimensions and features during manufacture of Production Tools which control I/R and/or coordination points of production Items. Unless Buyer has provided Seller with prior specific written authorization to do so, Seller shall not use Master Tooling for production purposes, i.e., Item verification, drilling, trimming or forming.

2.9.2 "Controlled Production Tooling" – Tooling such as jigs and fixtures used to establish dimensions and features of Items and which control I/R and/or coordination points of those Items.

2.9.3 "Electronic Data" – Computer-generated electronic data used to establish dimensions and features during manufacture of production tools which control I/R and also used during fabrication of production Items for control of I/R features, e.g., trim, attach holes.

2.9.4 "Inspection Gage/Fixture" - Utilized to inspect features of parts or assemblies.

2.9.5 "Tooling Gage - Only used for dimensional control of other tooling, including I/R or Non-I/R features.

**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 request information regarding PO requirements, including Engineering drawing clarifications, tool design clarifications and any related issue that does not pertain to a physical discrepancy within a tool.

*2.12.1 Examples of such submittals or request, but are not limited to, would be a request for Buyer to ship applicable coordinating tool to Seller for the purpose of accomplishing Production Tool to Master Tool coordination or clarifying language within this PO, Tool Design or Build Package.

2.13 Seller Aircraft Tooling Report (“SATR”)

2.13.1 A SATR is a document initiated by Seller to document a discrepant Buyer-furnished ST condition. Buyer shall reply with authorization for rework or repair, if required, of "out of engineering" discrepancies or conditions.

2.13.2 This online system is available on the Buyer’s Supply Chain Management Homepage and was created to provide Seller with a traceable electronic means of reporting ST discrepancies and achieving disposition authorization from Buyer’s program representative.

2.13.3 Access is granted by applying for an account on the Buyer’s Supply Chain Management Homepage at <http://www.lockheedmartin.com/aeronautics/materialmanagement>. Highlight “Quality Requirements” and select “Corrective Action”.

2.13.4 Seller shall initiate a SATR to document physical discrepancies, or requests for deviation from specifications or special processes of Buyer-furnished or any Buyer authorized manufactured Tool that is assigned an LM Aero asset number, including all rework, repair, or alter authorizations.

2.13.5 Seller shall make every attempt to correct any discrepancy discovered during any tool manufacturing of Buyer Furnished tools to ensure any defect is corrected and the Tool meets design requirements, if any, or manufacturing specifications and maintains contracted configuration, prior to submitting a SATR. The SATR shall affect Seller's Quality Rating.

2.13.5.1 SATR's initiated to document the condition of tool upon receipt from Buyer or a worn or unusable condition shall not affect Seller's Quality Rating.

2.13.6 SATR shall not be used to request deviation in materials specified per Tool Design of any ST. Material deviations shall be coordinated and authorized through Buyer and Program Representative prior to initiation of any manufacturing task.

*2.14 Order of Precedence for Control Media

2.14.1 F-16 document 16PP1957 - "Order of Precedence for Control Media for Manufacture of the F-16" takes precedence over all engineering dimensional requirements where master tools conflict with engineering requirements.

2.14.2 F-22 document 5PD41327 – "Order of Precedence for Control Media for Manufacture of the F-22" provides direction for implementation and management of identified variations between engineering designs and F-22 Control Tooling.

2.14.3 F-35, C-130, C-5 and P-3 program documents for "Order of Precedence for Control Media" is illustrated in PM-4053, section 3.1.

2.14.4 Tooling precedence over engineering requirements is defined in Part IV, section 2.0.

2.15 Tooling Manual PM-4053

2.15.1 Tooling Manual PM- 4053 is the Buyer's Manufacturing Specifications for Tooling. PM-4053 is "Protected Information" and access can be granted only to Sellers authorized to perform manufacturing, rework or repair of "specific" Buyer Furnished tooling on a continual basis. Sellers authorized to perform manufacturing, rework or repair on a limited basis may not be granted access. Access can be granted as determined by Buyer's Manufacturing Engineering organization.

* 2.15.2 To obtain access, Seller shall make a request to Buyer. Buyer will initiate the process of granting access by completing an internal Form # FWP5176 that is only found on the internal Intranet system. Buyer has the option to provide hard copies of applicable sections of PM-4053 as necessary to minimize the need for full access to this Protected Information by Parts Manufacturing Sellers if appropriate for minor rework, repair, alter, or manufacturing.

* 2.15.3 Tool design and manufacturing requirements set forth in PM-4053 for Tooling deliverable to an Aeronautics site are fully imposed when this Manual (TMS-MC-015) is referenced in a PO.

**2.16 Tooling Used As a Media of Acceptance (MOA)

2.16.1 Any tool, including Shop Aid or Production Aid, Buyer Furnished, or Seller Owned, that is used to drill, locate, install, assemble, or used for product acceptance that does not have a subsequent dimensional inspection of the established feature within the same manufacturing sequence, shall be

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 producibility, 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 “Replaceable Items” – are partially finished and have designed/controlled features which require alteration of the Items in addition to the normal application and/or methods of attachment at the point of installation. Such alterations are limited to specified areas and may include drilling, filing, trimming, bending, etc.

3.4 “Interchangeable Category Items” – are typically designated Items which are attached by bolts or screws, readily removable and replaceable. Such Items are designed in such a manner that all like Items made within the engineering drawing tolerances will substitute one for another. Interchangeable Category Items are Items that are maintained by Seller through use of normal manufacturing methods and compliance with engineering drawing dimension tolerances, without the use of I/R Control Media.

*3.5 Seller shall manufacture I/R production tooling, only from Buyer Furnished control media, e.g., Control Tools and Electronic Data, and shall identify all production tooling establishing an I/R feature of a deliverable Item to Buyer as specified in Part IV of this Manual.

3.6 Seller shall place all I/R Production Tools into a Periodic Inspection recall cycle as specified in Part I, section 11.0 and 12.0 herein.

4.0 “TO MATCH” HOLE PATTERNS AND OTHER I/R FEATURES

* 4.1 The term “To Match”, when specified on Buyer engineering drawings relative to hole locations, indicates that the dimensions including tolerances, even when met, may not necessarily ensure physical mating of Item hole patterns at the point of installation. Seller shall follow requirements in Part IV of this Manual.

5.0 CONTROL OF RECORDS FOR BUYER FURNISHED TOOLING

*5.1 As a minimum requirement, Seller shall record the following information for property management control of Buyer Furnished tooling, or comply with FAR 52.245-1 if applicable to this PO:

- Tool Number or Asset Number assigned by Buyer
- Buyer-assigned Item number and “Also Use” Item number/dash number that the tool will fabricate

- 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.lockheedmartin.com/aeronautics/materialmanagement> under Quality Requirements. The CPL is the form utilized by Buyer to record the status and location of Buyer and Government owned property.

6.1.1 CPL shall be processed as directed by Buyer whenever tooling is completed, received, reworked, or restamped, and when tooling is moved from the previously reported plant address.

6.1.2 The CPL shall be complete, current and include all Buyer furnished Tooling, e.g., Master Tools, Tooling Tools, Check Fixtures, Inspection Gages and Production Tools. Seller Owned tools are exempt from CPL reporting.

6.1.2.1 For the F-35 program, the CPL shall also include the authorizing Production Non-Recurring (PNR) number.

6.1.3 The Seller shall sign and stamp the CPL and forward the completed Form to Buyer.

6.1.4 Invoices for tooling shall not be processed until CPL is provided to Buyer with identification completed per PO Appendix T (Special Tooling "All Programs") or FAR 52.245-1, whichever is applicable.

*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" and requires unique opening and closing requirements. Seller's Quality Assurance (QA) personnel are allowed to open sealed containers in the event that Buyer's Representative is unavailable to support requested program need date(s).

*7.2.1 Seller shall complete Form FWP-1209 "Tooling Gage Storage Record" accompanying Control Tools, Master Tools or Inspection Gages for Fort Worth furnished tools when opening or closing the container.

*7.2.2 Seller shall make entry in "Tooling Inspection Record" (Form 1856-2) for Marietta Control Tools, Assembly Tools, or Master Tooling that are accompanied by such Form.

Note: Neither Form is a requirement for inclusion with Production type Tools. Replacement Form 1856-2 is accessible by hard copy only through a request from Buyer.

*7.2.3 Seller shall enter discrepancies, if any, in the remarks column. If Seller does not receive the applicable Form with the tool, Seller shall initiate an e-SPaR requesting the correct Form. These Forms are not available externally. Should one of these Forms be missing from the container, Seller shall immediately make request for replacement Forms from Buyer.

7.3 In no case shall Seller attempt to rework, in any manner, Buyer-furnished tooling without prior written authorization from Buyer.

*7.3.1 Seller shall review Buyer authorization (SATR disposition or PO revision) for repair and contact Buyer's Representative to discuss appropriate level of verification or oversight required by Buyer's Representative to ensure that rework has been completed.

7.3.2 All I/R tooling and tooling used as a media of acceptance/inspection shall require delta First Article Inspection (FAI) demonstrations upon completion of rework or repair, unless the reworked or

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

tolerances. If production is greatly increased, it may be necessary to replace these tools when authorized to Code 1 or 2.

8.5 "Code 4" – Low production rate tools made of low cost materials. These tools are used for accomplishing emergency, temporary, or off-station production operations. They must be capable of making Items or assemblies that will meet minimum quality control standards. When making Items with this type of tooling, a maximum amount of handwork, standard setups, layouts, etc. is permitted.

8.6 "Code 5" – Lowest cost tooling used for production operations. These tools are needed for making Items or assemblies where it is impossible to make them by layout, handwork, standard tools, or setups. Use of handwork, standard clamps, etc., is permitted when finishing Items to meet engineering tolerances.

9.0 TOOL PROTECTION AND STORAGE REQUIREMENTS

*9.1 Seller shall ensure its quality system maintains surveillance in order that Control Media is not abused or damaged while out of storage/shipping containers. Seller shall be responsible for Buyer Furnished tooling while in Seller's possession and shall take particular care when tools are being stored, handled, transported, loaded into and removed from jigs and fixtures. Preservation, storage and shipping container requirements are illustrated in Part IV of this Manual.

10.0 SHIPPING INSTRUCTIONS

*10.1 Buyer shall specify destination and mode of transportation for tools that are to be shipped from any point of origin.

Note: Seller shall ensure all Tooling and shipping/storage containers are in usable condition prior to shipment. If either tool or shipping/storage container is not in usable condition, Seller shall initiate an e-SPaR for PO authorization to rework, repair, or manufacture a new container. Specific container requirements are defined in Part IV of this Manual.

10.2 Seller shall provide advance notice to the Buyer's Representative when performing closure of a Control Media container.

*10.3 Seller shall contact Buyer's Representative for opening and closure of the Control Media or any sealed Tooling container. If Buyer's Representative is unavailable within two (2) business days to witness the opening or closure of the Control Media container, Seller's QA shall fill out the Form FWP-1209 or Form 1856-2 as applicable. Seller's QA and/or Buyer's Representative shall verify the following are complete and included before closure and sealing:

- A. Control Media contents are complete
- B. Applicable surfaces are greased/protected from the elements per Appendix A
- C. Loose details, i.e., L-pins, clamps, sub-assemblies, etc., are shored
- D. FWP1209 or Form 1856-2 is stamped and completed

Note: FWP1209 or Form 1856-2 is not required for production type tools.

10.4 Prior to shipment, Seller shall note physical damage, if any, to any tool and shall document all such damage, if any, as specified in Part I, Paragraphs 2.12 and 2.13.

10.5 Seller shall use lead seals, steel stamped by Seller, to seal the Control Media container.

10.6 If movement of Control Media will affect Seller's ability to meet a delivery schedule, Seller shall immediately notify Buyer.

10.7 At such time as Buyer determines that Buyer-furnished tools located at Seller's facility are to be dispositioned, Buyer shall list the tools and forward the listing, as appropriate, to Seller and Property Management, Subcontract Control Department. Upon receipt of the completed listing, Seller shall process the listed tools as follows:

- Segregate the tools to a secured storage area.
- Notify Property Management Subcontract Control of the specific location of the segregated tools and indicate the Seller representative that should be contacted regarding final disposition instructions.

10.8 Upon Buyer's written notification and transfer of tool title from Buyer to Seller, Seller shall remove all evidence of ownership markings from tools and tool containers or render markings unrecognizable. This tooling identification removal includes, but is not limited to, the following:

- Ownership markings on plaques
- Barcodes
- Steel stamping
- Vibro-engrave etching
- Paint markings

Seller shall reference FAR 45.506 - Identification for contractor requirements of U.S. Government-owned property. Seller shall exercise caution to ensure that Tool Code and part number identifications are not removed.

11.0 TOOLING PERIODIC INSPECTION AND VERIFICATION (PI/V)

*11.1 PI/V shall be a Seller process comprising the cyclical verification of "Selected Tooling" used as a media of acceptance for a feature(s) of an Item. Seller shall document and complete PI/V, if such Media exist, or as specified by PO. Exceptions to an annual re-verification requirement are defined in 11.5.

- "Selected Tooling" is defined as any Buyer-furnished or Seller-owned **tool used as a media of acceptance (inspection) for a feature of any Item deliverable to Buyer**, where the feature of the Item established by this tool is not physically measured or inspected by other methods.

Example of Selected Tooling that would be placed into a PI/V recall cycle: A Drill Jig (production Tool) used to drill four holes in an aircraft part and subsequently this Drill Jig is also used to verify the same four holes spacing, location, diameter, and depth, and Seller is not employing any other verification or inspection method to verify these features in the aircraft part.

- For the purpose of this Manual and specific to PI/V requirements, "annual" is defined as the duration of the PI/V cycle that shall not exceed one year from the previous date of PI/V.
- Due to Legacy program manufacturing practices and variances between one Supplier's equipment from another, some Non-Designed tools do not have designated control media and may fall into a PI/V category of visual verification. In this occurrence, Seller shall request appropriate instructions from Buyer and Program personnel to determine or validate the appropriate PI/V method for such tools via an e-SPaR. See Part IV of this Manual for additional Legacy tooling coordination information.
- Visual PI/V is defined in Section 11.5.
 - Example of, but not limited to, such tools appropriate for Visual PI/V would be ATT/19A, HRT/20A, DLT/11A, Form Block, Dies, or similar type tools.

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 Design or this PO requirement, if manufacturing discrepancies are documented and Corrective Action is requested by Buyer.

11.1.7 Seller's PI/V documentation shall be a unique record system controlling the annual re-verification of Buyer Furnished and Seller Owned Production Tools, Check Gages, and Inspection Gages.

11.1.8 Any deviations from these mandatory requirements for PI/V shall only be authorized by written authorization from Buyer.

11.1.9 Seller shall verify the configuration integrity of Hammer Die's, Form Die's and other tools subject to high wear prior to and after each production run.

11.2 Seller shall be responsible for establishing a PI/V procedure for Buyer-furnished or Seller-owned tools used as a media of acceptance to produce Buyer Items and present proof of administering these procedures to Buyer or Buyer's Representative upon request. Tools designated by Buyer as Master Tooling or Tooling Tools and used for coordinating purposes only, do not require PI/V but do require unique preservation controls to ensure configuration and integrity of tools are maintained. Preservation, maintenance and standard repair specifications are illustrated in Part IV of this Manual.

11.2.1 Sellers working to an Intra-Lockheed Martin Work Transfer Agreement (IWTA) between Lockheed Martin Companies shall be responsible for establishing and maintaining PI/V requirements, a procedure and process that ensures configuration control is maintained throughout this IWTA.

11.3 Seller shall perform PI/V of Selected Tooling at Seller's facility annually if specific instructions are not provided by PO or IWTA. Seller shall review tool history after each PI/V to determine whether tool performance has been such that subsequent periodic cycles can be increased, remain as scheduled or be reduced. Seller shall coordinate any deviations from the annual requirement through Buyer by initiating an e-SPaR and subsequently receiving authorization from Buyer's Program Management. Seller shall receive deviation authorization only through PO revision.

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, PI/V 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 a media of acceptance into storage and designate these tools as "Inactive". Seller shall perform PI/V on all "Inactive" tools prior to their being returned to "Active" status. If inactive tools are no longer required, Seller shall notify Buyer and Property Management for disposition instructions.

* 11.5 With an exception to Sellers working to an IWTA, and only in the absence of designated Control Media, Seller shall accomplish PI/V by means of visual inspection in lieu of performing physical tooling coordination. Seller shall accomplish the visual PI/V using the below criteria:

- Seller shall use "Fit Check Items" or originally manufactured Items to the maximum extent possible, if applicable.
- Seller shall obtain an up-to-date quality history data file for Item(s) effected by applicable tooling, and perform a quality analysis relative to any discrepancies which may be tool related. Seller shall take appropriate action based on analysis results.
- Seller shall perform a tool examination for obvious damage, excessive wear, and broken, loose, worn, or missing Items, e.g., both integral and removable, bushings, pins, and clamps.
- Seller shall immediately identify any adverse conditions revealed as a result of the above actions and request direction from Buyer by submitting a SATR or using the REA system, if applicable.
- Seller shall determine any adverse effect on Items in work in Seller's inventory or delivered to Buyer; and take appropriate action to segregate, document, and/or notify Buyer.
- Seller shall not consider shop floor planning operations, general review of tool prior to each use in a production environment or stamped off shop planning as evidence of performing PI/V.

11.6 Seller shall request from Buyer all necessary Tooling Tools to perform PI/V coordination to Control Media.

* 11.7 Seller's digitization of Master Tooling or Tooling Tools is an acceptable alternative to Seller storing Master Tooling or Tooling Tools at Seller's facility for coordination activity. Digitizing data is a method of retaining the Master Tooling features for coordination activity. Seller shall use this digitized data to perform acceptance of features of Buyer deliverable Items. Digitized data, Master Tools, Tooling Tools, and Control Tools do not require PI/V. **Digitized Data retains the same tolerances as the tool features it represents.**

CAUTION: Digitized data is acceptable for this PO only. Seller shall verify that any additional PO's for the same deliverable Item is to the latest revision for Master Tooling or Tooling Tools. Seller shall verify the digitized masters are to the latest configuration. When performing coordination or verification of a physical tool to digitized data, applicable tolerances apply as if performing a tool-to-tool coordination. Tolerance requirements are illustrated in Part IV of this Manual.

12.0 TOOLING PERIODIC INSPECTION AND RE-VERIFICATION (PI/V) RECORDS

* 12.1 Seller shall maintain a unique record for all tools requiring PI/V. Such record shall list:

- Tool Ownership (LM Aero/ Seller Owned)
- Buyer or Seller Tool Number

- 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 incorporated by PO revision or amendment. Clarification or deviation request shall be submitted as illustrated in Part I, section 2.12.

****15.0 BASIC PRINCIPLES FOR PRODUCTION USE OF TOOLING**

15.1 Seller shall take action to ensure the following principles are followed;

- Do Not Cut Lanyards or Remove Attached Details without authorization.
- Do Not Alter Tools (e.g., No Tape, No Writing, No Plugging Holes Etc.).
- Do Not Store Tools Anywhere Other Than Their Intended Location.
- Do Use Only Tools Approved For Production.
- Do not use Master Tools For Production Use.
- Do Not Use Broken or Incomplete Tools.
- Do Not Mishandle or Damage Tools.
- Do Not Use A Tool Unless Called Out In Shop Work Instructions.
- Do Submit SATR for disposition of any worn, damaged, or Out of Tolerance condition.

END PART I

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 Periodic Inspection / Validation recall cycle.

- **Controls Interchangeability/Replaceability (I/R)** –All I/R Tools require Seller to coordinate the manufacturing and I/R demonstration/validation prior to release for production use. Seller shall coordinate manufacturing of such tools with the use of Buyer Furnished Master Tool or Control Tool and Buyer’s Quality Representative, to determine appropriate level of oversight required during manufacturing and/or Final Acceptance, if necessary.
- **Trial Run/Proof Load Required** - Example would be a tool used at assembly and would require validation that it performs as designed to locate, clamp, attach, or support multiple flyable details or assembly hardware items as planned. Seller shall coordinate manufacturing and validation of such tools with Buyer’s Quality Representative, if applicable.
- **Non Complex Tools/Non (I/R)/Low Dollar, all similar categories** – Example would be a holding or vacuum fixture used on a NC milling machine that is not used in establishing a feature. This fixture is simply used to hold an alloy billet while machining. Work Scaffolding or Work Stands, shop aids, etc. shall be considered Non Complex Tools. The manufacturing and application of such tools should still be reviewed by Buyer’s Quality Representative during initial manufacturing planning, but formal or final acceptance is not required.
- **Minimum Manufacturing Requirements Imposed Upon Seller-Built, Non Complex Tools** – are specified in this Manual, located on the SCM External Home page under >Quality Requirements,> Control Spec’s.

*3.0 SPECIAL TOOLING INSPECTION AND QUALITY REQUIREMENTS – DELIVERABLE TOOLING

3.1 Seller shall comply with stress relief, annealing, welding, and non-destructive inspection (NDI) operations in accordance with PM-4053. Seller shall flow the following instructions in Purchase Orders to their sub-tiers:

- Buyer identification number for Seller
- Buyer identification number for Seller’s sub-tier (if applicable)
- All applicable Buyer-imposed specifications

3.2 Unless otherwise stated in Buyer’s Build-to-Package (“BTP”), CMM, theodolite, photogrammetry, calibrated machine probe, and/or laser tracking are the only acceptable methods for contour verification, and are the preferred methods for hole pattern verification. CMM inspection is the overall preferred method for verification. Exception: If the CMM output data is such that the data is not electronically transmittable to a CATIA model for review, and/or calculations must be performed manually in order to complete the inspection activity (e.g., vector data must be manually calculated for hole locations), the use of theodolites or laser tracking when the data can be readily uploaded electronically to CATIA are then the preferred methods of inspection.

3.3 Inspection Grid Pattern: Unless otherwise stated in Buyer’s BTP or specified in PM-4053, Seller shall inspect surfaces requiring verification using the following grid pattern:

3.3.1 A maximum distance of two (2) inches between points along contour for complex and/or compound surfaces. There are no minimum distance requirements.

3.3.2 A maximum distance of six (6) inches between points for planar surfaces. There are no minimum distance requirements.

3.4 Seller shall not proceed to the next verification milestone without prior written authorization by Buyer’s Representative in the Progressive Inspection Log (“PIL”), or an equivalent log.

3.5 Seller shall establish and/or maintain a quality system which requires the inspection of all dimensions of a tool. Seller’s QA shall log all three (3) place dimensions (2 place for metric) or any dimensions

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

fully illustrated in PM-4053, section 3.8. Trial Run is the process of verification that the tool functions as necessary to produce a part or assembly per engineering requirements in a production environment.

*3.10 When this PO specifies that a Trial Run is to be accomplished either at Seller's facility or a Lockheed Martin site, Seller shall stamp the tool identification plaque as listed below.

- **Type I Trial Run Required**, Stamp/Date the Trial Run Block and leave Prod. Block blank
- **Type II Trial Run Required**, Stamp/Date the Trial Run Block and leave Prod. Block blank
- **Type III Trial Run Required**, Stamp/Date the Trial Run Block and leave Prod. Block blank
- **Type IV Trial Run Not Required**, Stamp/Date the Prod. Block, enter "N/A" in Trial Run Block

*4.0 TOOL IDENTIFICATION AND SHIPPING REQUIREMENTS – DELIVERABLE TOOLING

*4.1 Tool identification for Buyer tooling is controlled by PM-4053. Seller shall check for the latest revision of PM-4053 requirements by visiting the on-line revision history link located on the Buyer's BTP website.

4.2 Seller shall identify each Seller-manufactured ST in a conspicuous place using a permanent method such as stamping, engraving, etching, stenciling, etc., as required, per PM-4053.

4.3 To ensure applicable inspection data and acceptance reports remain with the tool once received at LM Aeronautics' facilities, Seller shall secure all technical, inspection and acceptance data reports in a sealed envelope. The sealed envelope shall include the following note on the outside of the envelope: "**These documents to Remain with Tool – Do Not Remove**".

4.4 Seller shall package, preserve, and protect all tooling designated to be shipped overseas as directed in this PO and PM-4053, section 3.16.

5.0 PROCESS FOR TRANSFERRING TOOL DESIGNS FROM SELLER TO BUYER

5.1 Digital Data Transfer – The transfer of digital data between Seller and Buyer is controlled through Buyer's BTP Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) Engineering Data Transfer Group. Buyer shall identify Seller's Points Of Contact (POC) for setup of digital data transfer capabilities and forward this information to Buyer's BTP CAD/CAM Engineering Data Transfer Group. Buyer's BTP CAD/CAM Engineering Data Transfer Group shall contact Seller's POCs and identify required capabilities, data transfer site information, (including passwords, directory information, email notifications, and access controls), and how Seller will be notified of data transfer activities.

5.2 Hardcopy Data Transfer – Seller shall coordinate all hard copy transfer of designs through Buyer if required by this PO.

6.0 SEALING CRITICAL LOCATORS

6.1 Torque seal requirements for tooling are defined by site and program as follows:

Fort Worth requirements:	F-22A tooling – Pink All other tooling – Purple
Marietta requirements:	Tooling – Pink
Palmdale requirements:	Tooling – Pink

All torque seal applications that are not for sealing locators or critical locating features can be White.

7.0 DUPLICATE TOOL MANUFACTURING

7.1 Seller shall manufacture duplicates of LM Aero tools, when authorized by Buyer, and shall verify that the original LM Aero tool matches the original tool design before proceeding with duplication task.

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.**

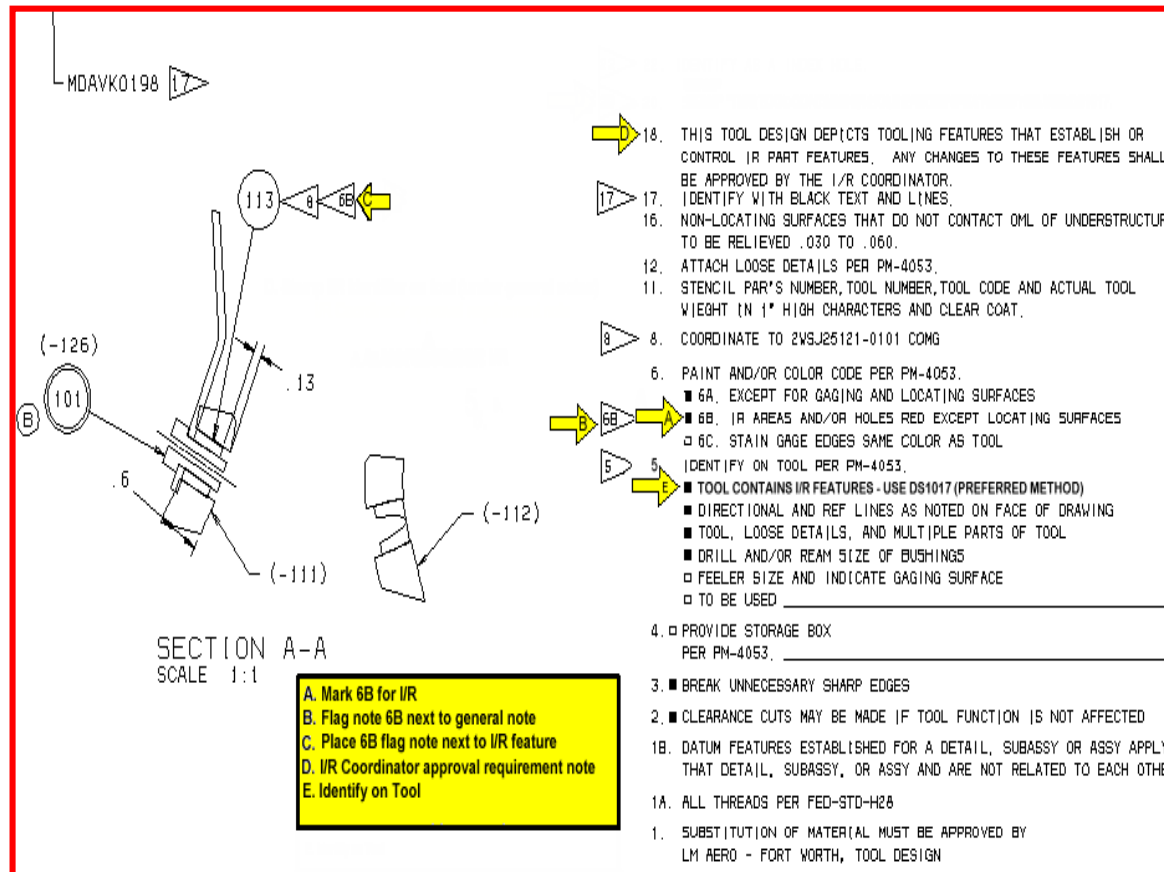


Figure 1. I-R Tool Design Requirements

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 Receipt of SE – Seller shall return a stamped copy of SE receiver to Buyer within five (5) working days upon receipt of SE.

2.1.1 Maintenance and repair parts for SE – Seller shall requisition maintenance and repair parts for the SE provided as MSE from Buyer.

2.1.2 Modification of SE provided as MSE peculiar modification of SE – Seller shall receive a tool order, a peculiar modification kit and written Buyer authorization. Upon completion of modification, Seller will return the stamped off / approved copy of the tool order to Buyer.

2.1.3 Time Compliance Tech Order ("TCTO") modification of SE – Seller shall receive a TCTO modification kit and written authorization from Buyer authorizing Seller to install the kit. Upon completion of kit installation, Seller shall return a completed Letter of Certification ("LOC") to Buyer.

2.2 Receipt of MTE – Seller shall acknowledge receipt of the CPL by signing and returning the original CPL to Buyer.

2.2.1 Maintenance and Repair parts for MTE – Seller shall requisition maintenance and repair parts for the MTE from Buyer.

2.2.2 Modification of MTE – Seller shall not perform modification on MTE without prior written authorization from Buyer.

2.3 Receipt, Maintenance and Modification of STE other than MTE Receipt – Seller shall acknowledge receipt of STE, if any, by signing and returning the original CPL to Buyer within five (5) working days after receipt of STE.

2.3.1 Maintenance and Repair Parts – Seller shall requisition maintenance and repair parts for STE from Buyer.

2.3.2 Modification – Seller shall not perform modification of STE without prior written authorization and direction from Buyer.

2.4 Disposition of SE, MTE and STE – Seller shall request disposition instructions from Buyer when SE, MTE, and STE become surplus or obsolete.

3.0 CHANGE AUTHORIZATION

3.1 Seller shall not rework, repair, or in any way alter control tools without prior Buyer written authorization in this PO or in a SATR disposition with a revised CPL and tool drawings, if required, to rework and/or re-stamp control tools per PM-4053, section 10.0.

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 “A” tools are control tools that establish dimensions and features of production tools which control I/R and/or coordination points of other production tools. Seller shall use these tools as Control Media only to fabricate production and inspection tools. The following is a list of the affected tools:

- COMG – Component Master Gage
- FCGA – Facility Gage
- MSFM/TOFM - For contour only. Lines on MSFM/TOFM are 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
- 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

5.0 LISTINGS OF SELLER-FABRICATED/PROCURED ST OR STE

5.1 Seller shall establish and maintain a part list and tool list, by manufacturer’s part number, of ST or STE fabricated or procured by Seller, as required by Buyer. Seller shall not include any Buyer-furnished ST or STE in the list(s).

5.2 Seller shall produce and maintain listings of all tools required to fabricate Federal Identification Item Number (“FIIN”) spare Items.

6.0 DRAWINGS, SKETCHES, TOOL DESIGNS, ETC.

6.1 Seller shall maintain Seller-owned or Buyer-furnished current tool designs, sketches, photographs, and schematic drawings used in the fabrication, testing, or calibration of tooling. Seller shall provide a disposition of this data at the same time disposition for related tooling is given, as requested by Buyer.

6.2 Seller shall ensure Seller’s STE drawings of any electrical, electronic, hydraulic or pneumatic type, at a minimum, consist of a schematic with component parts called out by characteristics and/or part number, including adequate calibration and operation instructions.

7.0 CALIBRATION AND RE-CALIBRATION OF BUYER-FURNISHED OR SELLER-FABRICATED STE

7.1 Seller shall develop and maintain a schedule for maintaining calibration of Buyer-furnished or Seller-fabricated STE. Seller’s schedule is subject to approval of Buyer’s representative and Seller shall ensure such schedule includes the following:

- Name and function of test equipment
- Serial or identification number of test equipment
- Criteria or standard to which test equipment is checked
- Frequency of test

7.2 Buyer shall determine mode of transportation for STE and make arrangements for shipment, when STE is required at another location.

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

* REVISED

** ADDED

PART IV APPENDICES

APPENDIX A – REWORK, REPAIR AND COORDINATION GUIDE

***** APPLICABLE TO PARTS MANUFACTURING SELLERS
THAT ARE AUTHORIZED TO REWORK, ALTER, REPAIR, AND MAINTAIN
CONFIGURATION OF FURNISHED AIRFRAME SPECIAL TOOLING *****

APPENDIX TABLE OF CONTENTS

1.0 GENERAL

2.0 TOOLING PRECEDENCE OVER ENGINEERING STATEMENTS

3.0 PRESERVATION OF BUYER FURNISHED TOOLS

4.0 STANDARD REPAIR TOLERANCES AND COORDINATION

5.0 STANDARD I/R IDENTIFICATION AND REWORK

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

7.0 SHIPPING AND STORAGE CONTAINERS FOR BUYER FURNISHED TOOLS

8.0 BUYER FURNISHED TOOLING AND SELLER TO SELLER TRANSFER OF TOOLS

9.0 SET – UP PROCEDURE FOR FLOOR BASED ASSEMBLY JIGS

1.0 SCOPE

*1.1 Appendix A is applicable for all programs at all sites and is included in this Manual as specification guidance for the preservation, alter, rework, repair and coordination of Buyer-furnished tools when authorized by PO, and to define applicability of Special Tooling for specific Legacy aircraft parts, components, and assemblies.

*1.2 Appendix A is not all inclusive of tool maintenance, alter, rework, repair, and coordination requirements. This Manual section is intended to be utilized in conjunction with the requirements set forth in PM-4053. If Seller does not have access to PM-4053, Buyer is authorized to furnish hard copies of applicable sections for Seller's use.

**2.0 TOOLING PRECEDENCE OVER ENGINEERING STATEMENTS

2.1 References to PM-4053 within this section are provided herein for such use by Seller. Buyer may furnish hard copies of applicable sections of PM-4053, and any distribution shall be limited to and applicable to this PO only.

2.2 For C-130 and P-3 Programs, Control Tools shall define the nominal configuration for the features they represent. In most cases, the C-130 and C-5 Programs manage configuration control of Interchangeable and Replaceable (I-R) features by means of Master Control Tools. Upon manufacture and acceptance, these Master Control Tools establish the master product definition and take precedence over the

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 necessary to bring the tool back within the approved temperature limits, not to exceed 72 hours.
- Fiberglass and composite tools in production shall have the caution label (DS-938) applied at the next rework or Periodic Inspection/Verification (PI/V) if applicable.
- Apply a MIL-C-16173 Grade 2 (light machine oil) protective coating or equivalent to unpainted alloy surfaces if stored sheltered from the elements, and a MIL-C-16173 Grade 1 (cosmolene) protective coating or equivalent if stored exposed to the elements. This does not apply to F-35 Program when Conex Containers are used for overseas shipments.
- All tools shall be free of rust and/or contamination before being shipped, stored, or placed into production use.

**3.2 Cleaning of Tool Surfaces prior to coating unpainted surfaces shall be by spraying the area to be cleaned with "Break-Free" cleaning solution (water base, soap, and alcohol solution), or moisten cheesecloth or clean cotton waste cloth with Break-Free and remove grease, oil, and other contamination from tool surfaces. Dry the tool with a clean cloth, or use dry compressed air on inaccessible areas. Finally

wipe the area to be protected with cleaning solvent. Protective coating must be applied within 24 hours after cleaning.

**3.3 Rust may be removed from "non-critical" tool surfaces by grinding, sanding, wire brushing, or Jet-Blast cleaned with dry ice. Rust may be removed from "critical" tool surfaces with a coarse cloth (Scotch-Bright). Wipe the residue from the affected surfaces with a clean cloth.

**3.4 Seller shall comply with the following requirements from the Table for Unpainted Surface Coating for tool storage:

Table 1.0 Unpainted Surface Coating

Material	Temperature Controlled	Storage Sheltered from Elements	Storage Exposed To Elements	Required Protection for Shipping
All Metal (Excluding Aluminum)	None	MIL-C-16173 Grade 2. See note 1 and 5 below	MIL-C-16173 Grade 1. See note 6 below	MIL-C-16173 Grade 1 or 2. See note 1 and 4 below
Metal F-22 Tool Storage	None	Ironclad MSDS #104364. See note 7	Ironclad MSDS #104364. See note 7	Ironclad MSDS #104364. See note 7
Aluminum	None	None	MIL-C-16173 Grade 2	MIL-C-16173 Grade 2
Plywood, Masonite, etc.	None	None	MIL-P-3038 Plastic Strippable .012, .015. See note 6.	MIL-P-3038 Plastic Strippable .012, .015.
Plaster Forms Co.	Clear Lacquer Trinity Coating Co. LC-41 or Equiv. See note 2.	Clear Lacquer Trinity Coating Co. LC-41 or Equiv. See note 2.	Not Allowed	Clear Lacquer Trinity Coating Co. LC-41 or Equiv. See note 2.
Metal Accessories	None	MIL-C-16173 Grade 2. See note 3	MIL-C-16173 Grade 1. See note 6	MIL-C-16173 Grade 1. See note 3
Lead and Zinc Alloy Dies	None	None	MIL-C-16173 Grade 1. See note 1	MIL-C-16173 Grade 1. See note 1

Unpainted Surface Coating Notes:

1. Coat critical surfaces plus a one inch margin.
2. Ship or store in boxes - must be securely braced or packed in Bubble pack, Styrofoam, or other acceptable packing material. Cracked or damaged areas must be recoated with LC-41 lacquer prior to use.
3. After coating, identify and store with the parent tool. Attach to the parent tool for shipping.
4. For tools sheltered from elements, use Grade 2 film; if the tool is exposed to elements, use Grade 1 film. For all overseas shipments, use Grade 1 film (cosmolene), unless the tool shipment is by air freight, then Grade 2 film (light oil) can be used on machined surfaces, in place of cosmolene. Grade 1 film "Cosmolene" is not applicable to F-35 tools after July 2011.
5. Exception: For Modification Kit Tools (MKTs and MKFs) in SDS997 Plastic Case (kudl-pak) containers with foam material, use light weight machine oil.
6. If outside storage is unavoidable, prepare per directions in Table 3.16-1. (Grade 1 film "Cosmolene" is Not-Applicable to F-35 tools after July 2011)
7. Ironclad protective metal coating, reference MSDS #104364, manufacturer ZEP Inc. Atlanta GA. (USA). Original use was for the F-22 program Tool Storage contract. Ironclad product use in the State of Texas is controlled by Texas regulations. Seller shall comply with all applicable State usage regulations or requirements.

**3.5 Removal of Grade 1 Film and Iron Clad Coating shall be accomplished by the following options:

3.5.1 Grade 1 Film shall be removed with a scraper, brush, or abrasive pad to remove thick volumes of cosmolene. Then use one of the following methods for final cleaning Grade 1 Film (Cosmolene).

- Jet (Ice) Blast
- WD-40 Spray (Use with wipe cloths to remove cosmolene film).
- Pre-Solve Orange degreaser (Ref. MSDS #43563)

3.5.2 Excess Ironclad shall be removed with a scraper, brush, or abrasive pad to remove thick volumes of Ironclad. Use one of the following methods for final cleaning of excess Ironclad:

- Approved Mineral Spirits materials can be used for removal of Ironclad
- C-200 Consol Solvent (Part: 14074372)
- Pre-Solve Orange degreaser (Ref. MSDS #43563)

*3.6 Seller shall provide storage containers for all Master Tooling and Inspection Gages fabricated with Buyer tool numbers. Seller shall provide containers to specifications identified on the tool design. Seller shall ensure the containers provide adequate support and protection of tools from the environment and mishandling during movement.

**3.7 Buyer furnished tooling identified per PM-4053 identification requirements prior to February 1, 2006 shall be acceptable indefinitely unless rework or repair authorization specifies attachment of a new DS228 Common Tool Identification Plaque for Fort Worth and Palmdale tools. The TNP001 Plaque is applicable for Marietta tools, if applicable per PM-4053, section 3.8. Such authorization will require the removal and discarding of any previous identification plaques or stickers with the following exceptions for Legacy Programs (C-130, C-5, P-3, F-16, etc.):

**3.7.1 The use of multiple tool identification plaques on tools will be acceptable only if authorized by ESPaR request and disposition. Some Legacy Programs require the historical data contained in sequential tool identification plaques to remain attached to the tool indefinitely.

**3.7.2 In all cases, the tool identification plaque with the most current information must be legible. If current tool identification plaque is worn and not readable, then a new common tool identification plaque would be required, if applicable by tool type and usage. Reference PM-4053, section 3.8 for specific information required in each block of plaque.


PART NO. 1		A/U 2	TOOL NO. 3			
TOOL CODE 4		SET 5	PARS NO. 6			
CONTRACT NUMBER 7			TOOL DESIGN 8 YES <input type="checkbox"/> NO <input type="checkbox"/>			
MAKE AUTHORITY 9			PIV 10 YES <input type="checkbox"/> NO <input type="checkbox"/>			
REV. LETTER	AUTHORITY		TOOL MFG.	HEAT SURVEY	RELEASED FOR	
ENG. 11	T.D. 12	13	14	15	TRIAL RUN 16	PRODUCTION 17
DS228-50 TOOL IDENTIFICATION PLATE LOCKHEED MARTIN 						

Fig. 1. Typical DS228 Common Tool Identification Plaque (Highlighted blocks shall require an appropriate entry for each program)

4.0 STANDARD REPAIR TOLERANCES AND COORDINATION

*4.1 For standard repair tolerances and coordination of Buyer-furnished tools, Seller shall:

- Maintain allowable production tolerances on interchangeable Items produced/verified with controlled production tooling as illustrated in Figure 2.
- Utilize a check pin for all I/R hole patterns to ensure patterns are made in accordance with the tool coordination tolerance tables included herein.
- Utilize controlled production tooling to check and verify allowable production tolerances on interchangeable Items are from .010 smaller to .010 larger than the tool, as illustrated in Figure 8.
- Utilize a check pin to check and verify the I/R hole pattern is made in accordance with the tool coordination tolerance tables included herein.

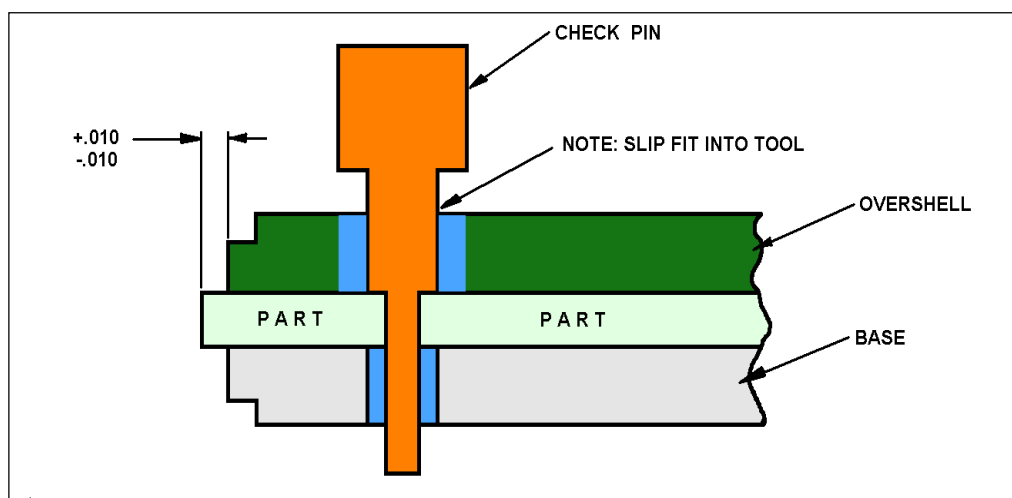


Figure 2. DOUBLE RAIL (INTERCHANGEABLE)

- Verify replaceable and non-I/R part perimeters produced with production trim tools or check fixtures have allowable production tolerances from a maximum of .030 smaller, to a maximum of .030 larger than the tool, relative to the engineering drawing applicable feature tolerance as illustrated in Figure 3 and 4.
- Verify perimeters are plus or minus .030 tolerances, unless otherwise stated on face of drawing. Example: An E.O.P. dimensioned as $+0.015, -0.030$ from a F.S., W.L., B.L. would apply. A "Tab" dimensioned as $+ \text{ or } -0.010$ for overall width, would apply if stated on the drawing.
- Utilize a check pin to verify all I/R hole patterns are made in accordance with the tool coordination tolerance table.
- The use of supplemental tooling such as plaster splashes, fiberglass lay-ups and/or metal tools is authorized when a coordination tool is not available and such use is approved by program disposition via an ESPaR. Such authorized tools shall require Limited First Run and or FAI article acceptance of the production items.

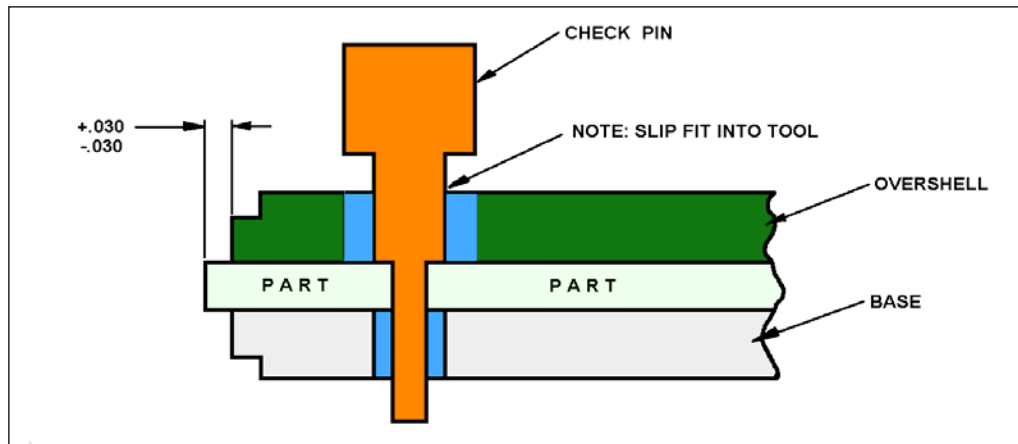


Figure 3. DOUBLE RAIL (REPLACEABLE, AND NON I/R, NET OR WITH EXCESS)

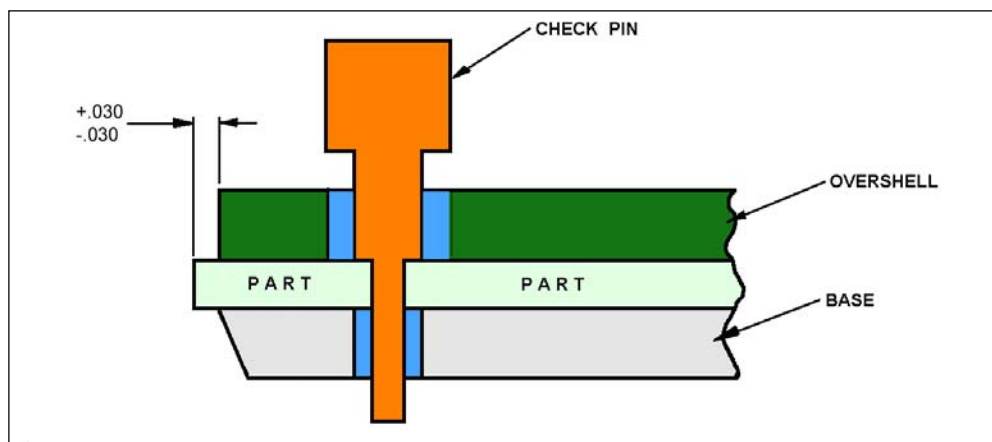


Figure 4. SINGLE RAIL SETBACK TYPE (REPLACEABLE, AND NON I/R, NET OR WITH EXCESS)

**** 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.

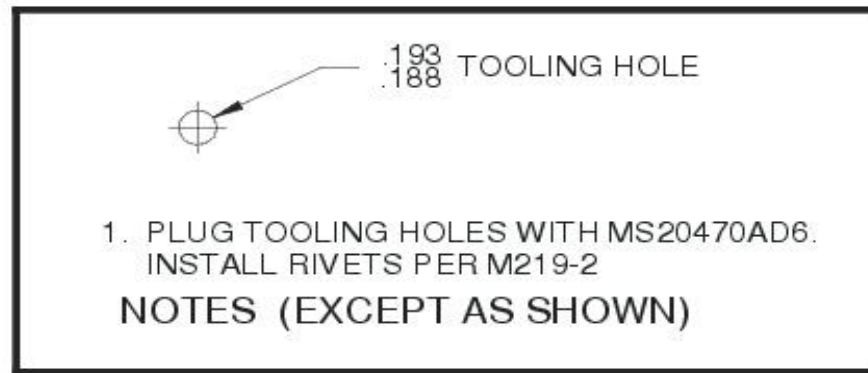


Figure 5. Plugged Tool Hole Example

**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.

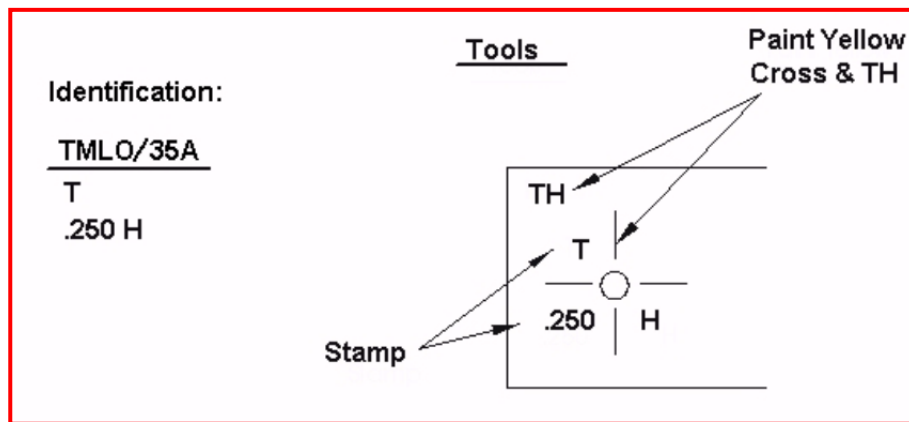


Figure 6. Typical Tooling Hole and Identification of Tooling Holes

**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.

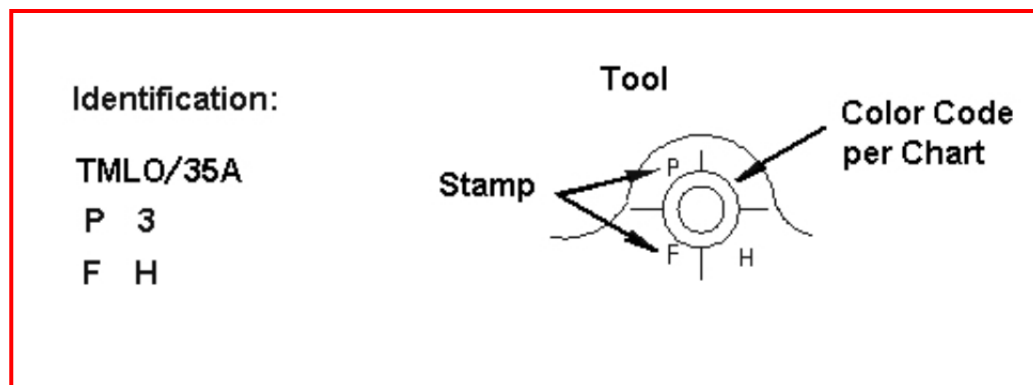


Figure 7. Typical Pin Hole and Identification of Pin Holes

** 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.

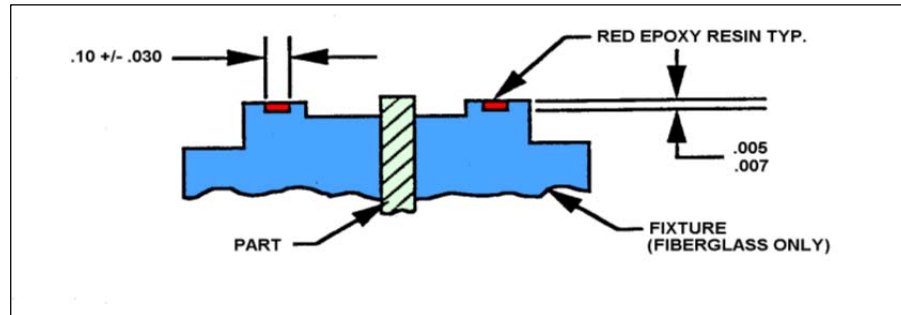
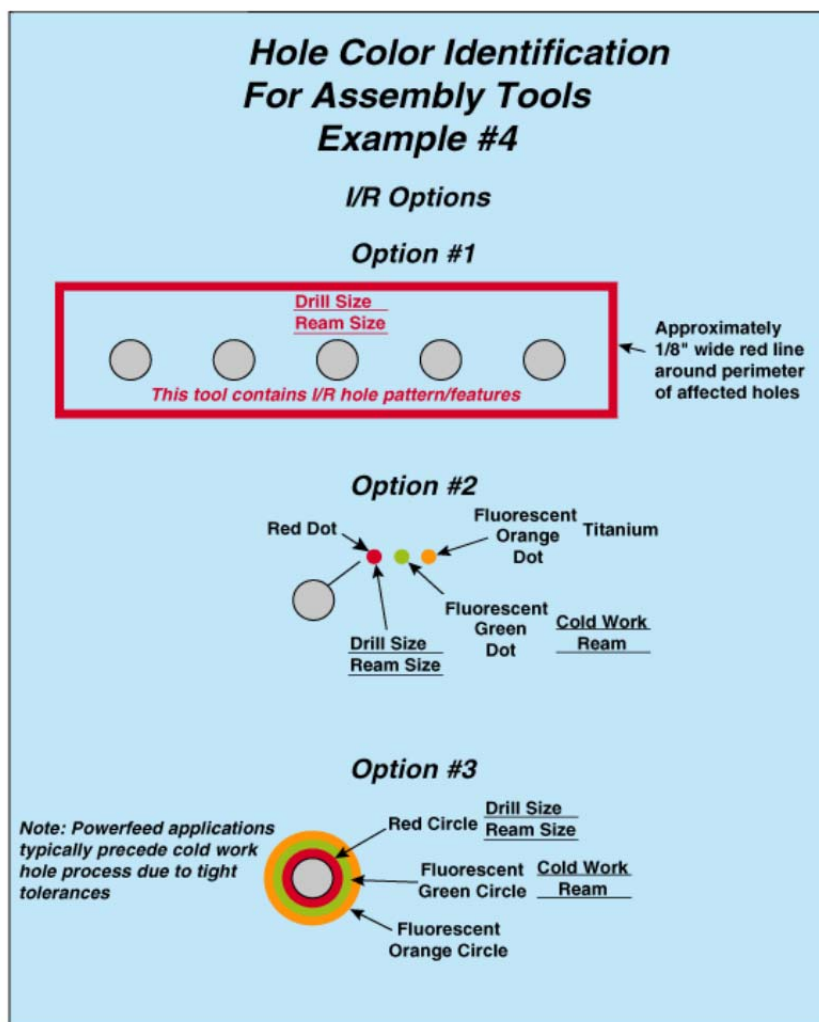


Figure 9. Example of I/R Wear Groove Indicators

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)

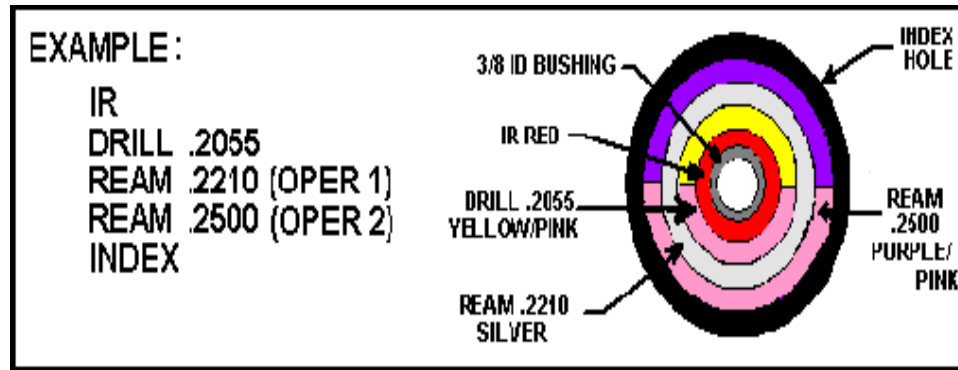


Figure 11. I/R Hole Identification Example Only

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 size tolerance of $+0.001$ to -0.000 , and Pin tolerance for such tools shall be -0.0025 to -0.0030 per PM-4053 or as specified by this PO or Tool Design, if any, or as directed by Buyers Program Engineering. Seller shall submit an E-SPaR when discrepancies exist.
 - Tooling holes may be authorized for detail parts manufacturing or location control during assembly and may or may not appear on engineering drawing. Sellers shall place tooling holes in detail parts only after authorization from Buyer's Program Engineering to avoid potential interference with subsequent installations.
 - Material excess tolerance shall be per PM-4053 specification or as Buyer authorized through this PO to allow deviation from standard tolerance for part manufacturing. Standard tolerance of $+0.060/-0.030$ when material excess call out is $.100$ up to $.250$. For material excess greater than $.250$, the tolerance shall be $+0.100/-0.060$.
- 5.5 For Control Tool to Production Tool Coordination – Seller shall pin the control tool to the tool being coordinated with $.0000$ to $.0005$ undersize pins at four(4) locations reasonably close to the corners of the control tool. Seller shall inspect the remaining holes in accordance with pin tolerances shown in Table 2.0 for "Coordination Check of Control Tools".
- 5.6 For Control Tool to Control Tool Coordination (Make New) – Seller shall install new control tool bushings utilizing pins with $+0.0000/-0.0002$ tolerance on diameter (Ref.: Transfer of hole pattern, Table 2.0).
- 5.7 For Control Tool to Control Tool Coordination (Rework) – During rework of control tools bushing, Seller shall install bushings utilizing pins with $+0.0000/-0.0002$ tolerance on diameter. (Ref.: Table 2.0, Transfer of hole pattern).
- 5.8 For Control Tool to Control Tool (Coordination Check Only) – Seller shall check the control tool back to the tool it was made from. During coordination checks of control tools, (Example: MSGA to TOGA), Seller shall pin four corner holes utilizing pins with $+0.0000/-0.0002$ undersize diameter. Ninety percent (90%) of the remaining holes are acceptable with $.0000$ to $.0010$ undersize diameter pins, and the remaining ten percent (10%) of the holes are acceptable with $+0.0000/-0.0025$ undersize diameter pins.
- 5.9 For Cross-Coordination of Control Tools – When duplicate control tools are fabricated, Seller shall cross-coordinate control tools in accordance with Table 2.0 "Coordination Check of Control Tools" to ensure compatibility.

- 5.10 For Bushing Installation – During the manufacture of new tools and reworks, Seller shall utilize tooling pins with +.0000/-.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 +.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

HOLES UNDER .250	STRAIGHT PINS	HOLES .250 AND OVER
Nominal +.0001/+.0004 Nominal +.0000/-.0002	Transfer of Hole Pattern Bushing I.D. Tolerance Pin Tolerance	Nominal +.0001/+.0006 Nominal +.0000/-.0002
Nominal +.0001/+.0010 Nominal -.0015/-.0020	Cross Coordination / Coord. Check of Control Tools Bushing I.D. Tolerance Pin Tolerance	Nominal +.0001/+.0010 Nominal -.0020/-.0025
STEP PINS		
Nominal +.0001/+.0004 Nominal +.0000/-.0002 Nominal +.0000/-.0002 .0005 Max	Transfer of Hole Pattern (New Make) Bushing I.D. Tolerance Lg. Dia. Pin Tolerance Sm. Dia. Pin Tolerance Concentricity	Nominal +.0001/+.0006 Nominal +.0000/-.0002 Nominal +.0000/-.0002 .0005 Max
Nominal +.0001/+.0010 Nominal -.0000/-.0002 Nominal -.0015/-.0020	Cross Coordination / Coord. Check of Control Tools Bushing I.D. Tolerance Lg. Dia. Pin Tolerance Sm. Dia. Pin Tolerance	Nominal +.0001/+.0010 Nominal -.0000/-.0002 Nominal -.0020/-.0025

Table 2.0 Coordination Check of Production Tools

HOLES UNDER .250	STRAIGHT PINS	HOLES .250 AND OVER
Nominal +.0001/+.0004 Nominal +.0000/-.0002 Nominal +.0001/+.0004	Transfer of Hole Pattern (New Make) C/T Bushing I.D. Tolerance Pin Tolerance P/T Bushing I.D. Tolerance	Nominal +.0001/+.0006 Nominal +.0000/-.0002 Nominal +.0001/+.0006
Nominal +.0001/+.0010	Coordination Check of Control Tools to Prod. Tools Bushing I.D. Tolerance	Nominal +.0001/+.0010
STEP PINS		
Nominal +.0001/+.0004 Nominal +.0001/+.0004 Nominal +.0000/-.0002 Nominal +.0000/-.0002 .0005 Max	Transfer of Hole Pattern (New Make) C/T Bushing I.D. Tolerance P/T Bushing I.D. Tolerance Lg. Dia. Pin Tolerance Sm. Dia. Pin Tolerance Concentricity	Nominal +.0001/+.0006 Nominal +.0000/-.0006 Nominal +.0000/-.0002 Nominal +.0000/-.0002 .0005 Max
Nominal +.0001/+.0010 Nominal +.0000/-.0002 Nominal -.0020/-.0025 .0005 Max	Coordination Check of Control Tools to Prod. Tools Bushing I.D. Tolerance Lg. Dia. Pin Tolerance Sm. Dia. Pin Tolerance Concentricity	Nominal +.0001/+.0010 Nominal +.0000/-.0002 Nominal -.0030/-.0035 .0005 Max
Nominal +.0000/-.0002 Nominal +.0001/+.0004 .0003	Additional Production Tool Tolerances O/D of Slip Bushing I/D of Slip Bushing Concentricity O/D to I/D	Nominal +.0000/-.0002 Nominal +.0001/+.0006 .0003
Nominal +.0000/-.0002 Nominal -.0010/-.0012 .0005 Max	Hinge Line Tool Tolerances Pins for End Hinges Pins for Middle Hinges Concentricity (end & middle)	Nominal +.0000/-.0002 Nominal -.0010/-.0012 .0005 Max

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 +/- .015 over 80% of gauging surface and +/- .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 +/- .010, except replaceable edges, net or with excess, which shall be +/- .030, unless otherwise stated on the engineering drawings.
- Production Tool to production Item tolerance for contour is .000 to +.020.

Note: This tolerance is a tooling application which recognizes the engineering drawing tolerance of +/- .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 +/- .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 +/- .015" tolerance allowable over 80% of the gauging surface, and +/- .020" over 20% of the gauging surface as illustrated in Figure 12.
- Tolerance from controlled production tooling to production Item equals +/- 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.

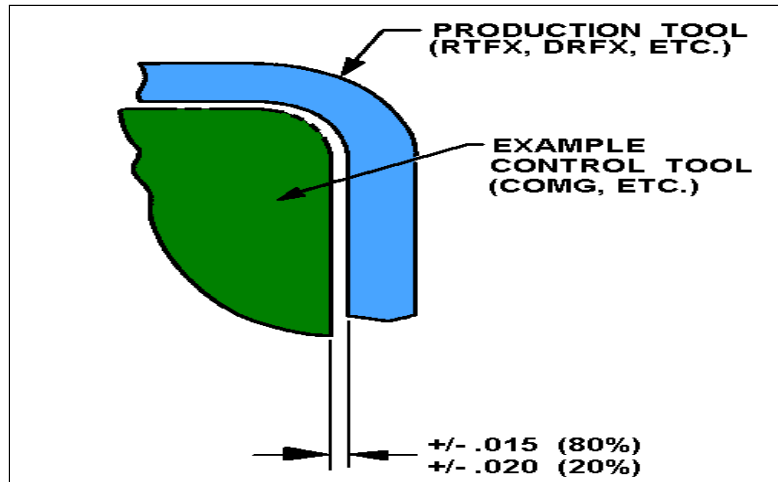
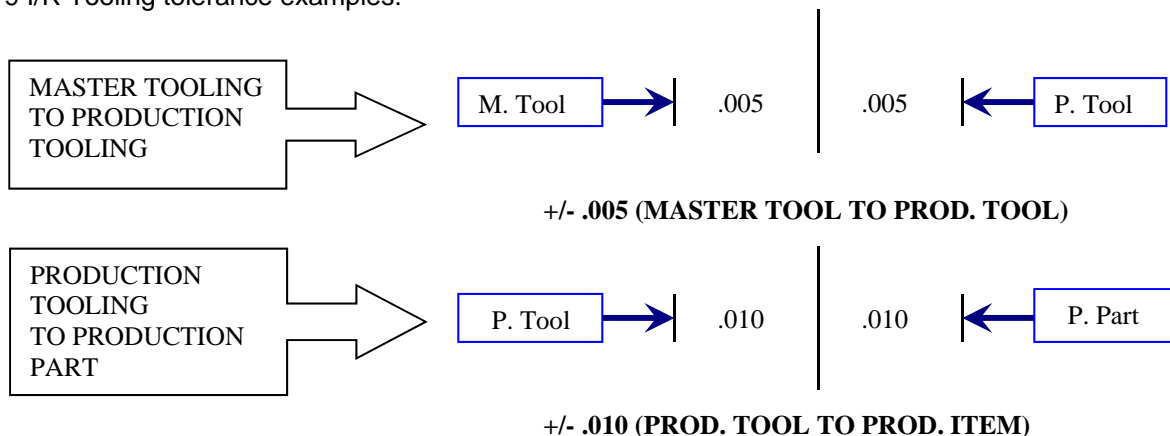


Figure 12. Production Tool to Control Tool

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:



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, even when met, may not necessarily ensure physical mating of Item hole patterns at the point of installation. This is true even though from a dimensional standpoint, the features are within engineering drawing tolerance limits. "To Match" features are physically established, within engineering drawing tolerance limits, through the use of Master Tooling. Once Seller physically establishes the features, Seller must maintain the actual positions to achieve and sustain "To Match" capability (example in Figure 13).

6.2 Buyer's Tooling specification, relative to Item features requiring physical control for configuration management purposes, is to provide Control Media, e.g., master gage, tooling gage, master plate, MEDM,

or other Electronic Data, to establish and maintain those Item features requiring control, over and above only the engineering drawing dimensions and their associated tolerances. If the Item feature requiring control has a critical configuration relationship requirement to other Item features, the Control Media will also establish those Item feature relationships, one to the other. Additionally, even though Item features may be within engineering drawing dimension tolerance band for those features, if an actual feature location does not comply with applicable Control Media allowed tolerance deviation, the feature location is not acceptable.

6.3 Buyer's Control Media drawing, if applicable, will denote maximum tool deviations permitted in feature location and/or relation to critical features that are acceptable on finished Items.

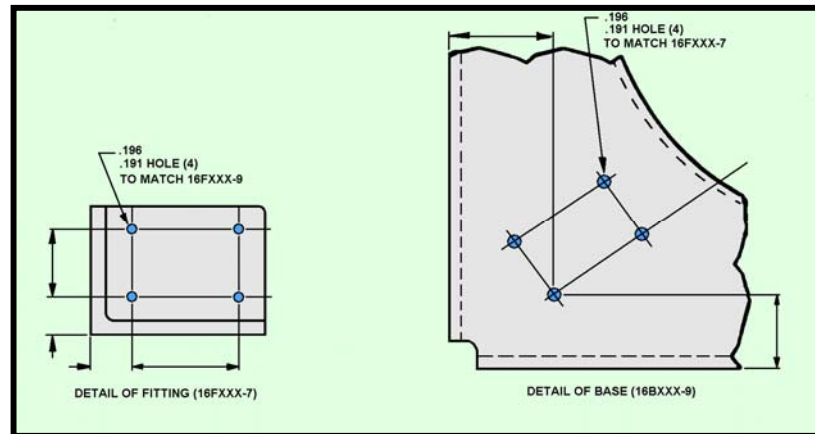


Figure 13. Example of “To Match” hole patterns as defined on engineering drawings.

****7.0 SHIPPING AND STORAGE CONTAINERS FOR BUYER FURNISHED TOOLS**

7.1 Domestic shipping and storage containers can be one in the same for Control Media Tooling, e.g., Master Gage, or Inspection Gage if appropriate.

7.2 Seller shall request from Buyer, a hard copy of the appropriate Container specifications applicable to this PO when Seller has not been granted access to PM-4053. Containers that will serve a dual purpose of shipping and storage shall also be identified as required in PM-4053, section 3.8, and manufactured per requirements in section 3.16, or as specified by Tool Design or this PO.

7.3 The following Tools require a wood shipping and storage container manufactured per PM-4053, section 3.16.4;

- FCGA (Facility Gage)
- FG/30E (Facility Gage) (MAR)
- COMG (Component Master Gage)
- MCG/24E (Master Control Gage) (MAR)
- MG/14E (Master Gage) (MAR)
- MHLT/26A (Master Hole Layout Template) (MAR)
- MSPE (Master Plate)
- MSGA (Master Gage)
- COTG (Component Tooling Gage)
- TOGA (Tooling Gage)

7.4 The following Tools do not require a storage container, but Seller shall store and ship in a manner that will prevent damage, unless otherwise instructed by this PO.

- FTP/21E (Fabricated Tooling Pattern) (MAR)

- 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, section 3.16.4 and 3.16.5.

7.6 Production Tool (non-gage tool) containers shall require Type I, II, or III containers for tools. F-35 program specifies unique shipping and container requirements in PM-4053, section, 3.16.5.

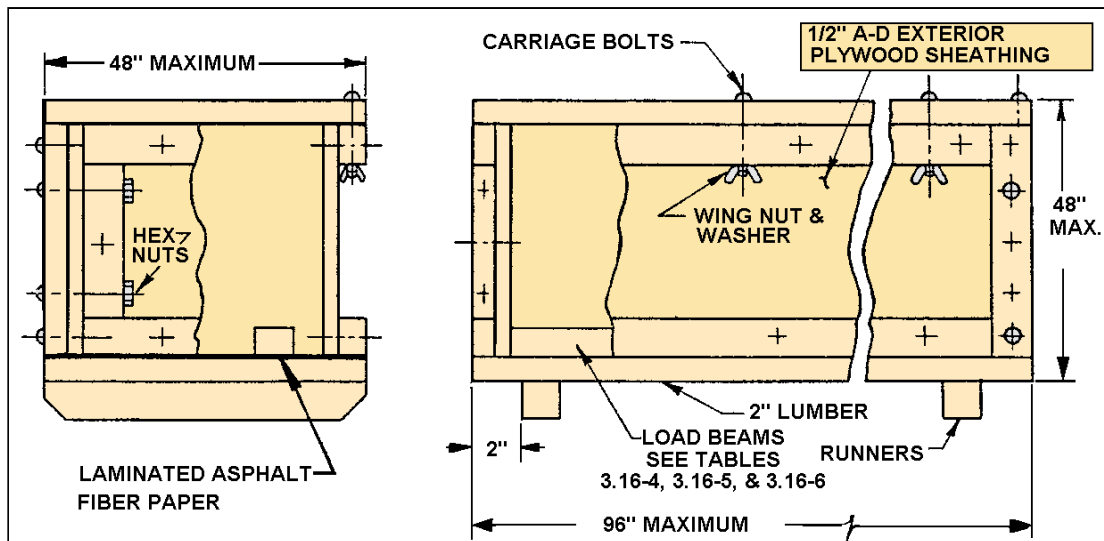


Figure 14. Example of Type I Container

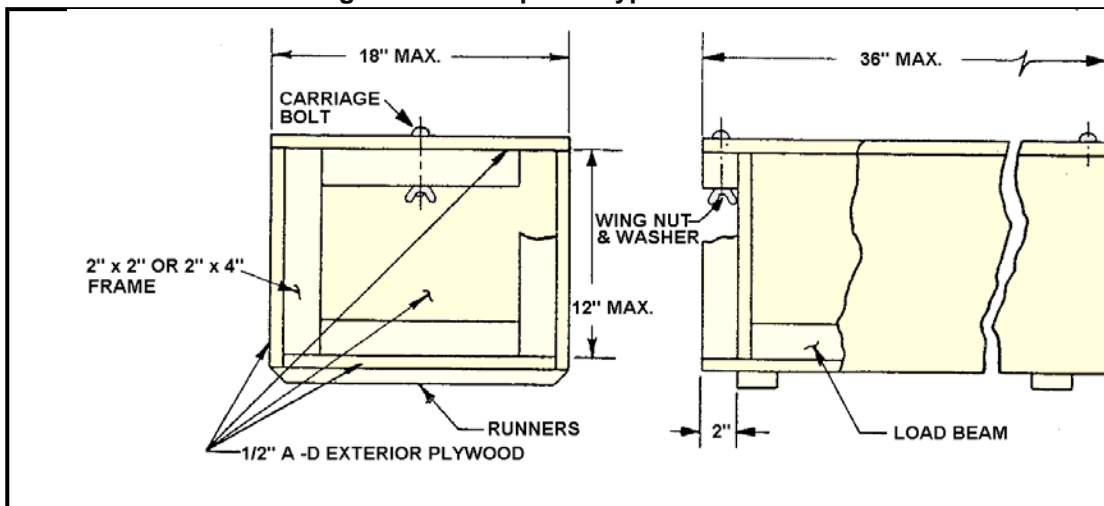


Figure 15. Example of Type II-3 Container

7.7 Larger Tools shall require containers unique to their specific size and shall be manufactured per requirements for Type I-4 containers.

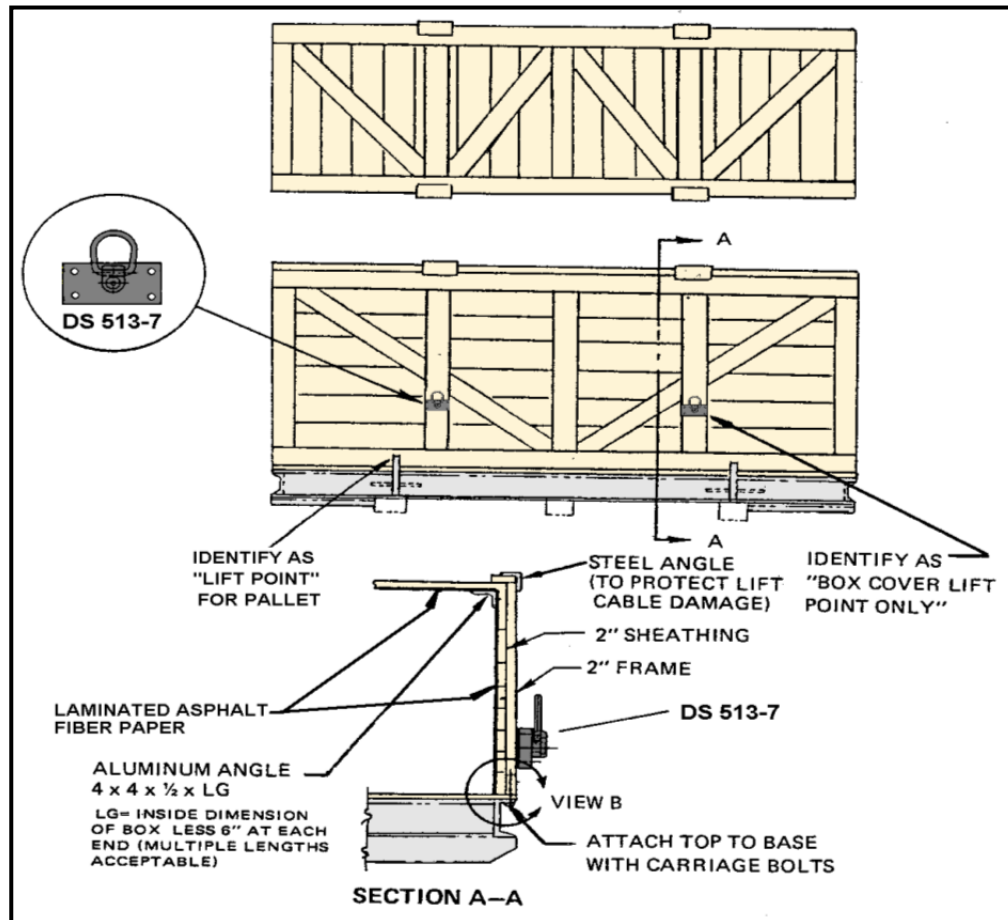


Figure 16. Example of Type I-4 Container for Large Tools

8.0 BUYER FURNISHED TOOLING AND SELLER TO SELLER TRANSFER OF TOOLS

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

8.2 Sellers authorized by Buyer to receive tools from another Seller shall re-verify Buyer transferred or Buyer Furnished tooling in addition to the requirements set forth in this Manual for receipt of tooling in Part I, section 6.0.

**8.3 As part of the receiving requirements, Seller shall be responsible for documenting condition of Control Tools upon receipt, including completing accompanying records within the container per Part I, section 10.3.

9.0 SET-UP PROCEDURE FOR FLOOR BASED ASSEMBLY JIGS

9.1 Seller shall utilize the following guidelines for Major Assembly Jigs and Gages utilized for assembly as re-verification criteria upon receipt. Conformance to the following criteria, Tool Design drawing, PM-4053 and the specific Jig reference system values shall constitute satisfactory acceptance criteria;

- 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 the peripheral rough-structure near each jack screw. Allow the jig to sit overnight (24 hours) to normalize to the environmental conditions under its own weight. Temperature and humidity readings shall be documented throughout the process if Laser verification is utilized for this process.
- Remove grease and/or other preservation treatments from the jig and loosen any pins and/or bushings that may have corroded during shipment.
- Install permanent details such as counter-balances, etc., that were temporarily removed for shipping and check to ensure proper function.
- Remove and establish storage means for removable details for each jig.
- Level the jig (horizontal plane) as necessary to maintain +/- .005 inches tolerance.
- Verify the plumb (vertical plane) of the jig to within +/- .005 inches tolerance. Use buttons where they are provided or the candlestick mounts common to the jig Lines Of Sight (LOS) for this purpose.

Note: It is sometimes necessary to adjust the level of the jig slightly in favor of the plumb in order to avoid excessive twist.

- Set-up and establish the jig reference system using the Laser Tracker targeting system (or equivalent) based on the coordinates provided on the jig. Target points and identification tags with values are stamped on each jig for this purpose.
- Measure the position of the candle-stick mounts, if applicable, per Tool Design drawing. Typically, there are four (4) mounts. Work from forward to aft along the Basic (lower) Line-Of-Sight (LOS), and then along the Auxiliary (upper) LOS. Observe squareness of the points and maintain within .005-inches total tolerance reading. The Auxiliary LOS is allowed run-out in the Z-axis (Water Line), but not in the X-axis (Buttock Line).
- Measure the position and alignment of the end-plates on the respective jigs to the basic and auxiliary LOS criteria per Tool Design drawing.
- Measure and create a y-axis (Fuselage Station) plane on the forward end-plate. The y-value should correspond to the nominal value shown on the tool design drawing and be planer within .010-inch total tolerance reading.
- Measure and create a y-axis (Fuselage Station) plane on the aft-ward end-plate as in the previous step. The y-value should correspond to the nominal value shown on the Tool Design drawing and be planer within .010-inch total reading. Observe the overall length of the jig between the end-plates and verify parallelism to +/- .010 inches tolerance.
- Anchor jig to floor as specified and illustrated in PM-4053, if applicable to tool type.

- Document all readings and/or damaged conditions noted in the steps per Part I, section 7.0 of this Manual.
- Submit SATR forms to document damage and out-of-tolerance conditions for rework/repair authorization, if any is required.
- Rework or repair any damaged tool details and out-of-tolerance conditions dispositioned by Buyer according to tool design drawing or special instructions. For C-130 and P-3 program, Seller shall make note of the completion of all verification points, inspection data, and rework or repairs within the “**Tooling Inspection Record**” **Form 1856-2** accompanying each jig.
- Perform additional inspection/verification items as requested by Buyer’s Representative, if applicable.
- Establish periodic inspection points and records for future dimensional stability checks by verifying these key features during this initial set-up process. See Part I, section 11.0 of this Manual for PI/V requirements.
- Verify or install a new DS-228 Tool Identification Tag, if required on all tools per PM-4053, section 3.8. Stamping and dating of Tool Identification Tag shall be accomplished as directed by Buyer’s Representative.
- Tool shall be placed into use for Trial Run/Tool Proof/FAI activity only.
- Tool shall not be released for Production service until successful Tool proofing activity is completed.

END OF APPENDIX A

END OF TMS-MC-015 MANUAL