

Landing Systems

Title: Supplier - Quality Notification – Entry Support	Doc#: LS-SBU-SQM-SPL001
Functional Group: Supplier Quality	Revision: 01

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1. 9/PURPOSE/SCOPE

This document provides guidance to suppliers on submission of a Quality Notification document to Collins Landing Gear facility for disposition of non conforming product.

2. RESPONSIBILITIES

2.1. Supplier: Notifies Collins of non conforming product at point of detection of defective parts via submittal of a Quality Notification. Submission of QN to Collins via accurately populated submission/continuation forms per guidance in this document. A detailed Corrective action may be requested following review of the QN submission.

2.2. MRB Quality/Coordinator: Review of information, notify Supplier of any turnbacks, MRB requests for information and enter QN into Collins ERP system.

2.3. MRB Engineering: Review Quality Notification and provide disposition.

2.4. Supply Chain – Buyer: Interface with supplier and MRB teams to ensure QN submission, requests for additional information/clarification and MRB disposition(s) are provided in a timely manner to support delivery requirements. Provides updates to supplier on the current status of QN via interrogation of tasking within ERP system.

2.5. Supplier Quality Management: Review Turnback Data and Corrective Action Requests to drive improvements in quality of submission and reduction in QN submissions.

3. REFERENCES/FORMS

- LS-SBU-A001-SQM
- LG DIV SQA FORM 2963
- LG DIV SQA FORM 4486

4. DEFINITIONS/ACRONYMS/ABBREVIATION

- MRB – Material Review Board
- QN – Quality Notification

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5. QN DOCUMENT SUBMISSION

5.1. Process

5.1.1 Non-conforming product requiring LS disposition per LS-SBU-A001-SQM shall utilize LG DIV SQA FORM 2963 for initial communication of the non-conformity

5.1.2 Refer to Section 5.2 for guidance on preparation of Form 2963 for discrepancies

5.1.3 Naming Convention – Initial Submission:
Supplier Name_QN_SupplierNCR#_Part Number_LS Purchasing Site
Ex: ABCInc_QN_123452_161Wxxxx-11_OAK

5.1.4 Upon electronic receipt of your QN Submission form, LS will enter the data within Collins' ERP and a unique QN number will be generated.

5.1.5 *If required to resend the initial entry form again (prior QN number generation), due to errors, duplication, or any rejection from the receiving site, it is recommended that the supplier add the revision level to the end of the naming convention, starting with Rev A, and so on for subsequent revisions. Ex: ABCInc_QN_123452_161Wxxxx-11_OAK_RevA*
Naming Convention – Initial Submission:
Supplier Name_QN_Supplier NCR#_Part Number_LS Purchasing Site
Ex: ABCInc_QN_123452_161Wxxxx-11_OAK

5.1.6 *QN update entries (Reconvene, Requests for more information, Proof of Mutilation) **after QN number has been generated** shall use Form LG DIV SQA FORM 4486 and be named accordingly. See Section 5.1.6 and on.*

5.1.7 LS will communicate the corresponding QN number back to you referencing the original e-mail distribution listing you sent per the respective form.

5.1.8 Naming Convention – QN Update Entries:
Supplier Name_QNRecon_QN#_Part Number_LS Purchasing Site

*Ex: Reconvene: ABCInc_QNRecon_256412_161Wxxxx-11_OAK
Additional Information: ABCInc_AdditionalInfo_256412_161Wxxxx-11_OAK
Proof of Mutilation: ABCInc_ProofofMutilation_256412_161Wxxxx-11_OAK
If required to resend this reconvene entry form **again**, due to errors, duplication, or any*

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- 5.1.9 Once a Collins Quality Notification number is assigned, Additional Information, Continuity, Clarification requests are to be handled via LG DIV SQA FORM 4486 in response to MRB request/disposition submitted to supplier via MoveIT MFT.
- 5.1.10 Form 4486 requests that prior to submission all questions are answered, specifically that all requested disposition information including evidence and sign-offs where required are provided within the attachments section.
- 5.1.11 All submissions initial or continuations shall be posted to MoveIT MFT to the respective folder under 'ToCOLLINS' (New Submission, Reconvene, or Proof of Mutilation respectively).
- 5.1.12 Submission files stay on the MoveIT MFT portal for a maximum of 7 days during which a folder administrator will access and download them.
- 5.1.13 To avoid duplication and ensure quicker turnaround, do NOT resubmit the same form/dataset to MoveIT unless requested by Collins MRB teams.
- 5.1.14 Status of a QN submittal may be received by reaching out to the Supplier Chain (Buyer) or SQM focal.
- 5.1.15 LS will correspond with disposition results via posting a response/copy of QN to the supplier's MoveIT MFT folder.
- 5.1.16 The QN Report is the quality record and will contain LS Quality and MRB authorization.
- 5.1.17 **The QN report shall be the quality record**, signed, stamped and approved by the supplier, at all the designated disposition steps, submitted with the finished product.

5.2. Requirements - Description of non-conformance

The information entered into any QN discrepancy field **must** contain an adequate description, which accurately reflects the actual condition. The intent is to ensure the inspector reports a sufficient amount of data in a clear and concise manner that is unambiguous for the dispositioning engineer. Furthermore, it is imperative that the originator of the QN correlates the discrepancy to the appropriate drawing requirement. A good inspector will be able to ascertain the correct amount of information that is needed in the description to convey the discrepancy clearly. The main idea is to take the perspective of your audience who will be reviewing the documentation. Keep in mind that the MRB engineer solely relies on Quality to provide a clear explanation. If the non-conformance description lacks clarity, then it's possible that a good part could be scrapped while a bad part could be accepted.

NOTE: As a reminder, the QN is a standalone document that must be easily understood by any person reviewing the information. If a MRB engineer requires viewing the part in person in order to fully understand the discrepancy, then the data is considered insufficient to evaluate. As such, the QN will be returned to the original inspector to

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At a minimum, the following basic information is required for EACH discrepant item identified on the QN:

- 1) PART CONFIGURATION
- 2) SERIAL NUMBER
- 3) DRAWING/SPECIFICATION
- 4) SHEET/PAGE NUMBER (2D Drawings/Specification)
- 5) SHEET/MODEL REVISION LEVEL
- 6) ZONE LOCATION/CAPTURE
- 7) DRAWING REQUIREMENT (as shown on the face of the drawing or PL)
- 8) DISCREPANCY
- 9) LAST OPERATION COMPLETED (as per the approved manufacturing plan)

See Appendix for detailed examples of different defect conditions.

5.3. Preparation of QN Form 2963

- 5.3.1 Opening either **FORM 2963 or 4486** for the first time will require enabling macros on your computer and as read only, no password required.
- 5.3.2 LG DIV SQA FORM 2963 shall be used to Identify and report non conformances against product at a supplier facility/sub-tier (undelivered to Collins Landing Systems). Where a suspect non conformance cannot be confirmed, reach out to your assigned Supplier Quality Management focal for guidance.
- 5.3.3 The form is structured in 2 sections.
 - Rows 2-20: QN Submission Sheet Header
 - Rows 21 onwards: Issue Description.
- 5.3.4 Upon completion of form, use the prescribed naming convention to title the file.

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5.3.5 See below guidance on populating LG DIV FORM 2963.xls:

Line	QN Fields	Entry Support
1		Title block. No entry required.
2	Collins Quality Notification #	this is to be filled in by Collins personnel upon issuing Quality Notification number
3	Vendor Name:	Enter your company name. (The organization to whom the Collins purchase order was issued to)
4	Vendor Number on PO	Enter your vendor number. It is on the Collins Purchase Order
5	Collins LS Procurement Site	Select the purchase order Collins Landing Systems site from the drop-down box.
6	Vendor's Manufacturing Control # (Router, traveler, etc. #)	Enter your manufacturing process/production control record number (traveler, router, etc.).
7	Vendor's Internal Non-conformance Control #	Enter your internal nonconformance control number. Mandatory field. Do not leave blank or mark Not Applicable/NA.
8	Date (mm/dd/yyyy) of Non Conformance:	Enter date (mm/dd/yyyy) of the nonconformance.
9	Responsibility (Choose Vendor or Collins LS)	Choose the responsible organization for the nonconformance from the drop-down box. If "Collins/ COLLINS" is selected, then clearly state the reason why in the cause text (Line 36).
10	Defective Part Number	Enter the defective part number <u>Proprietary parts:</u> Input part number as on PO.
11	Defective Part Number Description	Enter the part description of the part number (entered in line10) as stated on the drawing
12	Previous Quality Notification(s) or Previous Rejections for this Part/Serial Number	Enter any open/closed/cancelled Quality Notifications with Collins for the same part(s) AND same Serial number(s) or manufacturing batch (un-serialized).
13	Lot Quantity	Enter the lot quantity being produced that the discrepant product is associated.
14	Quantity Discrepant:	Enter the quantity discrepant <i>only</i> . <i>Note: This quantity is a subset of the manufactured lot quantity.</i>
15	Program/Project Name	Select the program/project number from the drop-down box. Choose "Other" if product supports multiple programs and/or is not identified. If "Other" is selected, specify this in adjacent column – Cell V15.
16	Engineering Drawing number or offload operation part number	Enter the engineering drawing number as depicted on the design authority for the discrepant part number. In the case of an offload operation from Collins enter the part number as listed on the manufacturing plan.
17	Engineering Drawing Revision Level or offload operation revision	Enter the revision level of the engineering drawing associated with the part number. The DIR document is not an engineering document. In the case of an offload operation from Collins enter the revision of the operation on the manufacturing plan.
18	Serial or Batch Number(s) of Nonconforming Part Number	Enter SNs (where tracked) or lot Batch number of all the discrepant product. Count of SNs to match qty in line 14.
19	1st Time Manufacturing or Sustaining	Denote whether this is your 1st time manufacturing this part or if this is on-going production
20	Non-conforming Part Number(detail) including configuration (-#)	Specify detail part number impacted by nonconformance.
21	Part Description of rejected detail Part Number	Specify the Detail Part number's (Line 20) part description.
22	Serial Number(s) of Nonconforming Part Number	Enter the serial number(s) for the rejected part number. Enter N/A if non serialized
23	Engineering Drawing/Document number or offload operation	Enter the engineering drawing number and relevant specification. In the case of an offload operation from Collins enter the part number as listed on the MPS. Eg: 161AXXXX, LGPSXXXX, AMSXXXX

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24	Sheet #, Rev #, Zone#, Capture (3D - Model) or offload operation number and Rev	<p>Specification/2D: Drawing, Sheet number, Revision, Zone, Parts/Notes List, Engineering order (EO/NIEO).</p> <p>Model Based/3D: CATIA Model & Revision, Capture or Feature within Model tree (should be defined implicitly for dimensions outside those included in captures using the associated tolerance and snapshot). Identify All Relevant Flag/General notes numbers.</p>
25	Attachment(s)	<p>Select from the drop-down box Yes or No, make sure you have attached before uploading to MoveIT MFT. Attachments are required to be annotated on each page with the following information:</p> <ul style="list-style-type: none"> Part number Part name Engineering Part number Serial number (if applicable) Supplier nonconformance control number Issue number <p>Ensure Attachments are legible and provide color copies where possible. Best Practice: Recommend attachments to be in PDF format.</p> <p style="background-color: yellow;">Submit QN Submission Template and any attachments in one Zipfile. Utilize prescribed naming convention for the Zipfile uploaded to MFT.</p> <p>Note: Annotation - Engineering Part number shall not include a suffix of '-900'.</p>
26	Requirement (SHOULD BE) Per Drawing and/or Offload operation:	<p>Enter the requirement clearly and exactly as documented from the Engineering Drawing/Document/Specification/Model that the Non-Conformance exists on including GD&T descriptions where required, i.e., Concentric, Perpendicular, Finish, etc.</p> <p>Include flow down from the top level to discrepant feature engineering. Copy the complete requirement from the relevant engineering Drawing/ Document/ Specification/ Model. If the requirement is defined outside the drawing, use complete sentences.</p> <p><u>Do not</u> provide an interpretation of the requirement. <u>Do not</u> add only pictures/captures of the drawing requirements as this field requires text to be completed.</p> <p><u>Proprietary Parts:</u> Include a copy of the drawing and/or capture showing the associated requirements within attachments.</p> <p>Example1: Min/Max Dia Position 0.25M A B C ; Flatness 0.25 ; Parallel 0.1 A .</p> <p>Example 2: Scenario - Scratch/Dent damage occurred as part of a drop.</p> <p>Expected Level of Information: On "Engineering Drawing/Document/Specification/Model" as defined on "Parts List/Notes" - Flag Note X: Surface finish to be 32RA or better.</p>

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27	Discrepancy (AS IS) Per Drawing and/or Offload operation:	<p>The Quality Notification document is a standalone document, the discrepancy should be stated as clear and precise as possible. State the discrepant condition as it relates to the released Engineering Drawing/Document/Specification/Model and the requirements defined in line 26, its physical location/orientation relative to features identified, and identify the failure mode when applicable; i.e. Dents, Chips, Scratches, Orientation, etc.</p> <p>All Physical defects need to be quantitatively defined against the drawing requirements.</p> <p><u>Serial Number Traceability:</u> Measurements/discrepancy should be defined to correlate against individual serial numbers (where applicable). <u>Resolution:</u> Measurement resolution should be in line with drawing requirements. <u>Non-Conformance Cause:</u> It is imperative to include detailed description of the cause of the non-conformance as it will impact disposition.</p> <p>Example(s): Scenario: Scratch/Dent damage occurred as part of a drop. Expected level of information: Part dropped from 'X' feet onto *insert surface here*. Part exhibits scratch measuring 'X' inches long, 'Y' inches wide, 'Z' inches deep. Defect was noted adjacent to hole measuring 'A' inches at DWG Location A-5, sheet 2.</p>
28	Quantity Discrepant:	Enter the quantity discrepant impacted by this issue.
29	List the last three operations completed: (give names)	Enter the <u>name of the last three operations completed</u> on the part or parts. If the last operation completed is a NDT operation state the machining, the process (cadmium, chrome etc.) operation that was completed prior to the NDT process along with the NDT operation. Do not enter operation numbers relative to your organization by themselves without a description. If the last three operations are the same, e.g., different levels of assembly or milling of different areas, kindly differentiate as best possible. For a part that is 100% complete, make note of this as such.
30	Is Heat Treat completed for Part Number listed	Select from the drop down box if heat treat is completed.
31	If Processor Caused select Processor from Dropdown otherwise select N/A	Enter the name of the processor caused, Copy name directly from Doc 200.
32	Defect Code	Select appropriate code from drop down box (mandatory)
33	Defect Text (Additional Detail Information)	Describe the defect in practical terms as best as possible.
34	Cause Code	Select a cause code from drop down box (mandatory).
35	Cause Text (Additional Detail Information)	Enter a details description of the cause of the non-conformance as determined at the time of submission. If the responsibility for the nonconformance is Collins/COLLINS then you must state why. This information is required in order to provide a disposition. (Mandatory)
36	Corrective Action Code	Update CA code from QN dropdown.
37	Corrective Action Text (Additional Detail Information)	Enter a corrective action text based on the actions taken to correct the direct cause and/or root cause of the discrepancy
38	Additional issue? (enter Yes in the adjacent block)	If there is another distinct and separate issue associated with these parts, choose Yes, and another set of issue text will be generated for you to complete. Each discrepancy against requirement identified on the Engineering Drawing/Document/Specification/Model correlates to a single issue.
39	Is the defect being raised against a Collins offload operation/Offload PO?	Select 'Yes' where the engineering authority (noted on the PO) is defined by a Collins/Customer Manufacturing Process Plan number.
40	Is the defect (exact requirement and discrepancy boundary) anticipated to be present on subsequent shipments?	Respond 'Yes' where the defect is anticipated to be present on subsequent shipments/product yet to be produced. Specify in this field, the applicable anticipated population and/or time period, for the known defined and bounded discrepancy. Detailed Cause and Corrective action(Ref Line 35 and 37) is required to be documented for each issue. Landing Systems MRB will use this information for consideration of a time/quantity defined approval.
41	Quality Representative:	Enter Name of Quality Representative handling non conformance within your organization.

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42	Quality Representative Email:	Include all corresponding e-mail addresses required for communication/ response back from Collins within your organization
43	Vendor Comments:	Include any additional comments including any clarification, comments or suggestions relative to the product in question. Identify the facts supporting a Collins caused requirement for submitting this Quality Notification request
44	Date (mm/dd/yyyy):	Automatically populates today's date.

5.3.6 The LG DIV SQA FORM 2963.xls cannot be closed, or data forwarded (Saved) without ensuring all the appropriate fields are correctly and completely filled in.

5.4. Preparation of QN Continuation Form 4486

5.4.1 Use form for the following reasons once a Collins Quality notification number has been generated:

- 5.4.1.1. Provide response to the MRB Disposition/Request for Additional information/Reconvene request communicated by Collins LS MRB via MoveIT MFT to the supplier.
- 5.4.1.2. Request corrections/changes to an open quality notification or defect item on previously submitted QN Submission form 2963.
- 5.4.1.3. Request cancellation of quality notification.
- 5.4.1.4. Submit Proof of Mutilation statement

5.4.2 After QN closure, a new QN submittal will be required. Under very specific circumstances the QN may be reopened per discretion of the MRB Team.

5.4.3 QN Update sheet tab – ‘Issue 1’ may be duplicated within the same worksheet to provide updates against existing issues/defects.

5.4.4 See below guidance on populating QN Continuation sheet - LG DIV FORM 4486.xls

Line	QN Field	Entry Support
1		Title block. No entry required.
2	COLLINS SAP QN #	Enter the Collins Quality Notification number reference provided.
3	Item #	Enter Item number from the corresponding Quality Notification.
4	Non-conforming Part Number(detail) including configuration (- #)	Enter the detail part number including dash number corresponding to the Item # - (line 3)
5	Serial Number(s) of Part Number this additional information references	Enter serial number(s) of the parts this additional information form references. Enter N/A is part is not serialized.
6	Today's Date	Auto-populates today's date. No input required.
7	Quality Representative	Enter Name of Quality Representative handling this non conformance within your organization.
8	Quality Representative Email	Include all corresponding e-mail addresses required for communication/ response back from Collins within your organization
9	Prior to submission have you:	No entry required.

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10	Validated that the reconvene requested QN buyoff documentation including data and approvals (stamps) and have been included as an attachment file in this form, as/or if defined in the MRB disposition	<p>Verify associated attachments have been added within field I-3 (attachments block).</p> <p>Substantiate QN reconvene with the requested QN buyoff (stamped production orders, certificates of conformance, etc), measurements/data and approvals.</p> <p>Attachments are required to be annotated on each page with the following information:</p> <ul style="list-style-type: none"> Part number Part name Engineering Part number Serial number(if applicable) Collins Quality Notification Number Supplier nonconformance control number <p>Item number</p> <p>Note: Engineering Part number shall not include a suffix of '-900'.</p>
11	Validate that this is not a duplicate submittal	Ensure this is not a duplicate submission for the reference serial number.
12	Validate that any sketches, pictures or diagrams are clear to avoid future reconvenes	Validate submission to ensure reconvene captures all requests from LS MRB.
13 & 14	N/A	Title/Heading block. No entry required.
15	White Board Area	<p>Where additional information has been requested on a QN, copy over request for information/reconvene directly from QN report response submitted to supplier. In a subsequent line, provide direct response to each element of the MRB Request.</p> <p>Ensure each element of Collins MRB request has been addressed and substantiated with supporting data/attachments as needed.</p> <p>For any reconvene or requests for additional information or to revise disposition, provide the exact status of the discrepant part.</p> <p>For new discrepancies directly related to the existing QN items/disposition resulting in a new issue, embed a QN initiation form 2963 detailing a new issue to be appended to the existing QN.</p> <p>For Defects unrelated to current defects/disposition, initiate a new QN submission.</p>

5.4.5 The *LG DIV SQA FORM 2963.xls* and *LG DIV SQA FORM 4486.xls* are work aids for the sole purpose of communicating non-conformance data between the supplier and LG. Upon receipt and entry of data into SAP, either by the supplier or LG, these work aids will become reference documents.

5.4.6 The guidance provided in this document is meant to provide support with entry of QN submission and driving a reduction in turnbacks owing to missing/incorrect information. Depending on the QN/Issue at hand, Collins LS MRB may request additional information to support delivery of a disposition.

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6. APPENDIX – SAMPLE DEFECT DESCRIPTIONS

6.1. EXAMPLE – DEFECT Description:

A discrepancy has been identified on an outer cylinder during inspection. The following situation shows the correct amount of information in the discrepancy field that must be presented on the QN. In this particular case, the non-conformance is related to a dimensional feature which can be referenced from the drawing. The written description below shows the correct relationship between the **drawing requirement** and the **discrepancy**.

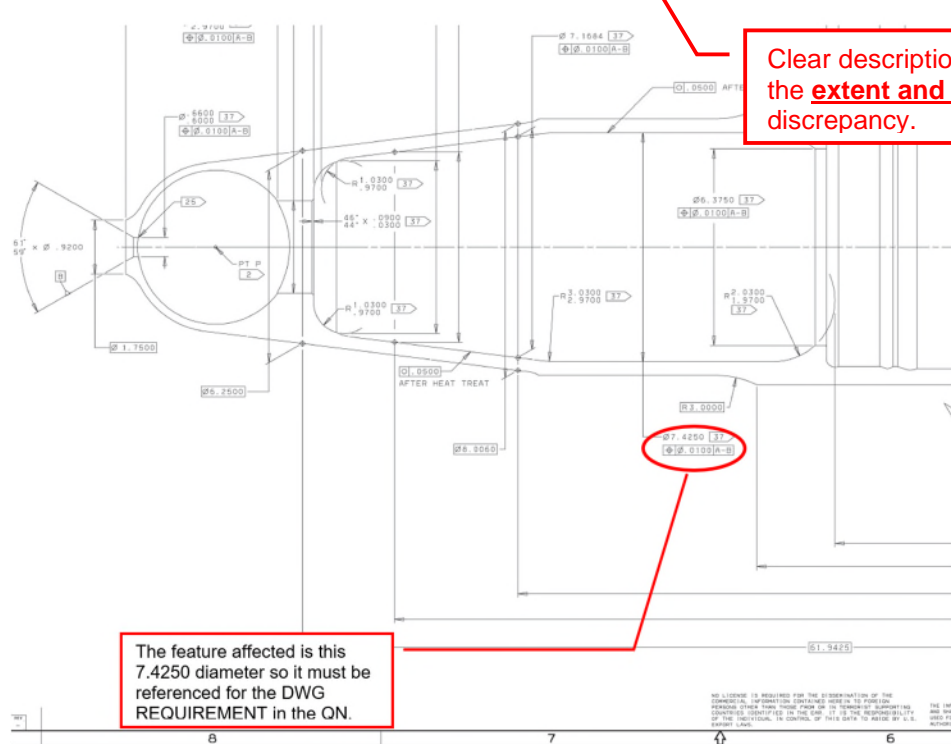
PART CONFIGURATION: 161AXXX-Y
 SERIAL NUMBER: WGDB1234
 DRAWING: 161AXXX
 SHEET NUMBER: 56
 SHEET REVISION LEVEL: A
 ZONE LOCATION: B7
 LAST OP. COMPLETED: SHOT PEENING

DWG REQUIREMENT: 7.4250 I.D., FL37

Correct feature referenced for the DWG REQUIREMENT

DISCREPANCY: 7.4250 I.D. HAS MULTIPLE CIRCULAR TOOL LINES 50 INCHES FROM OPEN END FACE APPROXIMATELY .001 DEEP. PART IS AFTER SHOT-PEEN AND BEFORE CHROME PLATE. SEE PHOTO ATTACHED FOR ADDITIONAL DETAILS.

Clear description that provides the extent and location of the discrepancy.



The feature affected is this 7.4250 diameter so it must be referenced for the DWG REQUIREMENT in the QN.

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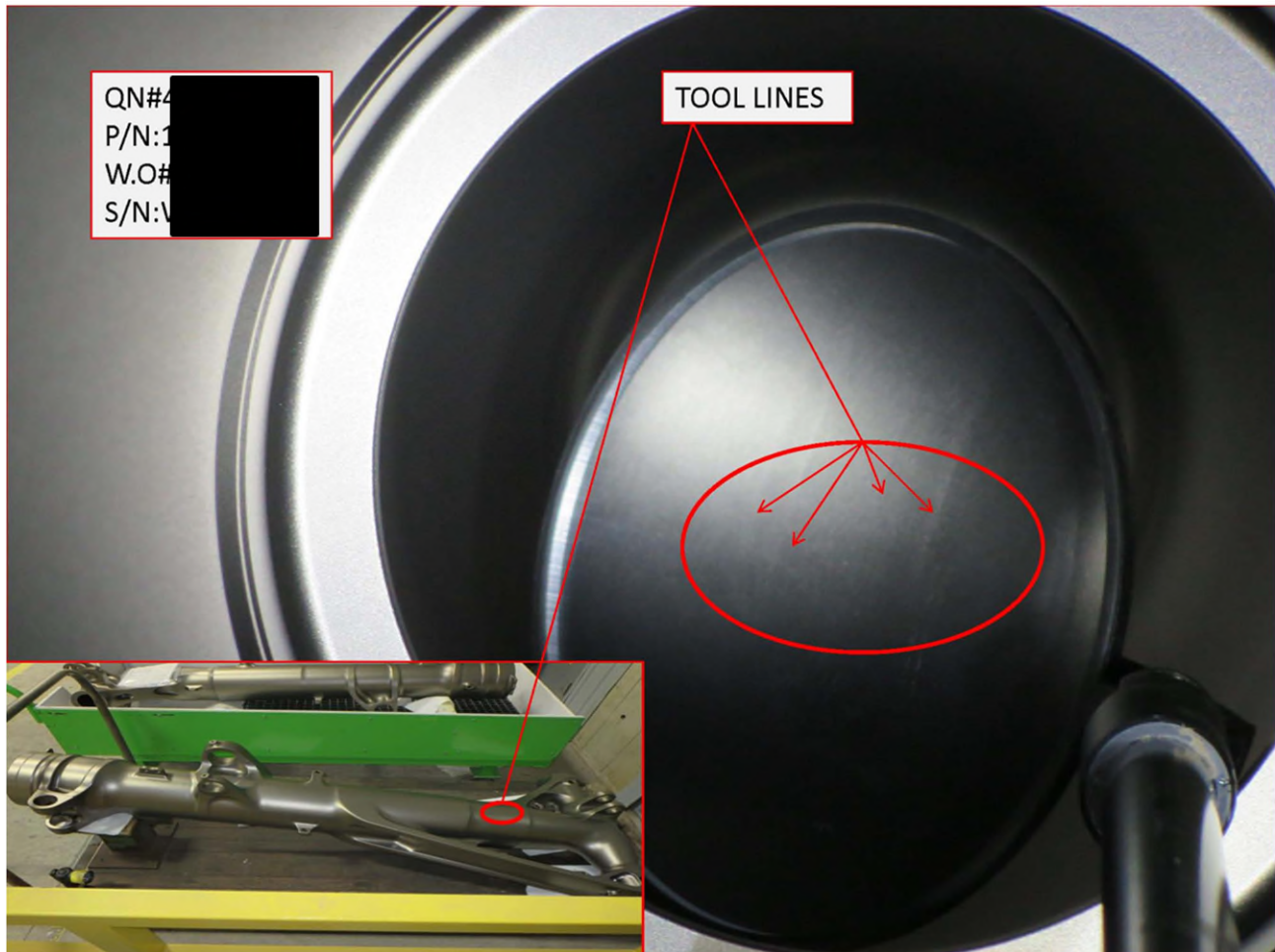
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The following attachment is provided in the QN as a visual aid that supplements the written description of the non-conformance. In this case, the presentation and level of detail in this marked up photo gives a good visualization of the reported condition, which corresponds to the description.

ITEM #0001 PHOTO: DEPTICTING TOOL LINES



There are a wide variety of non-conformances that can be generated during the manufacturing process. The following examples are intended to highlight some common occurrences while defining what MRB engineering considers to be sufficient information on the QN during the initial submittal. Furthermore, the examples are preceded with a short explanation that provides some insight to the thought process and the reasons for requiring specific information. Omission of any necessary data will result in a turnback, which causes a delay to the process.

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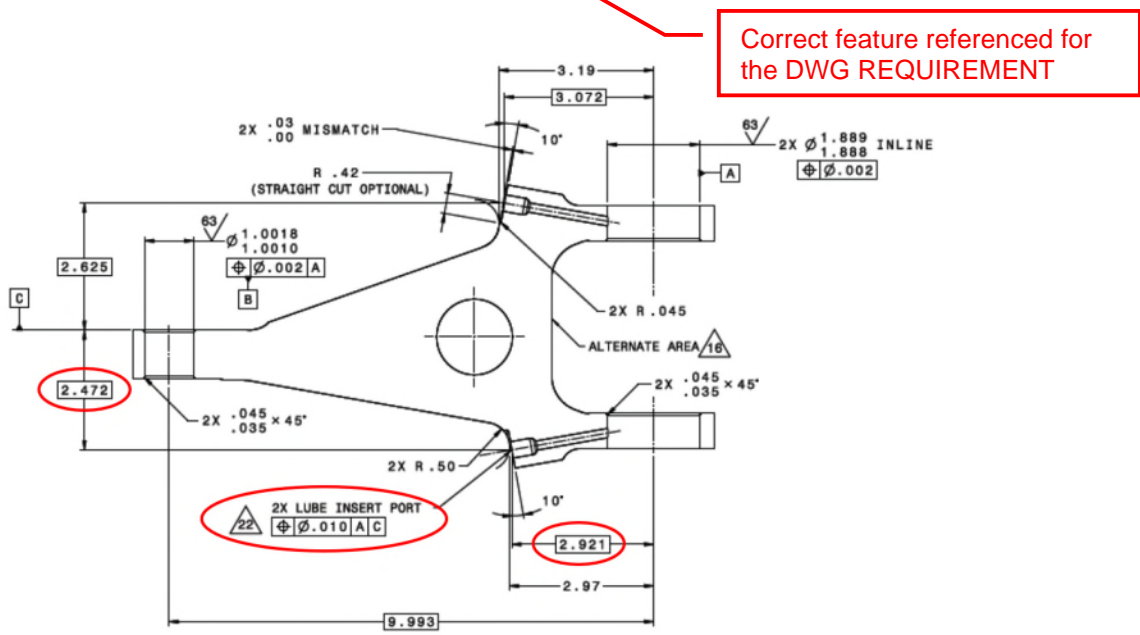
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6.2. Mis-Location of a Feature (Example 1)

Mis-location of a feature such as a bore (I.D) is frequently encountered in manufacturing. During the initiation of a QN, it is not correct to reference only the feature control frame without specifying the feature itself. Keep in mind that the feature control frame cannot exist alone. Therefore, the requirements section must include the feature in the discrepancy field as well as the feature control frame. Furthermore, in the description of the discrepancy, the associated basic dimensions must be given so the MRB engineer knows the direction of the shift.

PART CONFIGURATION: 4AWXY-1
 SERIAL NUMBER: ABC12345
 DRAWING: 46107
 SHEET NUMBER: 2
 SHEET REVISION LEVEL: B
 ZONE LOCATION: D2
 LAST OP. COMPLETED: 310 (CNC MILLING)

DWG REQUIREMENT: FL22 2X LUBE INSERT with a $\varnothing 0.010$ true position to Datums | A | C |



DISCREPANCY: The lube insert port feature at the lower location as shown on the face of the drawing exhibits a true position of 0.020 to Datums | A | C |
 REF. DWG Basic Dimension 2.472 is actually 2.4798
 REF. DWG Basic Dimension 2.921 is actually 2.9273

Clear description that provides the direction and magnitude of the shift of the discrepant feature.

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6.3. Manufacturing Defects (Example 2)

A localized surface defect caused during manufacturing is another frequent discrepancy encountered on a part. A surface defect is a generalized term that can be further defined on the QN as a tool line, a scratch or a gouge, etc. Each term implies something different, which can provide insight to the cause and severity of the discrepancy. Thus, it is important for the inspector to understand the implication and the applicability of the established terms that are commonly used in the shop to ensure the conditions are accurately described. It is noteworthy to also mention that the use of specific terminology is far more beneficial than basic terms to the MRB engineer who is evaluating the QN. Therefore, the inspector must be specific in documenting every non-conformance. Otherwise, the QN will be returned to the originator to provide complete details of the reported condition.

Reporting a surface condition, whether it's a circular tool line or a localized gouge, etc., must contain the following information:

- Correct description of the defect based on how it occurred
- Extent of the defect: (length x width x depth)
- If applicable, location of the defect relative to a unique feature such as a datum or part marking
- Clear photos (magnified views and zoomed-out views) of the discrepant area that visually shows the extent/location of the defect

PART CONFIGURATION: 2143MXXXX-1
SERIAL NUMBER: ABC12345
DRAWING: 2143MXXXX
SHEET NUMBER: 21
SHEET REVISION LEVEL: B
ZONE LOCATION: C4
LAST OP. COMPLETED: 430 (SHOT PEENING)

DWG REQUIREMENT: Tapered diameter between the 4.3000 O.D and 5.3000 O.D

DISCREPANCY: Tapered diameter between the 4.3000 O.D and 5.3000 O.D has a localized dent mark that measures approximately 0.160L x 0.130W x 0.005 deep at a location of 10.5000" from Datum –F– end face. With the part lying horizontal, the open end face on the left-hand side, and viewing the part from datum –F– end face with the trunnion cross holes in the up and down position, the damage is approximately located at the 3 O'clock position. See attached photo for additional details.

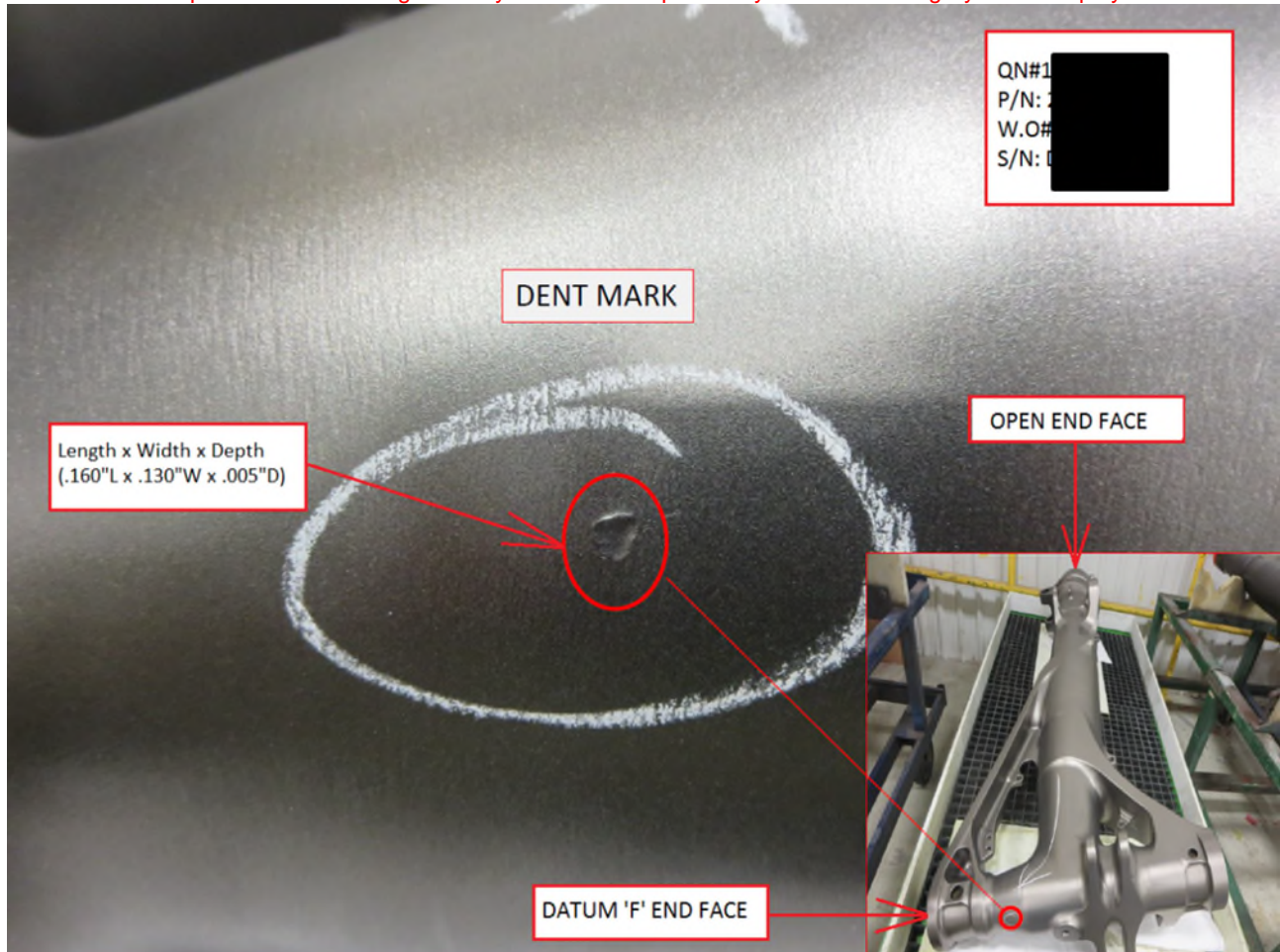
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NOTE: Providing the exact location of the defect also facilitates the process downstream. For certain cases on un-finished parts, be advised that the defect will likely disappear after it is smoothly blended. The subsequent NDT inspection may be difficult to execute if the inspector is struggling to detect the corresponding area. As a result, the inspector may inadvertently check the wrong surface. Since it is no longer obvious to the naked eye, the NDT inspector must solely rely on the initial documentation of the rejection to locate the affected area precisely.

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6.4. Undersized Lug Thickness (Example 3)

When a discrepancy occurs on a lug during the final machining process, there are 3 lug parameters that are of primary concern to MRB engineering; the lug inner diameter, lug thickness and lug radius dimension. The bore diameter and the lug radius (periphery) are the two features that dictate the lug's wall thickness. For the purposes of reporting lug data, the minimum wall thickness is preferred. In the case where one or more of the 3 lug parameters are discrepant, all 3 are required to be inspected and reported in the QN. If the lug features are plated (nickel, chrome, cadmium, zinc-nickel, etc.) per drawing requirements, be sure to provide the actual plating thickness for all common lug surface.

PART CONFIGURATION: 1003MXXXXXXC002
SERIAL NUMBER: ABC12345
DRAWING: 1003MXXXXXXC002
SHEET NUMBER: 1
SHEET REVISION LEVEL: B
ZONE LOCATION: B3
LAST OP. COMPLETED: 230 (DEBURR)

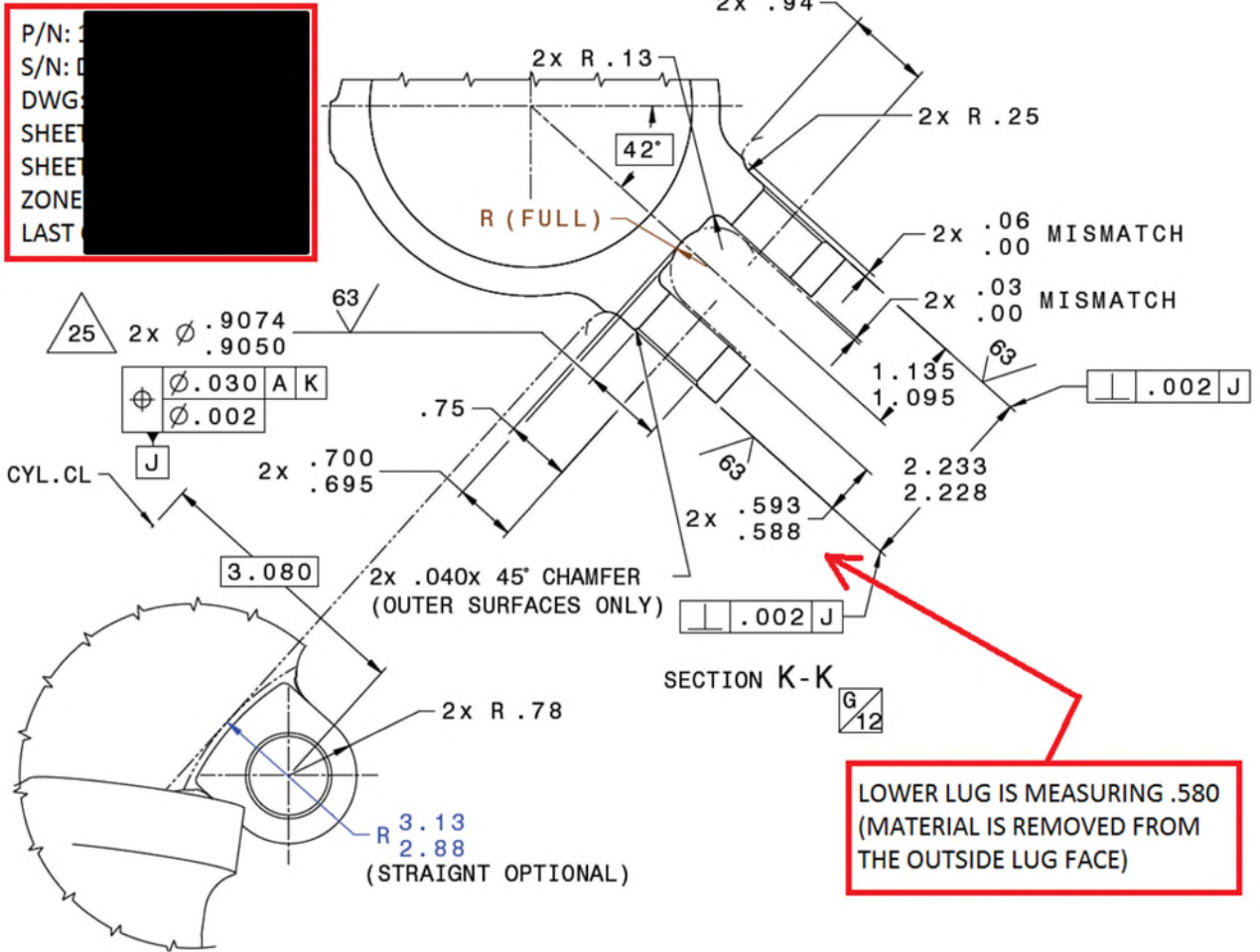
DWG REQUIREMENT: 2X 0.588/0.593 DIMENSION

DISCREPANCY: 1X 0.580 actual. The material is missing from the outside face on the lug opposite to the 1.095/1.135 linear dimension.
REF DWG 0.9050/0.9074 is currently measuring 0.9060
REF wall thickness common to DWG R 0.78 is measuring 0.327
See attached photo for details.

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6.5. Oversized Bushed Bores (Example 4)

During the manufacturing of the part, a bore can be machined oversize to remove surface defects or correct its position. In the case where a part has multiple bores of the same size (i.e 2X 1.0000/1.0007) and only 1 of the 2 is rejected, it is important for the inspector to clearly distinguish the discrepant bore from the other conforming bore. Because there are 2 similar features in close proximity to each other with similar design definition, a vague description can cause a misinterpretation that is detrimental to both the evaluation and repair process. For this reason, an accurate explanation from inspection is necessary to eliminate any kind of ambiguity. By doing so, it enables the technicians in the shop to easily locate the affected feature, which greatly reduces the potential of installing special/modified bushings into the wrong locations.

Reporting a non-conforming bore that is similarly defined on the drawing with other bores, must contain the following information:

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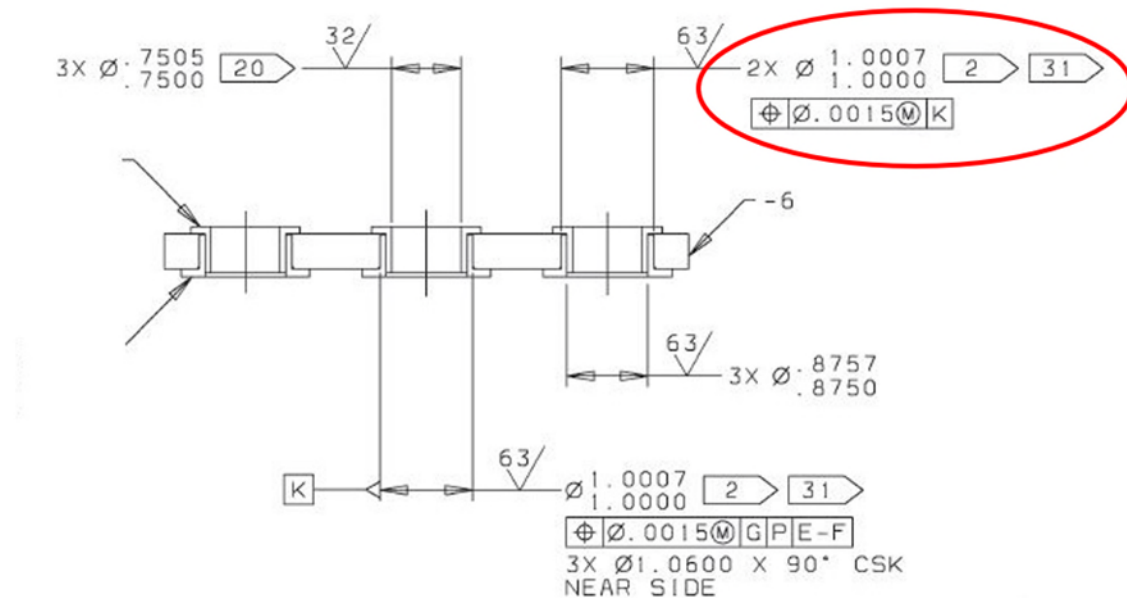
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- Actual size of the bore in question
- Clearly indicate which of the bores is affected by using a reference feature to describe the exact location

PART CONFIGURATION: 2143MXXXX-1
 SERIAL NUMBER: ABC12345
 DRAWING: 2143MXXXX
 SHEET NUMBER: 2
 SHEET REVISION LEVEL: C
 ZONE LOCATION: G4
 LAST OP. COMPLETED: 230 (DEBURR)

DWG REQUIREMENT: 2X 1.0000/1.0007

DISCREPANCY: 1X 1.0207 actual in one place. The discrepant bore is the one that is closest to the trunnion bore on Datum –E– side



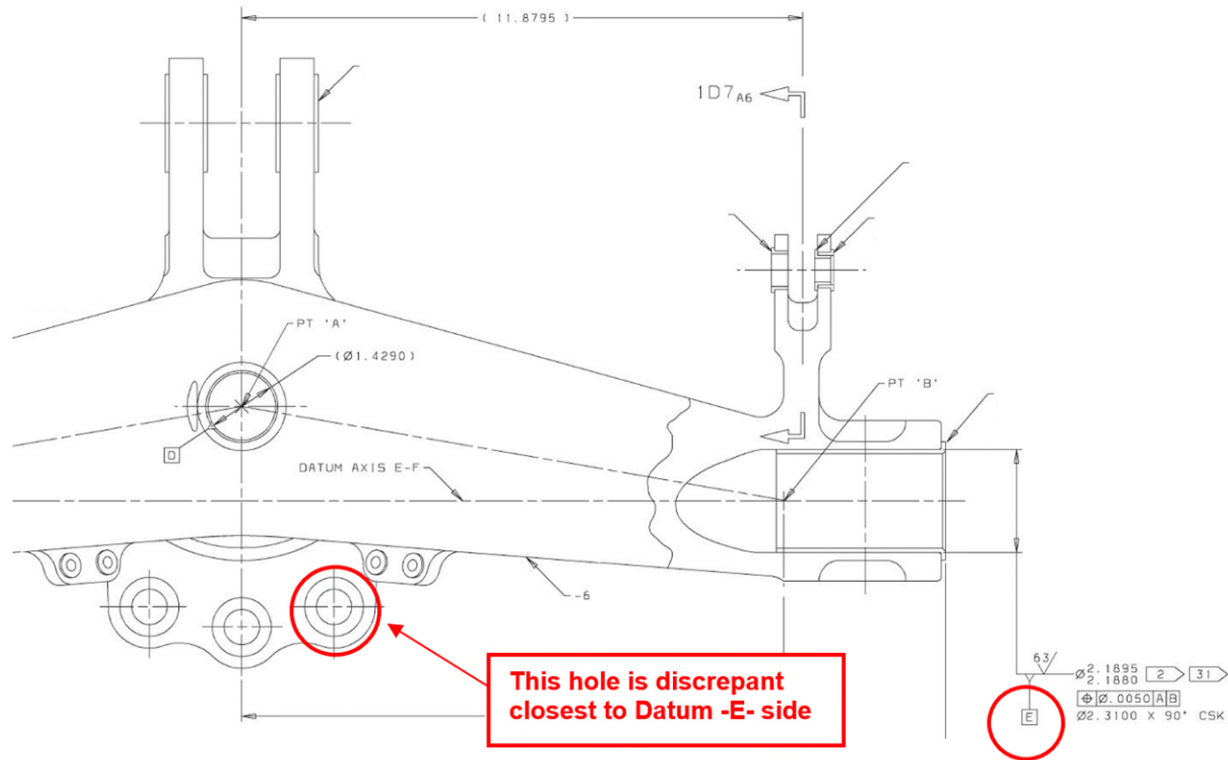
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6.6. Oversized Main Bore of Cylinders, Housings or Pistons (Example 5)

Inner diameters designed with tight tolerances with micro finishes finer than 32RA are highly sensitive features that are critical to the functional integrity of the component.

For pistons and outer cylinders whose main I.D (long bore) are reported oversize, it is necessary to identify the **LOCATION** and **EXTENT/MAGNITUDE** of the non-conformance on the QN. It is key to understand that both the location and extent/magnitude of the non-conformance are essential details that have a significant impact to the evaluation of the part. Either location or extent of the discrepancy can render a part functionally or structurally unacceptable. As a result, this type of data needs to be sufficiently and accurately documented, which includes a sketch mapping out the aforementioned details.

PART CONFIGURATION: 2143MXXXX-1
 SERIAL NUMBER: ABC12345
 DRAWING: 2143MXXXX
 SHEET NUMBER: 19
 SHEET REVISION LEVEL: C
 ZONE LOCATION: H9
 LAST OP. COMPLETED: 230 (shot peening and post-shot peen honing)

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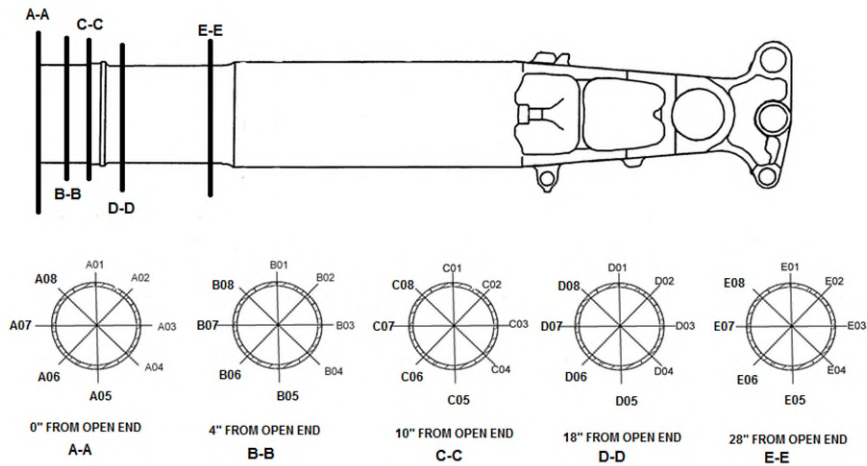
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DWG REQUIREMENT: 12.629/12.632 with a concentricity to Datum -B-

DISCREPANCY: The 12.629/12.632 I.D is oversized throughout the entire length and varies up to a maximum of 12.637. The following sections at different locations provide the actual measurements for the I.D size and wall thickness. See attached sketch for details regarding the actual size and wall thickness at 45 degree increments around the circumference on each section view.

Section A-A (0" from open end): Max oversize is 12.636" and min wall is 0.435"
 Section B-B (4" from open end): Max oversize is 12.637" and min wall is 0.432"
 Section C-C (10" from open end): Max oversize is 12.634" and min wall is 0.633"
 Section D-D (18" from open end): Max oversize is 12.635" and min wall is 0.352"
 Section E-E (28" from open end): Max oversize is 12.634" and min wall is 0.352"



A-A			B-B			C-C		
LOCATION	I.DIA	WALL	LOCATION	I.DIA	WALL	LOCATION	I.DIA	WALL
A01	12.636	0.438	B01	12.637	0.435	C01	12.634	0.634
A02	12.636	0.438	B02	12.638	0.434	C02	12.634	0.634
A03	12.635	0.439	B03	12.636	0.436	C03	12.633	0.635
A04	12.635	0.439	B04	12.637	0.435	C04	12.632	0.636
A05	12.636	0.437	B05	12.637	0.437	C05	12.634	0.635
A06	12.636	0.435	B06	12.638	0.432	C06	12.634	0.633
A07	12.635	0.438	B07	12.636	0.437	C07	12.633	0.634
A08	12.635	0.436	B08	12.637	0.435	C08	12.632	0.636

D-D			E-E		
LOCATION	I.DIA	WALL	LOCATION	I.DIA	WALL
D01	12.632	0.355	E01	12.632	0.356
D02	12.635	0.352	E02	12.632	0.357
D03	12.632	0.355	E03	12.632	0.357
D04	12.632	0.355	E04	12.634	0.354
D05	12.632	0.357	E05	12.632	0.356
D06	12.635	0.352	E06	12.632	0.356
D07	12.632	0.352	E07	12.632	0.352
D08	12.632	0.352	E08	12.633	0.353

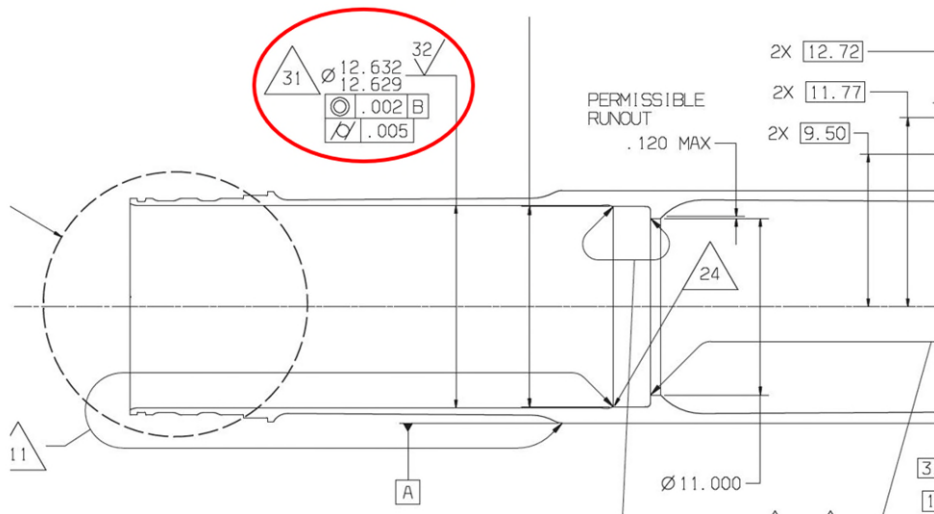
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6.7. Oversized / Undersized Threads (Example 6)

After a thread is fully manufactured, inspection is required to verify conformance to drawing/specification requirements. The thread shall be inspected with a go-gage and no-go gage. If the thread fails either gage inspection, the following information shown below is required. Whether it is locally or uniformly undersized/oversized across the full length, it is critical for the inspector to report the extent of the discrepancy. In the event that the threads are not uniformly discrepant, the inspector shall provide actual measurements for each thread along the total thread length. Additional inspection shall be performed to determine the presence of burrs, cadmium build up or thread deformation that could impede gage inspection. It is also important to specify whether the thread is plated or not at the time of inspection.

PART CONFIGURATION: 161TXXXX-1
 SERIAL NUMBER: ABC12345
 DRAWING: 161TXXXX
 SHEET NUMBER: 1
 SHEET REVISION LEVEL: NC
 ZONE LOCATION: B2
 LAST OP. COMPLETED: 160 (FINAL INSPECTION)

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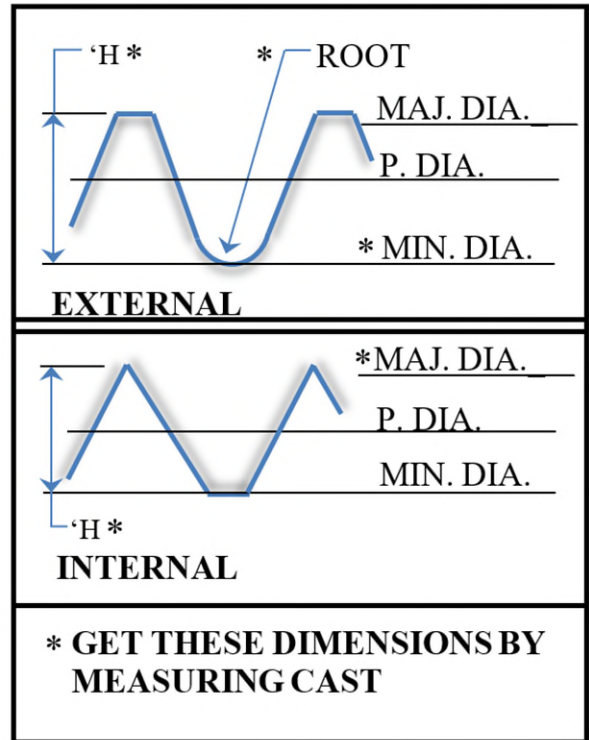
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DWG REQUIREMENT: B/P 9.5000-12 UNJS-3B thread per AS8879; Pitch Diameter should be 9.4459/9.4546

DISCREPANCY:

The thread accepts the no-go gage full length of thread; Pitch Diameter measures 9.4577
 See attached “Thread Inspection Data” table for additional thread information

THREAD INSPECTION DATA		
FROM		YES
<u>CAST & COMPARATOR OVERLAY</u>		<input type="checkbox"/>
B/P DIM.		PART DIM.
9.4189 / 9.4289	MIN. DIA.	9.4230
9.5000	MAJ. DIA.	9.5167
9.4459 / 9.4546	PITCH DIA.	9.4577
Not applicable	ROOT RAD.	Not applicable
	‘H’	
<u>COMMENTS:</u>		



B/P CHARACTERISTIC
PER <u>AS8879</u> SPEC,
BEFORE PLATE <u>9.4479 / 9.4566</u>
AFTER PLATE <u>9.4577</u>
GO GAGE GOES <u>FULL</u> TURNS
NO GO GAGE GOES <u>FULL</u> TURNS

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6.8. BAKE VIOLATIONS

Many landing gear components require finishes/coatings and special processes such as chrome plating, nickel plating, cadmium plating, nital etch inspection. Although these special processes have great benefits, they induce hydrogen into the parts, which needs to be fully removed by baking at a temperature of 375° +/- 25° Fahrenheit. If hydrogen is not fully purged out within a specified time frame, it may cause a phenomenon called hydrogen embrittlement, which is detrimental to the structural integrity of the component. It is key to mention that the part begin the embrittlement bake relief cycle as per the governing process specification. In instances where bake violations occur, the following examples below list the required information that shall be included in the QN during the initial submittal to MRB.

6.8.1 POWER OUTAGES AFFECTING EMBRITTLEMENT RELIEF BAKE CYCLES

Defect description should include type of plating with spec call-out and a statement of what specification or plating technique requirement was violated: lower temperature limit, maximum bake delay, or minimum bake time. If other platings were previously applied to the part, report all prior QN #s and also if any interrupted bake cycles were used. Upload related oven chart having clear time and temperature scales, annotated with items 3, 5, 6, 7 and 8 as defined below.

As a common practice within COLLINS Landing Gear, it is highly recommended the part be given another full length bake cycle as soon as possible (as if it had never been baked). If bake time delay from Plating TIME IN could exceed the required maximum delay allowed by specification, it is advisable to move parts to an approved facility with a working oven to avoid a violation of the governing process specification.

1. Plating DATE and TIME IN
2. Plating DATE and TIME OUT
3. Bake DATE and TIME when the temperature first achieved 350°F
4. Power interruption cause and number of similar parts affected (this info is helpful for both customer and internal M&PT coordination)
5. DATE and TIME when oven temperature dropped below 350°F
6. If applicable, state if the oven door was opened at any time during the power interruption and if the parts were moved to another oven
7. DATE and TIME when oven temperature was restored to 350°F
8. Bake DATE and TIME OUT

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6.8.2 POWER OUTAGES AFFECTING STRESS RELIEF BAKING CYCLES

The following scenarios cover only 300M or 4340M steel parts and assumes the practice of combining stress relief with embrittlement relief after nital etch inspection. Defect description should include the spec call-out and a statement of the non-conformance relative to the requirement. Upload related oven chart having clear time and temperature scales, annotated with items 3, 4, 6, 7, 9, 10 and 11. Items 3, 7 and 9 are helpful when it is a combined embrittlement/stress relief bake.

1. Nital etch DATE and TIME IN
2. Nital etch DATE and TIME OUT
3. Bake DATE and TIME when the temperature first achieved 350°F
4. Bake DATE and TIME when the temperature first achieved 500°F
5. Power interruption cause and number of similar parts affected (this info is helpful for both customer and internal M&PT coordination)
6. DATE and TIME when oven temperature dropped below 500°F
7. Bake DATE and TIME when the temperature dropped below 350°F
8. A statement whether the oven door was opened at any time during the power interruption and if the parts were moved
9. Bake DATE and TIME when the temperature was restored to 350°F
10. DATE and TIME when oven temperature was restored to 500°F
11. Bake DATE and TIME OUT.

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6.9. BASE METAL DEFECTS CAUSED BY PLATING AND PROCESSING

Landing gear components are manufactured with plating and special processes that contain various caustic and acidic chemicals. Although these substances are intended to be tightly controlled, they can be harmful if the chemicals are not fully removed from the components. Any residue remaining from a processing operation will typically cause an etching effect (chemical attack) that erodes the substrate. In addition to the loss of material, there is another concern for induced hydrogen from being in direct contact with the chemical. With respect to capturing the condition in the QN, the visual appearance of the etched surface can be somewhat difficult to describe, which often times is conveyed incorrectly. If the inspector encounters difficulty, then it is **highly encouraged** that M&PT engineering be consulted to assist Quality in determining the condition and the appropriate language to use in describing the defect in the QN. The following below serves as a guide to outline the expectations for entering the correct information that accurately reflects the actual condition.

REQUIRED INFORMATION:

1. If the surface condition has been confirmed (in coordination with M&PT, whenever necessary) to be etching/chemical attack, then ensure either terms “etching” or “chemical attack” is used in the non-conformance description.
2. Cause of the defect is important to the evaluation and disposition of the affected part. Therefore, Quality shall investigate alongside Operations to establish the root cause (i.e. a pool of residual fluid from a processing operation that remained inside the long bore I.D).
NOTE: For Boeing commercial product, it is a requirement to provide the customer with the root cause of the etching/chemical attack condition.
3. The extent/magnitude of the surface defect(s) (length x width x depth)
4. Affected feature(s) relative to the drawing requirement(s). If the etching exists on the entire part such as an axle, then reference the overall length of the part as the drawing requirement and state that all features between end faces are affected by etching.
5. Augment the non-conformance description by including clear digital photograph(s) to visually show the condition of the affected features.

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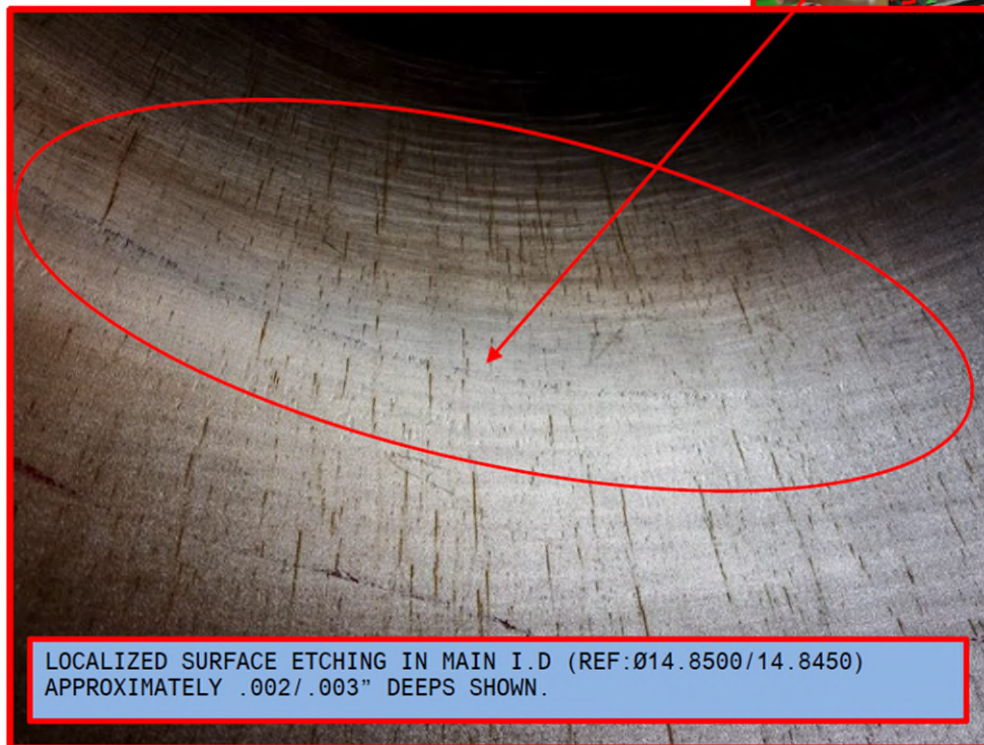
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PART CONFIGURATION: 161TXXXX-1
SERIAL NUMBER: ABC12345
DRAWING: 161TXXXX
SHEET NUMBER: 25
SHEET REVISION LEVEL: B
ZONE LOCATION: D9
LAST OP. COMPLETED: 270 (FINAL MACHINING AFTER HEAT TREATMENT)

DWG REQUIREMENT: 14.8450/14.8500 I.D with 16 RA

DISCREPANCY: Long bore I.D has etching that is approximately 0.003 deep x 0.075 wide in a localized area. Looking at the open end of the cylinder, the location of the etching is 32" from the end face and covers between 5 and 7 O'clock when the trunnion is lying horizontal with the drag brace lugs facing upward

QN462
P/N 16
S/N DJ
W/O #



LOCALIZED SURFACE ETCHING IN MAIN I.D (REF:Ø14.8500/14.8450)
APPROXIMATELY .002/.003" DEEPS SHOWN.

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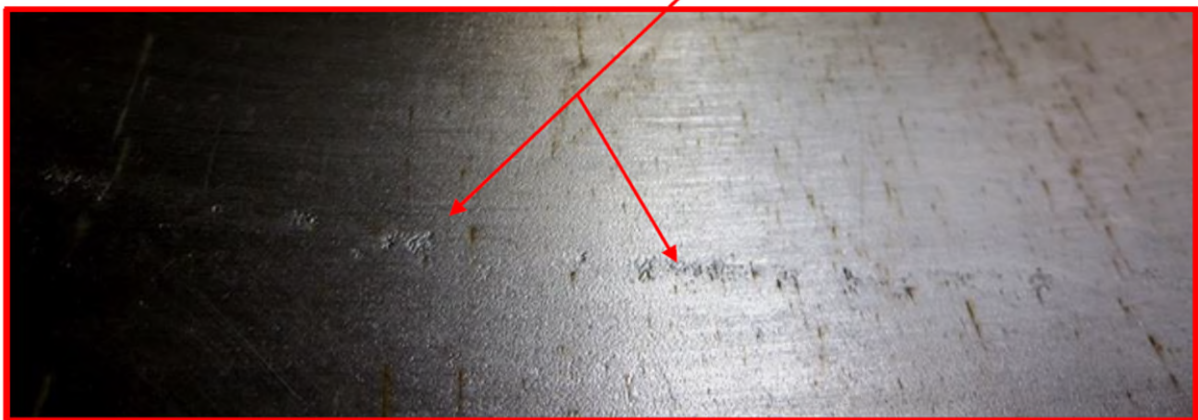
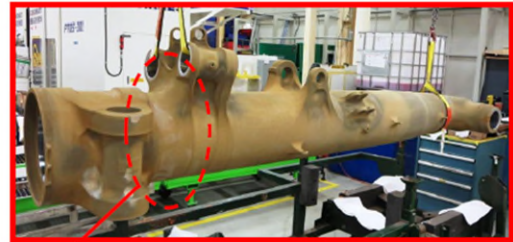
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QN46	
P/N 10	
S/N D	
W/O #	



6.10. PLATING DEFECTS IN CHROME, NICKEL AND HVOF

Defects in plating can frequently occur within the manufacturing process. This can include but not limited to voids, blistering, pitting, scratches, polish marks, dents, depressions, discrepant runout conditions, coating thicknesses outside the drawing range. In cases where the above mentioned coatings exhibit a discrepant condition, the following basic information shall be provided in each instance

REQUIRED INFORMATION:

- Affected feature relative to model/drawing requirements
- Length x width x depth of the defects
- Proper locating dimensions of the defects relative to adjacent surface or drawing datum
- Detailed sketch annotating the exact location(s) of the defect(s)
- Indicate if the defect is completely through the coating and base metal is exposed
- Digital photo(s) to visually show the defect

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6.11. DROPPED OR INCIDENT RELATED PARTS THAT SUSTAIN IMPACT

Incident parts are one of the most complicated discrepancies to evaluate, mainly due to the fact that the severity ranges from a minor defect to scrap. The aerospace industry has established a procedure (ARP4915) that defines a recommended practice specific to landing gear for dispositioning incident related components based on material type. COLLINS LG has since adopted ARP4915 as the standard for handling such cases. In order to evaluate incidences of any kind, the following information shall be provided to MRB engineering:

- Compile all relevant facts that are related to the incident in the form of a summary. Be as descriptive as possible to capture the key details of the event.
- Document all features (dimensional requirements from the drawing) that exhibit evidence of impact. In addition, it is very beneficial to the engineer’s evaluation that the first point of contact is identified to understand the area or region that absorbed the initial impact load.
- Another vital piece of information for the MRB engineer to understand is how the incident occurred whether it fell from a crane, hoist or cart. If it is was a free fall, then this key detail needs to be specified in the QN.
- Provide clear photographs of the affected areas to visually show the physical damage that was caused by the impact. Secondly, it would be also quite helpful to include a series of photos to replicate the sequence of events.

Key questions to answer when a part is involved in an incident?

1. Did the part experience a free fall? Or did it slide off a cart and contact the ground? Was there any part of the holding fixture/device that helped prevent a free fall, such as a sling or strap holding onto one side of the part?
2. Approximately how far was the drop? 3 feet high, 4 feet high, etc.
3. What feature first made contact with the ground? (First point of contact). What is the location and extent/magnitude of the resulting defect on this feature?
4. What other features were affected after the first point of contact? What is the location and extent/magnitude of the resulting defect on these feature(s)?

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6.12. THREAD DAMAGE

If a part incurs damage on threaded features, then it is essential that the discrepancy is defined in a clear and concise manner for a proper engineering assessment. As such, the location and extent/magnitude of the defects on each affected thread must be specified on the QN in order to determine the structural and functional impact.

REQUIRED INFORMATION:

- Affected thread feature(s) relative to the drawing/model requirement
- Location of the affected thread(s) relative to the end face
- The number of threads with damage
- The extent/magnitude of the damage on each thread (length, width and depth)
- marked up digital photo that shows the extent/magnitude of the defect(s) on each thread

PART CONFIGURATION: 161TXXXX-1
SERIAL NUMBER: ABC12345
DRAWING: 161TXXXX
SHEET NUMBER: 25
SHEET REVISION LEVEL: B
ZONE LOCATION: D9
LAST OP. COMPLETED: 270 (FINAL MACHINING AFTER HEAT TREATMENT)

DWG REQUIREMENT: 16.5000-8 UNJS-3B THREADS PER AS8879

DISCREPANCY: Localized tool mark on the 4th thread from the end face. The defect measures approximately 0.020" wide x 0.500" long x 0.005 deep. Looking from the open end of the cylinder with the trunnion lying horizontal and the drag brace lugs are facing upward, the defect is at the 6 – 7 o'clock position. Refer to the attached photos for details.

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QN480
P/N: 1
S/N: D
W/O #



Revision Description			
Revision	Release Date	Summary and Reasons for Changes	Originator
00	6-Oct-2022	Initial document Creation	P. Shah
01	22-Sep-2023	Preparation of QN Form 2963 – Added 2 new fields. Add Appendix – QN defect examples	P. Shah, B. Lau, D. James

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