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THE ATTACHED STANDARD PRACTICES MANUAL, ATA NO. 20-00-02/70-00-01, REVISED FEBRUARY 24, 2015 IS ISSUED FOR USE IN SUPPORT OF THE FOLLOWING AIRCRAFT.

AIRCRAFT APPLICATION

GENERAL

REVISION NO. 20 DATED FEBRUARY 24, 2016

This is a PARTIAL revision. The pages of prior issues which are not affected retain previous revision dates. Please remove and discard the affected pages and replace with the pages of this revision. Enter on the Record of Revisions the date the pages are inserted.

HIGHLIGHTS

SUBJECT/PAGE	DESCRIPTION OF CHANGE
Title Page	
Pages T-1 thru T-4	Updated to current revision.
Record of Revisions	
Page RR-1/RR-2	Added Revision 20.
Record of Temporary Revisions	
Page TR-7/TR-8	Added Temporary Revision No. 20-92/70-92, 20-93/70-93 and 20-94/70-94.
List of Effective Pages	
Pages LEP-1 thru LEP-4	Updated to reflect Revision 20.

HIGHLIGHTS

SUBJECT/PAGE	DESCRIPTION OF CHANGE
SECTION III - INSPECTION	
Page 301	Updated Step 1.B.(1) to incorporate TR 20-92/70-92.
Page 302	Updated Step 1.D.(4) to incorporate TR 20-94/70-94.
SECTION IV – REPAIR	
Page 404	Updated Steps 2.F.(1), 2.G.(1), 2.H.(1) and (3).
Page 405	Updated Steps 2.I.(1) and 2.J.(3)(a) and added Steps 2.J.(4) thru 2.J.(5)(b) to incorporate TR 20-93/70-93.
Page 434	Deleted Step (d) and NOTE following Step (5).
Pages 444 and 445	Updated Step 6.A.(2)(b)1. Rearranged order of steps. Deleted Step (c)2.
APPENDIX	
Page 710A/710B	Updated Table 704 to incorporate TR 20-93/70-93.

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20-49/70-49	526	Dec 19/06					8
20-50/70-50	305	Dec 19/06		Technical intent overridden by Engineering change			8

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20-53/70-53	733	Feb 6/07		Technical intent overridden by Engineering change			8
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20-61/70-61	417	Apr 27/07		Technical intent overridden by Engineering change			8
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20-65/70-65	423	Apr 27/07		Technical intent overridden by Engineering change			8
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20-67/70-67	430	Apr 27/07		Technical intent overridden by Engineering change			8
20-68/70-68	438	Apr 27/07		Technical intent overridden by Engineering change			8
20-69/70-69	446	Apr 27/07		Technical intent overridden by Engineering change			8
20-70/70-70	447	Apr 27/07		Technical intent overridden by Engineering change			8
20-71/70-71	448	Apr 27/07		Technical intent overridden by Engineering change			8
20-72/70-72	464	Apr 27/07		Technical intent overridden by Engineering change			8
20-73/70-73	476	Apr 27/07		Technical intent overridden by Engineering change			8
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20-79/70-79	302	Feb 8/08		(Superseded by TR 20-80/70-80)			8
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20-81/70-81	TC-2	Mar 24/08		Technical intent overridden by Engineering change			8
20-82/70-82	220	Mar 24/08		Technical intent overridden by Engineering change			8
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20-92/70-92	301	19 Mar 2015					20
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	710	29 Apr 2015					20
20-94/70-94	302	1 Oct 2015					20

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		SWLA-2	Blank
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INTRODUCTION

1. General

Information provided in this manual pertains to overhaul and repair processing for parts manufactured by Honeywell Inc., Phoenix, Arizona.

Specific instructions and authority for applying processes to parts are covered in applicable Overhaul Manuals, Component Maintenance Manuals, Inspection/Repair Manuals, Workscope Planning Guides, Repair Manuals, and Maintenance Manuals for the unit in work. The procedures in this manual should only be used when specifically referenced from one of these manuals. If data contained in a manual covering a specific unit conflict with data contained in this manual, the manual covering the specific unit will take precedence.

Layout of this manual generally follows Air Transport Association Specification No. 100 as reflected in the Table of Contents.

Equipment, consumables, and specifications referenced in the text (SECTION VII) are listed in SECTION VII Appendix, along with the manufacturers names and addresses. Specific methods are referenced in the text as shown in the following examples: (Method No. 203C indicates a specific cleaning method), (Method No. 405B indicates a specific repair method). Refer to the Table of Contents for chapter indicated.

2. Abbreviations and Definitions

Abbreviations used throughout the manual are explained in Table 1.

Table 1. Abbreviations and Definitions

Abbreviation	Definitions
ac	Alternating current
AISI	American Iron and Steel Institute
amp	Ampere(s)
AMS	Aerospace Material Specification
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
AWS	American Welding Society
C	Celsius or Centigrade
dc	Direct current
Dia	Diameter
Dim.	Dimension
F	Fahrenheit
FAA	Federal Aviation Administration
ID	Inside Diameter
in.	Inch
In-lb	Inch-Pound
kPa	Kilopascal
L	Liter
MAX.	Maximum
MIN	Minimum
ml	Mililiter
mm	Millimeter
No.	Number
OD	Outside Diameter
oz-in.	Ounce-Inch
REF	Reference
RPM	Revolutions per minute
SAE	Society of Automotive Engineers
v	Volt

SECTION I – DISASSEMBLY

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SECTION I – DISASSEMBLY

1. Standard Disassembly Practices

A. General

This section of the manual provides general information that is applicable to the disassembly of any unit. Specific instructions for a particular unit must be obtained from the applicable manual for the unit.

B. Identification of Matched Parts and Sets

(1) Refer to applicable parts list for the unit being disassembled prior to starting disassembly procedures.

(2) List items that are specified as matched parts or sets.

(3) During disassembly, identify and tag the matched items for processing through cleaning, inspection, etc. Do not co-mingle matched items with other like items.

C. Handling Component Parts

CAUTION: EXERCISE CARE IN HANDLING COMPONENTS TO PREVENT DAMAGE TO SERVICEABLE PARTS THROUGH ROUGH HANDLING.

Perform the following steps for component parts that are removed from the basic unit, but do not require disassembly.

(1) Tag components for identification and processing.

(2) Clean components in accordance with SECTION II.

(3) Perform visual inspection of components in accordance with SECTION III.

(4) Cap, plug, or seal ports and orifices. Place components in a clean plastic bag or equivalent container for protection from contaminants.

D. Disassembly Area

Disassembly must be accomplished in a clean, dry, dust-free, well lighted area. Workbenches must be clean and covered with paper or other protective material.

E. General Procedures

(1) Place parts on workbench in the order of disassembly in preparation for cleaning and inspection. Keep hardware and small parts together in trays or baskets.

(2) Provide proper coverings or supports to protect curvic couplings, shafts, gears, studs, and projecting parts from damage. If tapping is required to separate parts, use a cellulose-tipped hammer or a fiber or rawhide mallet. If clamping is necessary, clamp parts in vises that have micarta jaws or equivalent.

(3) After disassembly, spray steel parts with lubricant specified for the unit. Cover all parts with clean paper or suitable coverings unless cleaning and inspection is to be accomplished immediately.

CAUTION: USE PLASTIC CAPS OR PLUGS ON ALL FUEL, PNEUMATIC, OR LUBRICATION SYSTEM COMPONENTS. DO NOT USE CLOTH, TAPE OR ALUMINUM CAPS OR PLUGS.

(4) Seal ports, bores, and passages of assemblies or components with tape or suitable closures between overhaul procedures. Cover large openings with cardboard taped in place.

(5) During each stage of disassembly:

- Examine all parts and assemblies for signs of scoring, burning, or other defects.
- Note physical conditions which will not be apparent after cleaning.
- Tag involved parts before they are cleaned and laid out for detail inspection.
- Check additionally for evidence of damage caused by improper procedures at previous overhauls. Report such damage in accordance with current practice.

(6) Record manner and location of lockwiring for duplication during reassembly.

(7) Note manner and location of attaching parts on tube assemblies and wiring harness assemblies for duplication during reassembly.

(8) Discard all removed packings, gaskets, and seals at time of disassembly.

(9) Discard all removed self-locking nuts at time of disassembly if no minimum criteria for re-use is included in manual covering equipment.

(10) Before discarding any bearing refer to applicable unit overhaul manual, inspection/repair manual, or repair manual for accept or reject criteria.

F. Disassemble Bearings

NOTE: Refer to applicable manual for removal and/or disassembly procedure for bearings. Specified tooling must be used during bearing removal to prevent cocking, misalignments, and exerting force on rolling elements.

(1) Observe bearing handling procedures.

(2) Immediately place bearings in individual sealed plastic bags (SECTION VI) to minimize handling of bearings, and avoid direct contact with bare hands. Do not drop bearings.

(3) Keep components (races, rollers, cages, etc.) of each bearing separate from components of another bearing. Reassembled bearings must contain only the original components of that bearing.

SECTION II – CLEANING

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SECTION II – CLEANING

1. Standard Cleaning Practices

A. General

WARNING: CLEANING PROCEDURES MUST BE ACCOMPLISHED IN A WELL-LIGHTED, WELL-VENTILATED AREA WITH ADEQUATE SAFETY AND FIRE PREVENTION EQUIPMENT READILY AVAILABLE.

(1) Compounds or materials, along with manufacturer's addresses, are listed in SECTION VII, under Consumables.

(2) Prior to cleaning record all identifying marks that could be removed by the cleaning and repainting process. Parts must be remarked using same method and location. (Refer to Repair Method No. 414A - Marking of parts.)

(3) Cleaning procedures for individual parts must be consistent with good shop practices and the following procedures:

NOTE: Correct and thorough cleaning for all parts is important to the successful inspection, overhaul, and satisfactory operation after overhaul.

WARNING: USE CORRECT PERSONAL PROTECTION. SOLUTIONS USED FOR CLEANING ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

METHYL-ETHYL-KETONE (MEK) IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR CONTACT WITH SKIN. OBSERVE ALL FIRE PRECAUTIONS.

(a) All metallic parts must be cleaned to remove oil, grease, rust stains, and soiled areas. Flange areas, register diameters, and sealing surfaces must be cleaned of oil, gaskets, and sealing compounds, if present. Remove adherent gasket or sealing compound residues using acetone (ASTM D 329) (SECTION VII) or methl-ethyl-ketone (MEK) (ASTM D470) (SECTION VII) and a soft or stiff fiber bristled brush.

(b) Clean painted parts, but do not remove paint if paint is still serviceable.

(c) Heat discoloration of metal surface is not objectionable; however, scale which may come loose and damage the unit must be removed. Carbon residue and combustion products must be removed.

(d) Corrosion products, whenever they appear, must be removed and the base metal treated to prevent further corrosion before re-assembly.

(e) Steel and 400 Series stainless steel parts require the application of corrosion-preventive compound (MIL-C-6529, Type III) (SECTION VII) after cleaning to prevent rust and corrosion.

(f) Clean dissimilar materials as follows:

CAUTION: AN ASSEMBLY MUST NOT BE CLEANED IN A SOLUTION THAT IS DETRIMENTAL TO ONE OF THE PARTS IN THE ASSEMBLY.

1 Analyze assemblies that combine dissimilar materials carefully and determine types of materials.

CAUTION: BRASS AND BRONZE ALLOYS CAN BE AFFECTED BY CHROMIC ACID SOLUTIONS.

2 Clean assemblies containing brass, bronze, steel, and cadmium using methods applicable to the base metal involved.

3 Clean assemblies containing synthetic materials using methods that are non-destructive to the material.

(4) Place parts in clean cloth bags or equivalent containers after cleaning, for protection from contaminants. Ports and orifices must be capped, plugged, or sealed.

NOTE: Alternate cleaning products may be used in place of those specified in Method No. 202A, Alkaline cleaning solutions and Method No. 202E, rust stripper. Selection and usage of alternate chemicals must be performed in strict accordance with Chapter 4.A. and B.

When Method No. 203B, Vapor Degreasing, is specified for use, aqueous cleaning may be performed with cleaning product in Method No. 202A or alternate cleaner in accordance with Chapter 4.A. and B.

2. Preparation of Cleaning Solutions

WARNING: SOLUTIONS USED FOR CLEANING ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

A. Method No. 202A: Alkaline Cleaning Solutions Mixing Instructions

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

Prepare alkaline cleaner solution as follows:

(1) Dissolve 4 to 6 ounces (118.29 to 177.4 ml) of alkaline cleaner (Diversey/Ridoline 909, CeeBee A7X7, Daraclean, Ecomate FN, or equivalent) (SECTION VII) in each gallon (3.78L) of distilled or de-ionized water used.

(2) Maintain solution at 130 to 180°F (54 to 82°C) in an air agitated tank.

B. Method No. 202B: Chromate Conversion Coating Mixing Instructions

WARNING: USE CORRECT PERSONAL PROTECTION. CHROMATE CONVERSION COATING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

Prepare chromate conversion coating solution as follows:

NOTE: Prepare chromate conversion coating solution in small batches. Use only freshly prepared solutions.

(1) Dissolve one ounce (29.57 ml) of powder (Iridite No. 14-2) (SECTION VII) in each quart (946.3 ml) of distilled or de-ionized water used.

(2) Maintain solution at 70 to 80°F (21 to 27°C).

C. Method No. 202C: Chromic-nitric Pickle Mixing Instructions

WARNING: USE CORRECT PERSONAL PROTECTION. CHROMIC-NITRIC PICKLE SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

Prepare chromic-nitric pickle solution as follows:

(1) Mix 12.0 to 13.5 ounces (0.354 to 0.399 L) of chromic acid flake (SECTION VII) and 1.0 to 1.4 pints (0.47 to 0.66 L) of nitric acid (Federal Specification A-A-59105) (SECTION VII) with enough distilled or de-ionized water to make one gallon (3.78 L).

(2) Maintain solution at 70 to 80°F (21 to 27°C).

D. Method No. 202D: De-oxidizer Mixing Instructions

WARNING: USE CORRECT PERSONAL PROTECTION. DE-OXIDIZER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

Prepare de-oxidizer solution as follows:

(1) Dissolve 8 to 16 ounces (0.236 to 0.473 L) of de-oxidizer (Oakite 34M) (SECTION VII) in one gallon (3.78 L) of distilled or de-ionized water.

(2) Maintain solution at 65 to 95°F (18 to 35°C) in an air agitated tank.

E. Method No. 202E: Rust Stripper Mixing Instructions

WARNING: USE CORRECT PERSONAL PROTECTION. RUST STRIPPER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

CAUTION: EXERCISE EXTREME CAUTION WHEN PREPARING RUST STRIPPER SOLUTION. MIXING MAY PRODUCE TEMPERATURES EXCEEDING THE BOILING POINT OF THE SOLUTION. ADD OAKITE RUST STRIPPER WHILE AGITATING SOLUTION AS A MEANS TO PREVENT LOCALIZED OVERHEATING.

Prepare rust stripper solution as follows:

WARNING: USE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(1) Dissolve three to five pounds of rust stripper (Oakite Rustripper) (SECTION VII) in each gallon of distilled or de-ionized water used.

(2) Maintain solution at 160 to 200°F (71 to 93°C) in an air agitated tank.

F. Method No. 202F: Magnesium Touch-up Mixing Instructions

WARNING: USE EXTREME CAUTION TO PREVENT CONTACT WITH SKIN. IF POWDER OR MIXED SOLUTION COMES IN CONTACT WITH SKIN, FLUSH OFF IMMEDIATELY WITH WATER. DO NOT INHALE DUST FROM POWDERS OR VAPORS FROM THE SOLUTION.

Prepare magnesium touch-up solution as follows:

WARNING: USE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(1) Add 1.3 ounces (38.45 ml) of chromic acid flake (SECTION VII) to slightly less than one gallon of distilled or de-ionized water, mix until completely dissolved.

(2) Add 1 ounce of calcium sulfate (SECTION VII).

(3) Stir vigorously for at least 15 minutes to make sure saturation of the solution with calcium sulfate.

G. Method No. 202G: Electrocleaner Mixing Instructions

WARNING: USE CORRECT PERSONAL PROTECTION. ELECTROCLEANER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

Prepare electrocleaner solution as follows:

(1) Combine 9 ounces of electrocleaner (Wyandotte FS) (SECTION VII) to each gallon (3.78 L) of distilled or de-ionized water.

(2) Maintain solution at 160 to 200°F (72 to 93°C).

H. Method No. 202H: Sodium Hydroxide Mixing Instructions

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(1) Mix sodium hydroxide 20 percent by weight with water and maintain at room temperature.

3. Standard Cleaning Methods

CAUTION: SPECIFIED CLEANING METHODS OUTLINED MUST BE FOLLOWED. THE VARIOUS SOLUTIONS AND MATERIALS SPECIFIED IN THE CLEANING METHODS CAN BE USED ONLY ON THE PARTS AND MATERIALS INDICATED. FAILURE TO USE THE PROPER CLEANING METHOD MAY RESULT IN IRREPARABLE DAMAGE TO THE PART BEING CLEANED. REFER TO APPLICABLE MANUAL FOR UNIT IN WORK FOR SPECIFIC MATERIAL AND INSTRUCTIONS.

A. Method No. 203A: Using Petroleum Solvent

Degrease parts using petroleum solvent as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Place solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) in dip tank or use as a spray in a positive outside-ventilated spray booth.

(2) Dip, soak, agitate or spray parts to be cleaned until oil and grease have been removed.

(3) Remove caked grease or soft carbon deposits using stiff plastic fiber bristled brush.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(4) Air-dry parts with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

B. Method No. 203B: Using Vapor Degreasing

NOTE: Aqueous degreasing per Method No. 203V is an acceptable alternate for vapor degreasing.

Degrease parts using vapor-degreasing method as follows:

WARNING: AQUEOUS CLEANER/DEGREASING SOLUTION IS A MILD IRRITANT. AVOID DIRECT EYE CONTACT OR EYE IRRITATION AND REDNESS MAY OCCUR. SAFETY EYEWEAR IS RECOMMENDED. DIRECT SKIN CONTACT CAN CAUSE SKIN IRRITATION. WEARING PROTECTIVE GLOVES IS RECOMMENDED. AVOID INHALING SPRAY MIST VAPORS, MAY CAUSE IRRITATION.

(1) Use 1,1,1-trichloroethane (in accordance with MIL-T-81533), trichlorotrifluoroethane (in accordance with MIL-C-81302), trichloroethylene (in accordance with ASTM D 4080), n-propyl bromide or perchloroethylene (in accordance with ASTM D4376) in vapor degreaser at a temperature range in accordance with manufacturer's recommendations.

(2) Place parts in a rack so that all surfaces will have direct contact with vapor.

NOTE: Parts that do not allow free drainage must be racked so they may be turned over below vapor level to eliminate degreaser solvent (SECTION VII) dragout when parts are removed.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(3) Spray flush parts free of heavy grease or other contaminants, then position parts in vapor zone for final cleaning.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(4) Air-dry parts with clean dry compressed air until parts are dry.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

C. Method No. 203C: Using Glass Bead Peening

Clean parts using glass bead peening as follows:

NOTE: Do not glass bead peen parts until fluorescent penetrant (SECTION III) or magnetic particle inspection (SECTION III) has been performed. Maximum pressure of 20 psig (138 kPa) must be used on titanium couplings. Maximum pressure of 40 psig (276 kPa) must be used on all other coupling materials.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(1) Clean hard carbon, paint, corrosion, and scale from parts by peening with glass beads (Screen No. 100-230 (130 Grit) Class IV, Size AF or AG) (SECTION VII).

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(2) Clean parts with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

NOTE: Glass bead peening equipment must be cleaned and recharged with new beads after each 24-hour period of operation.

(3) Mask any surfaces that could be damaged by peening.

CAUTION: REGULATE AIR PRESSURE TO KEEP EROSION OF BASE METAL TO A MINIMUM. KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(4) Peen corroded areas with glass beads, Step (1), until corrosion products are removed.

(5) Rinse surface free of glass beads.

(6) Dry part in an oven at 205 to 235°F (96 to 113°C) for 1 hour.

D. Method No. 203D: Using Abrasive Blasting

Clean parts using abrasive-blasting method as follows:

NOTE: Do not abrasive blast part until fluorescent penetrant inspection (SECTION III) or magnetic particle inspection (SECTION III) has been performed.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(1) Clean hard carbon, lead deposits, corrosion, and scale from parts by abrasive blasting using a standard sandblast cabinet and sand (120 Grit) (MIL-A-22262) (SECTION VII) or aluminum oxide grit (120 Mesh) (SECTION VII).

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(2) Clean parts with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) or vapor degreaser to remove oil and grease contamination.

(3) Mask any surfaces that could be damaged by abrasive blasting.

WARNING: USE CORRECT PERSONAL PROTECTION. ABRASIVE BLAST PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: REGULATE AIR PRESSURE TO KEEP EROSION OF BASE METAL TO A MINIMUM. KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(4) Set blasting equipment air pressure at 15 to 30 PSIG (103 to 207 kPa), then subject parts to abrasive blasting. Reduce air pressure as required to control action on base metal.

E. Method No. 203E: Cleaning Non-corroded Aluminum

Clean non-corroded aluminum parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Clean surfaces with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(2) Immerse parts in alkaline cleaner solution (Method No. 202A) for 5 minutes minimum.

(3) Scrub surface with a soft fiber bristled brush to remove surface contamination.

NOTE: If old gaskets or sealing compounds are present, carefully lift softened gaskets with knife blade and scrape surface clean.

(4) Rinse parts with water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(5) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

WARNING: USE CORRECT PERSONAL PROTECTION. De-oxidizer Solutions ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

CAUTION: DO NOT ALLOW PARTS TO REMAIN IN CONTACT WITH DE-OXIDIZING SOLUTION LONGER THAN THREE MINUTES OR CHEMICAL ETCHING WILL OCCUR.

(6) Treat bare areas with de-oxidizing solution (Method No. 202D) for one to three minutes. Repeat previous Steps (3) and (4) to rinse and dry part.

WARNING: USE CORRECT PERSONAL PROTECTION. CHROMATE CONVERSION COATING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(7) Coat treated areas with chromate conversion coating solution (Method No. 202B). Allow area to remain wet for 1 minute.

NOTE: Maintain the pH of the chromate conversion coating solution (Method No. 202B) at 0.9 to 1.0 by adding chromic acid flake (SECTION VII) or nitric acid (Federal Specification A-A-59105) (SECTION VII) to the solution as necessary.

(8) Rinse parts with water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(9) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(10) Dry in oven at a temperature not to exceed 160°F (71°C).

(11) Store parts in dry place away from corrosive fumes.

F. Method No. 203F: Cleaning Corroded Aluminum

Clean corroded aluminum parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: CORROSION MAY BE CAUSE FOR REJECTION OR REPAIR OF A PART. REFER TO INSPECTION (SECTION III) AND/OR REPAIR (SECTION IV) WHENEVER CORROSION APPEARS TO BE BEYOND SURFACE FINISH.

(1) Clean surfaces with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(2) Immerse parts in alkaline cleaner solution (Method No. 202A) for 5 minutes minimum.

(3) Scrub part surface with stiff fiber bristled brush to remove surface contamination.

NOTE: If old gaskets or sealing compounds are present, carefully lift softened gaskets with knife blade and scrape surface clean.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(4) Rinse parts in water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(5) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure – Refer to Repair Station Health and Safety rules or National safety guidance.

WARNING: USE CORRECT PERSONAL PROTECTION. CHROMIC-NITRIC PICKLE SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(6) Treat corroded areas with chromic-nitric pickle solution (Method No. 202C) until corrosion is removed. Repeat Steps (4) and (5) to rinse and dry parts.

NOTE: If parts are hard anodized and chromic-nitric pickle solution (Method No. 202C) is used to remove heavy corrosion, softening of the finish will result. Completely strip parts and apply new anodize finish in accordance with Repair (SECTION IV).

WARNING: USE CORRECT PERSONAL PROTECTION. CHROMATE CONVERSION COATING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(7) Coat bare area with chromate conversion coating solution (Method No. 202B). Allow area to remain wet for 1 minute.

(8) Rinse parts with water 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(9) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(10) Dry part in oven at a temperature not to exceed 160°F (71°C).

(11) Store parts in dry place away from corrosive fumes.

G. Method No. 203G: Cleaning Non-corroded Magnesium

Clean non-corroded magnesium parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Clean surfaces with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(2) Immerse parts in alkaline cleaner solution (Method No. 202A).

NOTE: Allow parts to soak for 5 to 10 minutes if flange surfaces have gaskets or sealing compounds stuck to them.

(3) Brush part surfaces with soft plastic fiber bristled brush to remove surface contamination.

NOTE: If old gaskets or sealing compounds are present, carefully lift softened gaskets with knife blade and scrape surface clean.

(4) Rinse parts in warm tap water at 80 to 110°F (27 to 43°C).

CAUTION: WHEN PREPARING MAGNESIUM TOUCH-UP SOLUTION USE EXTREME CAUTION TO PREVENT CONTACT WITH SKIN. IF POWDER OR MIXED SOLUTION COMES IN CONTACT WITH SKIN, FLUSH OFF IMMEDIATELY WITH WATER. DO NOT INHALE DUST FROM POWDERS OR VAPORS FROM THE SOLUTION.

(5) Brush magnesium touch-up solution (Method No. 202F) onto bare metal areas. Keep surface wet for 1 to 2 minutes.

(6) Rinse in clean tap water at 50 to 90°F (10 to 32°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(7) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(8) Dry parts in oven at 250°F (121°C) for 2 hours.

H. Method No. 203H: Cleaning Corroded Magnesium

CAUTION: CORROSION MAY BE CAUSE FOR REJECTION OR REPAIR OF A PART. REFER TO INSPECTION (SECTION III) AND/OR REPAIR (SECTION IV) WHENEVER CORROSION APPEARS TO BE BEYOND SURFACE FINISH.

Clean corroded magnesium parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Clean surface with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(2) Immerse parts in alkaline cleaner solution (Method No. 202A) for 10 to 15 minutes.

(3) Scrub surfaces with a stiff fiber bristled brush to remove any loose contaminants.

NOTE: If old gaskets or sealing compounds are stuck to flange areas, carefully lift softened materials with a knife blade and scrape surface clean.

(4) Rinse parts in water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

CAUTION: ALL TRACES OF MOISTURE MUST BE REMOVED IMMEDIATELY TO PREVENT CORROSION.

(5) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(6) Place in an oven at 250°F (121°C) for 2 hours to complete drying.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

CAUTION: REGULATE AIR PRESSURE TO KEEP EROSION OF BASE METAL TO A MINIMUM. KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(7) Glass bead peen corroded areas to remove corrosion.

NOTE: Glass bead peening or abrasive blasting must not be used until fluorescent penetrant (SECTION III) inspection has been performed.

If glass bead peening equipment is not available, abrasive blasting at 15 to 30 PSIG (103 to 207 kPa) may be used to remove corrosion. Mask any surface that could be damaged by abrasive blasting.

If paint is loose or blistered following cleaning, refer to Repair (SECTION IV) for treating and repainting.

CAUTION: ALL TRACES OF MOISTURE MUST BE REMOVED IMMEDIATELY TO PREVENT CORROSION.

(8) Rinse surface free of glass beads (Screen No. 100-230 (130 Grit) Class IV, Size AF or AG) (SECTION VII).

(9) Dry part in oven at 250°F (121°C) for 2 hours or proceed immediately with Step (10).

CAUTION: WHEN PREPARING MAGNESIUM TOUCH-UP SOLUTION USE EXTREME CAUTION TO PREVENT CONTACT WITH SKIN. IF POWDER OR MIXED SOLUTION COMES IN CONTACT WITH SKIN, FLUSH OFF IMMEDIATELY WITH WATER. DO NOT INHALE DUST FROM POWDERS OR VAPORS FROM THE SOLUTION.

(10) Immerse parts in magnesium touch-up solution (Method No. 202F) for 15 to 45 seconds.

CAUTION: ALL TRACES OF MOISTURE MUST BE REMOVED IMMEDIATELY TO PREVENT CORROSION.

(11) Rinse in clean tap water at 50 to 90°F (10 to 32°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(12) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(13) Dry part in oven at 250°F (121°C) for 2 hours.

I. Method No. 203J: Cleaning Plain Steel and Stainless Steel

Clean plain steel and stainless steel parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Clean surfaces with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

NOTE: It is not necessary to remove heat discoloration.

CAUTION: EXTREME DAMAGE CAN OCCUR TO NON-STEEL PARTS IF CLEANED WITH RUST STRIPPER SOLUTION.

(2) Immerse parts in rust stripper solution (Method No. 202E) for 10 to 20 minutes.

NOTE: The solution will remove rust, loosen scale, dissolve varnish deposits, and soften organic compounds.

WARNING: USE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

CAUTION: DO NOT DAMAGE HIGHLY FINISHED SURFACES. USE ONLY STIFF PLASTIC FIBER BRISTLED BRUSH ON HIGHLY FINISHED SURFACES.

(3) After soaking in rust stripper solution, remove parts, rinse, and scrub surfaces with stiff plastic fiber bristled brush, or glass bead peen to remove carbon and scale.

NOTE: Do not glass bead peen parts until fluorescent penetrant (SECTION III) or magnetic particle (SECTION III) inspection has been performed.

(4) Rinse thoroughly in clean tap water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(5) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(6) Preserve steel parts after cleaning by placing them in a clean container.

NOTE: Storage preparation requirements depend on the alloy content and how long it will be before inspection (if required) of the part will be completed.

(a) Low alloy steel parts that will be subjected to magnetic particle inspection (SECTION VII) within 8 hours may be left dry until inspected.

(b) Low alloy steel parts that will be subjected to magnetic particle inspection (SECTION VII), but will be held longer than 8 hours prior to inspection, must be coated with corrosion-preventive compound (MIL-C-16173, Grade 3) (SECTION VII).

(c) Low alloy steel parts not subject to inspection, and those that have completed inspection, must be placed in a solution of corrosion-preventive compound (MIL-C-6529, Type III) (SECTION VII) for 3 to 5 minutes. Place treated parts in clean container and store away from moisture and corrosive fumes.

(d) Stainless steel and heat resistant alloy parts must be kept dry and boxed for protection from physical damage.

(e) Stainless steel of the 400 Series must be placed in a solution of corrosion-preventive compound (MIL-C-6529, Type III) (SECTION VII) for 3 to 5 minutes.

J. Method No. 203K: Cleaning Titanium

Clean titanium parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: DO NOT USE 1,1,1-TRICHLOROETHANE (MIL-T-81533) (SECTION VII) TO CLEAN TITANIUM PARTS. HIGH TEMPERATURE OPERATION OF TITANIUM PARTS AFTER CONTACT WITH CHLORINATED CHEMICALS CAN CAUSE PART FAILURE DUE TO CRACKS.

(1) Clean surfaces with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) to remove oil and grease contamination.

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(2) Immerse parts in alkaline cleaner solution (Method No. 202A) at temperature of 160 to 180°F (71 to 82°C) for 3 to 5 minutes minimum.

(3) Scrub part surface with a stiff plastic fiber bristled brush to remove surface contamination.

NOTE: If old gaskets or sealing compounds are present, carefully lift softened gaskets with a knife blade and scrape surface clean.

(4) Rinse parts in water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(5) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(6) Dry in oven at 160 to 250°F (71 to 121°C) for 1 hour.

(7) Store parts in dry place.

K. Method No. 203L: Cleaning Electrical Components

Clean electrical component parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Wipe with clean, lint-free cloth dipped in methyl-ethyl-ketone (MEK) (ASTM D470) (SECTION VII) or solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII).

(2) Clean electrical connectors using degreaser and cleaner (MS-941/CO_2) (SECTION VII) and remove oily type soil with cotton swab dipped in aqueous cleaner/degreaser solution (SECTION VII).

L. Method No. 203M: Cleaning Fittings and Plumbing

Clean fittings and plumbing as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Spray tubes and fittings externally and internally with solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) in an outside-ventilated spray booth.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(2) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(3) Insert protective plugs and caps in each end of plumbing and fittings.

M. Method No. 203N: Cleaning Electronic Components

Clean electronic components as follows:

NOTE: Do not use ultrasonic or vapor degreasing on electronic components. Avoid excessive use of solvent. In all cleaning, a final drying of components with compressed air is recommended. Do not clean for the sake of appearance only. Clean only as required to facilitate function and/or inspection.

(1) Clean "mechanical" surfaces such as chassis, housings, etc, with abrasive paper (Federal Specification P-P-101) (SECTION VII), or abrasive cloth (Federal Specification P-C-451) (SECTION VII), followed by a final cleaning with a lint-free cloth dipped in isopropyl alcohol (Federal Specification TT-I-735) (SECTION VII) and compressed air.

(2) Clean printed circuit boards using an eraser (Pink Pearl No. 101) (SECTION VII) with extremely light pressure. Use eraser dry, then finish off with a lint-free cloth dampened with isopropyl alcohol (Federal Specification TT-I-735) (SECTION VII).

(3) Clean connector pins/sockets with a fiber bristled brush dipped in isopropyl alcohol (Federal Specification TT-I-735) (SECTION VII).

(4) Clean temperature sensors and exposed wire elements as follows:

(a) Sealed-probe type

Use 120 or finer grit abrasive paper (Federal Specification P-P-101) (SECTION VII) or abrasive cloth (Federal Specification P-C-451) (SECTION VII).

NOTE: Avoid reducing wall thickness.

(b) Exposed glass-encapsulated bead type

Use a stiff fiber bristled brush dipped in fluorinated solvent, trichlorotrifluorethane (MS-941/CO_2) (SECTION VII).

(c) Exposed wire

Use a stiff fiber bristled brush dipped in solvent, isopropyl alcohol (Federal Specification TT-1-735) (SECTION VII).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(5) Clean the interior of electronic components cabinets using compressed air. Avoid the use of solvents, if possible.

N. Method No. 203P: Cleaning Bearings

CAUTION: USE EXTREME CARE WHEN HANDLING BEARINGS OR BEARING COMPONENTS.

DO NOT USE WIRE BRUSH OR ABRASIVES TO CLEAN BEARINGS.

COMPONENTS OF EACH BEARING ARE A MATCHED SET. USE EXTREME CARE NOT TO MIX BEARING COMPONENTS. MATCHED SETS MUST BE MAINTAINED. MATCHED SETS MUST BE MAINTAINED DURING CLEANING.

DO NOT STACK BEARINGS IN CLEANING BASKET.

TO CLEAN SEALED BEARINGS, REMOVE CLOSURES (SHIELDS, SEALS) AND LUBRICANT. DO NOT CLEAN SEALED BEARINGS WITH CLOSURES INSTALLED.

Clean separable and non-separable bearings as follows:

(1) Place bearings in wire dip basket one-layer deep. Minimize conditions where air may be entrapped or solvent circulation restricted.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS AND MANUFACTURERS INSTRUCTIONS.

CAUTION: USE CORRECT PERSONAL PROTECTION. CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(2) Degrease bearings at room temperature for 5 minutes with 10 micron filtration. Degrease per Method No. 203A (petroleum solvent), 203B (vapor), or 203V (aqueous). Flush and brush as required. Use a medium fiber bristled brush as required to remove residue. After removal from solution, permit excess fluid to drain.

(3) If bearings are visually clean and free of contaminants, repeat Step (2) with 3 micron filtration.

(4) If bearings are not visually clean and free of contaminants, degrease per Method No. 203B (vapor) or 203V (aqueous) in ultrasonic cleaner with degreaser heated 140 to 180°F (60 to 82°C) and filtered to 3 microns. Do not exceed 10 minutes in ultrasonic cleaner.

WARNING: USE CORRECT PERSONAL PROTECTION. RUST STRIPPER SOLUTIONS ARE HAZARDOUS. AVOID FUMES, DUST OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

CAUTION: DO NOT USE RUST STRIPPER ON ALUMINUM. SOME OLDER BEARINGS HAVE ALUMINUM SEPARATORS.

(5) If carbon or varnish remains, place bearings in wire dip basket one layer deep and immerse parts in clean heated rust stripper (Method No. 202E) for not more than 10 minutes. Use a medium fiber bristled brush as required to remove residue. After removal from solution, permit excess fluid to drain into stripper tank.

WARNING: USE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(6) Immerse bearing in clean heated alkaline cleaner (Method No. 202A) filtered to 10 microns. Soak for a minimum of 10 minutes. After removal from solution, permit excess fluid to drain.

(7) Flush (rinse) bearing with clean heated 140 to 180°F (60 to 82°C) deionized water filtered to 3 microns and agitated. After removal from solution, permit excess fluid to drain.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS. DO NOT POINT IT AT YOUR SKIN.

(8) Pressure air-dry with clean dry compressed air until free of moisture. Optional: Hot air or oven air heated 140°F (60°C) drying or Ardrox 3962 de-water or equivalent.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

CAUTION: WHEN HANDLING CLEAN, UNOILED BEARINGS; WEAR EITHER SYNTHETIC RUBBER, NYLON MESH WITH POLYESTER PALMS AND FINGERS, OR CLEAN COTTON GLOVES. DO NOT TOUCH WITH BARE HANDS.

(9) Conduct final bearing check within 24 hours, apply clean solvent (Federal Specification P-D-680, Type 1) and permit to drain.

(10) Place bearings in protective covered container. Maintain matched sets.

O. Method No. 203Q: Cleaning Rubber or Non-metallic Materials

Clean rubber or non-metallic parts as follows:

(1) Using a mild detergent and soft fiber bristled brush, scrub parts to remove contamination.

(2) Rinse parts with water at 80 to 110°F (27 to 43°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(3) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

P. Method No. 203R: Cleaning Metallic Filter Elements

WARNING: CLEANING MUST BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING MUST BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS MUST BE ON HAND IN CASE OF FIRE.

Clean metallic filter element as follows:

NOTE: Metallic filter element may be cleaned, as a temporary expedient, by dipping in solvent (SHELLSOL D60) (SECTION VII), and dried with filtered, compressed air. However, the cleaning method described below must be employed for a thorough cleaning.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Clean filter element in cold solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII).

WARNING: USE CORRECT PERSONAL PROTECTION. RUST STRIPPER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(2) Soak filter element in rust stripper solution (Method No. 202E) for 30 minutes.

(3) Remove filter element from solution and rinse thoroughly with clean water.

WARNING: USE CORRECT PERSONAL PROTECTION. ELECTROCLEANER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(4) Immerse filter element in electrocleaner solution (Method No. 202G) for 4 to 6 minutes. During this period, filter element must be made an anode for 1 to 2 minutes at a potential of 4 to 7 VDC.

(5) Rinse filter element in cold running tap water.

WARNING: USE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(6) Immerse filter element in equal parts muriatic acid (35 percent HCI, Commercial Grade) (SECTION VII) and water, by volume, at room temperature for one-half to 1 minute.

(7) Rinse filter element thoroughly in cold running tap water.

WARNING: USE CORRECT PERSONAL PROTECTION. ELECTROCLEANER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(8) Immerse filter element in electrocleaner solution used in Step (4) for 4 to 6 minutes.

(9) Rinse in cold running tap water.

(10) Pressure flush filter element (internal and external) using clean water.

(11) Place filter element (open end down) in beaker and fill beaker with cleaner (Dowclene EC) (SECTION VII) to submerge filter element.

(12) Place beaker containing filter element in ultrasonic cleaner tank and fill ultrasonic cleaner tank to within three-eighths inch of top with water.

(13) Operate ultrasonic cleaner for 5 minutes.

(14) Discard contaminated cleaner in beaker (Dowclene EC) and rinse filter element and beaker with clean cleaner (Dowclene EC) (SECTION VII) using plastic squeeze bottle.

(15) Refill beaker with clean cleaner (Dowclene EC) and operate ultrasonic cleaner for an additional 5 minutes.

(16) Repeat Steps (14) and (15) until cleaner (Dowclene EC) remains clean after a 5 minute operation period.

(17) Remove the filter element from beaker and pressure flush (internal and external) using clean water.

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(18) Pressure air-dry filter element with clean dry compressed air.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(19) Pressure drop check cleaned filters in accordance with Inspection (SECTION III).

(20) If cleaned filter element is not to be installed immediately, place in clean, dry container.

Q. Method No. 203S: Cleaning Compressor Blades and Applying Anti-fretting Coating

Clean compressor blades and apply anti-fretting coating as follows:

WARNING: USE CORRECT PERSONAL PROTECTION. CHROMIC-ACID PICKLE SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

(1) Clean compressor blades for 1 hour in 20 percent chromic acid pickle solution (MIL-M-3171C, Type I) (SECTION VII), heated to 180 to 200°F (82 to 93°C), to remove existing anti-fretting coating from dovetail area of blades.

(2) Repeat cleaning procedure if necessary to remove anti-fretting coating; distinguished by dark blue/black color.

(3) Rinse blades in hot water, 160 to 200°F (71 to 93°C).

WARNING: USE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(4) Pressure air-dry compressor blades.

(5) Prepare graphite varnish anti-fretting coating.

NOTE: Mix one part corrosion preventive synthetic resin varnish (AMS3132) (SECTION VII) by weight to two parts alcohol dispersion of colloidal graphite solution containing 18 to 22 percent of graphite (SECTION VII) by weight, thinned with ester thinner alcohol (AMS3170) (SECTION VII).

(6) Apply anti-fretting coating by spraying one or more coats to obtain film thickness of approximately 0.0002 inch (0.005 mm).

NOTE: Air dry blades a minimum of 10 minutes between coats.

(7) Heat blades for 1 to 2 hours at 290 to 300°F (143 to 149°C).

R. Method No. 203T: Cleaning Igniter Plug

WARNING: USE THE CORRECT PERSONAL PROTECTION. ABRASIVE BLASTING WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Use a standard sandblast cabinet and 120 grit sand (MIL-A-22262) to remove hard carbon or lead deposits and corrosion and scale by subjecting parts to abrasive blasting. Proceed as follows:

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. DO NOT BREATHE THE FUMES. DO NOT PERMIT CHEMICAL TO TOUCH EYES OR SKIN. DO NOT USE NEAR OPEN FLAMES OR HIGH TEMPERATURES.

(a) Clean parts with solvent (MIL-PRF-680) spray in an outside ventilated spray booth to remove oil and grease contamination.

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. THE AIRFLOW CAN CAUSE CUTS. DO NOT POINT IT AT YOUR SKIN. SOLVENT IS TOXIC AND FLAMMABLE. DO NOT BREATHE THE FUMES. DO NOT PERMIT CHEMICAL TO TOUCH EYES OR SKIN. DO NOT USE NEAR OPEN FLAMES OR HIGH TEMPERATURES.

(b) Air-dry igniter plug with dry, filtered, compressed air.

(c) Mask any surfaces that are subject to damage by blast cleaning

WARNING: USE THE CORRECT PERSONAL PROTECTION. ABRASIVE BLASTING WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT, AS DAMAGE TO PART WILL RESULT.

(d) Set blasting equipment air pressure at 15 to 30 PSIG (103 to 207 kPa), then subject parts to sandblast.

(e) Reduce air pressure as required to control action on the base metal.

S. Method No. 203U: Removing Aluminum Particles From Titanium Parts

Remove aluminum particles from titanium parts as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(1) Remove aluminum particles from the part by soaking in sodium hydroxide solution (Method No. 202H). Soak until all aluminum particles are removed. If necessary, use a nylon brush to remove particles.

(2) Rinse parts in water at 80 to 110°F (27 to 43°C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. THE AIRFLOW CAN CAUSE CUTS. DO NOT POINT IT AT YOUR SKIN.

(3) Pressure air-dry with clean dry compressed air until free of moisture.

NOTE: Air pressure - Refer to Repair Station Health and Safety rules or National safety guidance.

(4) Dry in oven at 160 to 250°F (71 to 121°C) for 1 hour.

(5) Store parts in dry place.

T. Method No. 203V: Aqueous Cleaning

(1) Remove Grease From Parts With Aqueous Cleaning.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL OR SOLUTION CAN CAUSE SKIN, EYE, AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(a) Put the part in a rack and into the solution (Brulin 815GD, Daraclean 282, Turco 5948DPM or Ecomate FN) (SECTION VII) so that all surfaces are touched by the solution.

NOTE: The maximum cleaning time is 30 minutes.

(b) Keep the part in the solution for 10 to 30 minutes. Refer to Table 201 for the chemistry and temperature limits of the solutions.

Table 201. Material Specifications

Chemical	Concentration	Temp F (C)	Max. Time	Immersion Agitation
Daraclean 282	8 - 12 V/V Percent	140 to 160 (60 to 71)	30 Minutes	Yes
Brulin 815GD	8 - 12 V/V Percent	140 to 160 (60 to 71)	30 Minutes	Yes
Modern Chemical Blue Gold	5 - 12 V/V Percent	140 to 160 (60 to 71)	30 Minutes	Yes

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL OR SOLUTION CAN CAUSE SKIN, EYE, AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(c) Remove the part from the solution and let the unwanted solution drain into the tank.

(d) Flush the part with water for 10 seconds minimum.

(e) Flush the part in a double cascade rinse for 15 seconds minimum.

(f) Flush the part with water at 140°F (60°C) for 15 seconds minimum.

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. THE AIRSTREAM CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(g) Dry the part with compressed air. An alternate procedure for drying is included in the following step.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(h) Dry the part in an oven at 160°F (71°C) maximum.

U. Method No. 203W: Plastic Media Blasting

(1) The following procedure describes a mechanical method of removing coatings without harming the substrate. This method is an abrasive blasting process using a dry media of thermoset or thermoplastic plastic grit. Plastic media can be reused since it is not prone to break down and it retains its angular shape. It is necessary to clean the media before reuse.

NOTE: Plastic media can leave a film that can be detected during fluorescent penetrant inspection. Remove film with ethyl alcohol (SECTION VII).

(2) Media used in plastic media blasting must be fabricated from virgin plastic (Grade A) with a particle size (U.S. Standard Sieve) and shape with sharp edges and corners. Plastic media are classified by type which specifies the hardness and material composition. Definitions of the different media types are as follows:

Type I A polyester plastic with a 3.0 mohs (34 to 42 Barcol) hardness. This media is recommended for use on delicate surfaces and is the least damaging of all media types.

Type II A urea formaldehyde based plastic with a 3.5 mohs (54 to 62 Barcol) hardness. This material may be used if the Type I material produces a less than desirable removal rate.

Type III A melamine formaldehyde plastic with a 4.0 mohs (64 to 74 Barcol) hardness. Type III media are very aggressive and are recommended for stripping iron based substances where residual stress is not a concern.

Type IV A phenol formaldehyde plastic with a 3.5 mohs (54 to 62 Barcol) hardness. This media is similar to Type II.

Type V An acrylic plastic with a 3.5 mohs (46 to 54 Barcol) hardness. Types I through IV are thermoset type plastics. This media is thermoplastic and tends to be softer and longer lasting.

(a) Media Particle Size: Each type of blast media is available in a wide variety of size distributions. Blending of the different types/sizes is not permitted.

.

(b) Media Material Restrictions: The media must be manufactured in accordance with the best commercial practice and supplied in accordance to the following restrictions.

1 No inorganic fillers are allowed in the media.

2 Media must not have or create an objectionable odor or affect the health of the personnel when used.

3 Media must not contain more than 1 percent of chlorine.

4 Media must be resistant to static electric build up. Antistatic agents are recommended.

5 Media must be free of any foreign matter detectable to the naked eye.

(c) Media Types I through V

To get plastic abrasive media material refer to Section VII Table 706 Consumables.

(3) Equipment Required.

(a) Blast Equipment: Blast equipment must be of proper type and adequately sized for the task. It must allow the operator ease of control over the intensity and targeting of the blast stream.

(b) Screening: Screening or filtering equipment is essential for media maintenance. It is mandatory to screen or filter new and used media prior to remove undersize, or broken abrasive particles, corrosion debris, coating debris, metal particles or any other media contamination.

WARNING: INHALING DUST PARTICLES IS HAZARDOUS. DUST PARTICLES CAN ALSO BE EXPLOSIVE. SUITABLE DUST COLLECTION AND VENTILATION SYSTEMS ARE ESSENTIAL TO PROTECT PERSONNEL FROM THESE HAZARDS.

(c) Dust Collection and Ventilation: Provisions must be made to collect the dust formed during blasting and provide adequate dust free ventilation to personnel. Filtering type respirators should be used.

(4) Process Parameter Development.

CAUTION: NOZZLES LARGER THAN 0.375 INCH (9.53 MILLIMETERS) DIAMETER CAN PROVIDE SUCH A LARGE AMOUNT OF MEDIA THAT CAN CAUSE DAMAGE TO COMPONENTS AND ARE NOT RECOMMENDED.

Test blast a small area using 30 PSIG (207 kPa), a 3/8 inch diameter nozzle, a 60 degree blast angle, Type I media and 12 inches (304.8 mm) standoff distance. An acceptable removal rate is typically 0.50 to 0.75 square feet (0.047 to 0.070 square meters) per minute for metal substrates (approximately 0.30 square feet (0.03 square meters) per minute for organic matrix composites). If the removal rate requires improvement, adjust the following process parameters (a) through (d), and select the best combination that will provide an acceptable removal rate while not harming the substrate or the sub coatings. Record the process parameters giving the best results.

NOTE: Nozzle sizes range from 0.25 to 0.625 inch (0.635 to 15.88 millimeters) diameter and each will have their own characteristic removal rate and blast energy.

(a) Plastic blast media are grouped according to increasing hardness and abrasiveness. (Refer to Step (2)) Therefore, if Type I removal rate is too slow, try Type II.

(b) Blast pressure at the nozzle directly affects the removal rate and may be varied from 25 to 45 PSIG (172 to 310 kPa) for pressure blast systems. Higher pressures are necessary for suction type blasters. Excessive pressure will damage the media. Pressures should be kept on the low side; in the range of 25 to 30 PSIG (172 to 207 kPa).

NOTE: Use less pressure to avoid damaging delicate substrates.

CAUTION: USING HIGH SPRAY ANGLES (75 TO 90 DEGREES) WILL IMPART MORE ENERGY TO THE SUBSTRATE THAT MAY CAUSE WARPAGE OR CRACKING.

(c) Blast angle has a proportional effect on removal rate. The higher the angle, the higher the removal rate. On delicate substrates, it is advisable to use low blast angles of 45 degrees or less.

(d) Standoff distance typically ranges from 6 to 24 inches (152 to 610 mm) and has a significant influence on removal rate. It is recommended that a range be selected and maintained as close as possible during the entire blasting operation.

(5) Areas to be blasted must be dry and free of moisture, grease, oil, or any loose contaminants.

WARNING: AVOID PROLONGED INHALATION OF SOLVENT VAPORS. WEAR RUBBER GLOVES AND USE PROTECTIVE HAND CREAM TO PREVENT CONTACT WITH SKIN. DO NOT HEAT SOLUTION.

(a) Degrease components according to the cleaning method for the component parent material listed in Section II or wipe with a clean lint-free cloth (SECTION VII) using solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII).

(b) Mask or plug all internal passages to prevent blasting materials from entering.

NOTE: Protect all areas adjacent to or near areas to be blasted with masking tape (SECTION VII) or equivalent.

(c) Using the appropriate process parameters (refer to Step (4)), blast a small area using a circular motion until the desired removal has been achieved, then proceed to a new area. Never allow the blast stream to dwell on a single area at any time; always keep the impingement area moving. Try to work in a fluid manner maintaining continuous motion.

NOTE: When blasting, the blast stream must be smooth and continuous to prevent uneven erosion of coatings or damage to the substrate.

Plastic media blast cleaning exposes substrates to corrosion or potential contamination from the environment. Areas should be plastic media blast cleaned as preparation for a subsequent coating operation.

4. Alternate Cleaners

A. General

(1) Alternate cleaners may be used in lieu of those specified in Method No. 202A and Method No. 202E. Previously approved alternates are listed below and do not require further testing prior to use. Refer to Step (5) below for definition of Types.

(a) Approved alternates for Method No. 202A cleaning product, Diversey/Ridoline 909, CeeBee A7X7, Daraclean, Ecomate FN, or equivalent SECTION VII:

- Ardrox 6025 (Types I and II)
- Ardrox 6333 (Types I and II)
- Armakleen M-HP-2 (Types I and II)
- Brulin 815GD (Types I, II, and IV)
- Brulin 1990 (Types I and II)
- CeeBee A7X7 (Types I and II)
- Daraclean 282 (Types I and II)
- Ecomate FN (Types I and II)
- Modern Chemical Blue Gold (Types I and II)
- Oakite 61-B (Types I and II)
- Turco 5948DPM (Types I and II)
- Turco Liquid Sprayeze NP-LT
- X-IT Plus (Types I, II, and IV)

(b) Approved alternates for Method No. 202E cleaning product, Oakite Rustripper:

- Ardrox 185 (Type VI)
- Ardrox 1854 (Type VI)
- CeeBee J84A (Type VI)
- Turco 4181 (Type VI)

(2) Any other cleaners desired for use in place of those specified in Method No. 202A and 202E must be chosen per the methods in SECTION II, Part E.

(3) Procedures for preparation and use of alternate chemicals must be documented with revision control and must be in accordance with cleaning material manufacturers instructions, notes, warnings, and cautions addressing the agents to make sure no harm is caused to the products, parts, equipment, or appliances (per FAA Advisory Circular 43-205). These procedures must be available to Honeywell upon request.

(4) Results of tests performed to verify acceptability of alternate cleaners not listed above must be documented and available to Honeywell upon request.

(5) Tests specified for each Type of cleaning (see types below) in Table 202 must be performed to determine acceptable alternate cleaners to be used in place of products specified in Method No. 202A and 202E which are not already listed above as approved alternate cleaners. Alternate cleaning products not listed above must only be used for the Type of cleaning (in Table 202) for which they specifically meet all of the test requirements.

(a) Type I – General cleaning prior to chemical processing or other processes not covered in Types II-IV.

(b) Type II – Cleaning prior to fluorescent penetrant inspection or magnetic particle inspection.

(c) Type III – Cleaning prior to adhesive bonding.

(d) Type IV – Cleaning prior to organic coating (including painting).

(e) Type V – Paint removal.

(f) Type VI – Rust removal.

(6) For Type 1 cleaning applications, materials that meet the requirements of MIL-PRF-87937 or MIL-C-29602 may be used.

B. Test Methods for Determination of Acceptable Alternate Cleaners

Table 202. Test Application

TEST	TEST METHOD	TYPE[4]					
		I	II	III	IV	V	VI
Etch Rate[1]	204A	X	X	X	X		
Sandwich Corrosion[1]	204B	X	X	X	X	X	
Intergranular Attack	204C	X	X	X	X		
Cleaning Ability	204D	X	X	X	X	X	
Chemical Analysis	204E	X	X	X	X	X	X
Hydrogen Embrittlement[1]	204F	X	X	X	X	X	
Stress Corrosion and Hydrogen Pickup of Titanium[1,2]	204G	X	X	X	X		
Immersion Corrosion[1]	204H	X	X	X	X	X	
Effect on Painted Surfaces	204J	X	X	X	X		
Acrylic Crazing Test	204K	X	X	X	X		
Residue	204L	X	X	X	X		
Cleaning Prior to Fluorescent Penetrant Inspection (FPI)	204M		X				
Cleaning Prior to Bonding	204N			X			
Cleaning Prior to Painting	204P				X		
Cleaning Prior to Painting (Magnesium)[3]	204Q				X		
Dissimilar Metals Corrosion	204R					X	
Sodium Hydroxide Base Remover	204S						X

1 – Test must be performed for aqueous and semi-aqueous cleaners (which includes all alkaline and acidic solution). This test is not necessary for purely organic solvents.
2 – Test must be performed for cleaning products, which will be used on Titanium alloys.
3 – Test must be performed for cleaning products, which will be used on Magnesium alloys.
4 – X = Test applies to this type.

(1) Method No. 204A: Etch Rate Corrosion Test.

NOTE: This test must be performed for aqueous and semi-aqueous cleaners (which includes all alkaline and acidic solutions). This test is not necessary for purely organic solvents.

(a) Immerse each of the materials (listed in Table 203) panels with at least 4 square inches (2581 millimeter squared) of total surface in the cleaner for 24 ±0.5 hours.

(b) The testing must be done at the maximum operating temperature and concentration of the solution to be used during processing of parts.

(c) The degreasing solution must not cause etching or corrosion of the metal.

(d) The maximum allowable weight change for each material must be listed in Table 203.

Table 203. Material Weight Change

Material	Weight Change (mg/sq. in./24 Hr)
Bare aluminum (2024-T4 or T6)	2.5
Magnesium (AZ31)	5
Bare low alloy steel (AISI 4130)	7.5
Cadmium plated steel (plate in accordance with QQ-P-416, Type II, or AMS 2400)	2.5
Titanium 6 – 4	1.25
Nickel – based alloy (INCO 625 or INCO – 718)	7.5
Ferrous alloy A286	7.5
Stainless Steel Alloys	7.5

(2) Method No. 204B: Sandwich Corrosion Test.

NOTE: This test must be performed for aqueous and semi-aqueous cleaners (which includes all alkaline and acidic solutions). This test is not necessary for purely organic solvents.

(a) Testing must be conducted in accordance with ASTM F 1110, except aluminum alloys and the number of sandwich test specimens must be as specified in Table 204.

(b) Prepare two sandwich test specimens for each of the materials listed in Table 204 for each degreasing solution tested.

(c) When tested in accordance with ASTM F 1110, the concentrated cleaner and a solution within the recommended concentration range must not cause a corrosion rating greater than one on any test panel.

Table 204. Material Condition Specification

Material	Condition	Specification
7075 – T6	Uncoated	- - -
2024 – T3	Uncoated	- - -
7075 – T6	Anodized	MIL-A-8625, Type II, Class 1, or AMS 2471
2024 – T3	Anodized	MIL-A-8625, Type II, Class 1, or AMS 2471

(3) Method No. 204C: Intergranular Attack Test.

(a) Submerse all of the materials listed in Table 203 in the solution at the maximum concentration to be used for production for 24 ±1 hours at room temperature.

(b) The degreasing solution must not cause intergranular attack in excess of 0.0002 inch (0.00508 mm) or end grain pitting in excess of 0.001 inch (0.0254 mm).

(4) Method No. 204D: Cleaning Ability Test.

(a) Panels of 2024-T6, at least 10 inches (254 mm) by 3 inches (76.2 mm), must be coated with the following, and must be allowed to set for a minimum of 24 hours (except machine coolant, which must be allowed to set for 2 hours maximum). A minimum of 2 panels must be coated with each material.

- Farbest 7220 Antirust oil (or other product approved in accordance with MIL-C-16173, Grade 3)

- Machine Coolant Lubrication Oil (MIL-L-7808 or MIL-L-23699)

(b) Clean the contaminated panels using the solution under nominal test conditions to be used in production.

(c) Any visual surface staining or residue on the panels cleaned in the degreasing solution compared to those solvent cleaned must be cause for rejection.

(5) Method No. 204E: Chemical Analysis Test.

(a) Chemical analysis procedures must be documented for all solutions to determine solution concentration (except for solutions, which are used at 100% concentration).

(b) The chemical analysis procedures must be furnished to the user by the supplier and verified by the user prior to use of the solution.

(6) Method No. 204F: Hydrogen Embrittlement Test.

NOTE: This test must be performed for aqueous and semi-aqueous cleaners (which includes all alkaline and acidic solutions). This test is not necessary for purely organic solvents.

(a) Unplated, notched tensile bars made from AISI 4340 in accordance with ASTM F 519, Type 1a, must be tested in accordance with ASTM F 519 for cleaners. Degreasing solutions must be tested undiluted and diluted to the maximum concentration to be used for production.

(b) Treated test specimens must meet the requirements of ASTM F 519.

(7) Method No. 204G: Stress Corrosion and Hydrogen Pickup of Titanium Test.

NOTE: This test must be performed for aqueous and semi-aqueous cleaners (which includes all alkaline and acidic solutions). This test is not necessary for purely organic solvents.

(a) Cleaning solutions must be tested in accordance with ASTM F 945, Method A for stress corrosion cracking.

(b) Titanium alloy must be tested for hydrogen pickup by exposing it to the degreasing solution for 40 minutes at the maximum operating concentration and temperature to be used in production.

(c) Test specimens must be free from stress corrosion cracks.

(d) Degreasing solutions must not increase the hydrogen content of titanium alloy parts by more than 20 PPM when exposed for 40 minutes minimum at the maximum operating concentration and temperature to be used in processing production parts.

(8) Method No. 204H: Immersion Corrosion Test.

NOTE: This test must be performed for aqueous and semi-aqueous cleaners (which includes all alkaline and acidic solutions). This test is not necessary for purely organic solvents.

(a) Cleaning solutions must be tested in accordance with ASTM F 483.

(b) Average weight loss is not to exceed 10 Mg.

(9) Method No. 204J: Effect on Painted Surfaces Test.

(a) Cleaning product must be tested in accordance with ASTM F 502.

(b) Following testing, product must not decrease in film hardness greater than 1 pencil and no staining.

(10) Method No. 204K: Acrylic Crazing Test.

(a) Cleaning product must be tested in accordance with ASTM F 484.

(b) Following testing, product must not crack, craze, or stain acrylic.

(11) Method No. 204L: Residue Test.

(a) Cleaning product must be tested in accordance with ASTM F 485.

(b) Following testing, product must leave no residue or stain.

(12) Method No. 204M: Cleaning Prior to Fluorescent Penetrant Inspection (FPI) Test.

(a) Ni-Cr Tapered Panels. (Refer to Figure 201.)

1 Ni-Cr tapered test panels with crack depth range from 10 to 50 microns must be contaminated with the following materials:

- Machine Coolant
- Lubrication Oil (MIL-L-23699)
- Farbest 7220 Antirust Oil (or other product approved in accordance with MIL-C-16173, Grade 3)

2 After contamination, the panels must be allowed to set for a minimum of 24 hours prior to cleaning (except panels coated with machine coolant must be allowed to set for 1 to 2 hours). A panel contaminated with each soil must be cleaned using the test cleaner and a panel contaminated with each soil must be solvent cleaned.

3 After cleaning, the panels must be inspected in accordance with ASTM E1417 and the following:

- Type I, Method A or D, Level 2, 3, or 4 sensitivity penetrant, and Form d developer.

4 Excess penetrant must be removed with a clean, dry, lint-free cloth or absorbent towel until no residual penetrant remains on the panel surface.

NOTE: No additional processing (e.g. solvent wipe, water rinse, etc.) permitted. Panels must be observed under suitable UV light to make sure removal of excess surface penetrant.

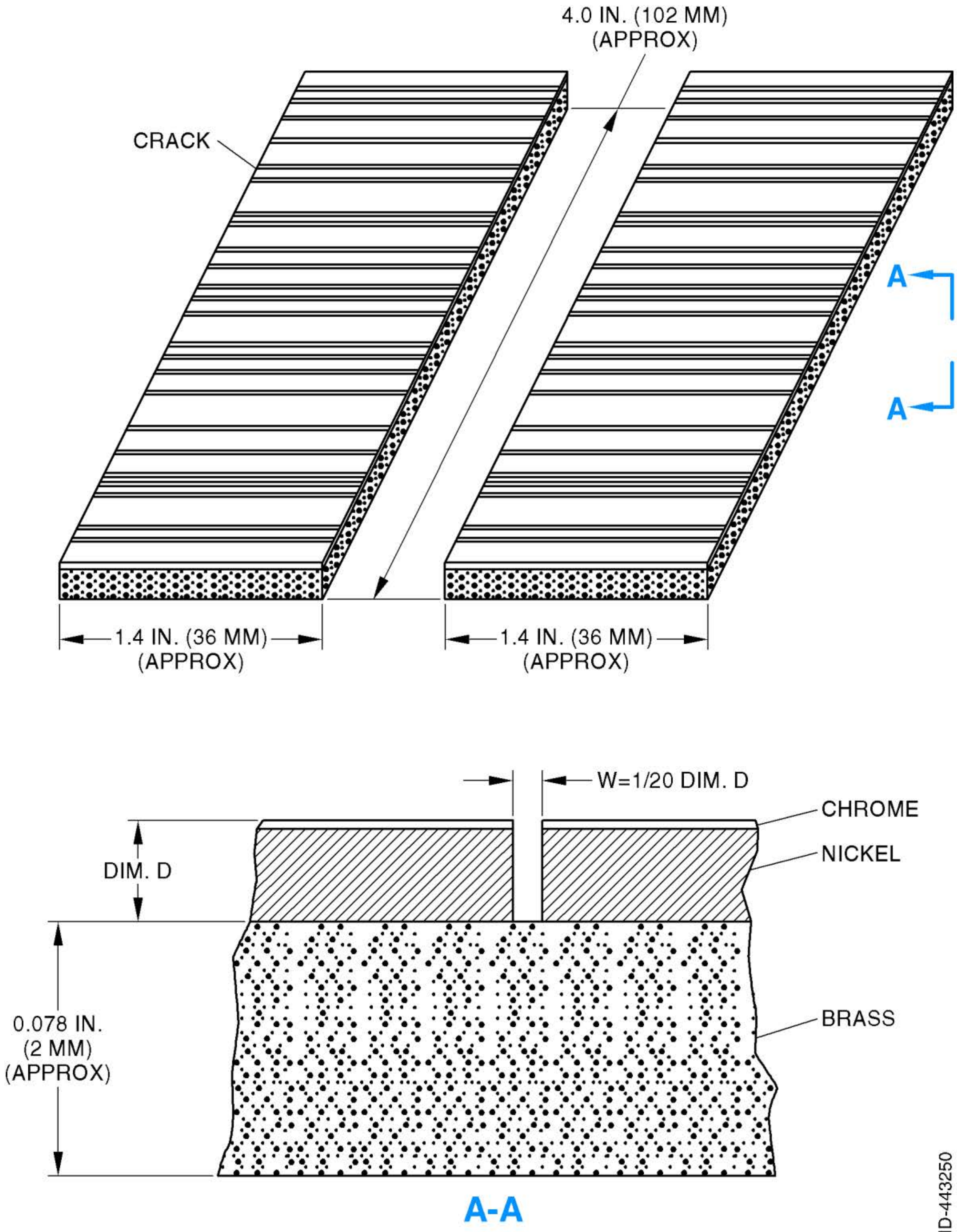
(b) TAM panels.

1 After contamination, the panels must be allowed to set for a minimum of 24 hours prior to cleaning (except panels coated with machine coolant must be allowed to set for 1 to 2 hours).

2 A panel contaminated with each soil must be cleaned using the test cleaner and a panel contaminated with each soil must be solvent cleaned. After cleaning, the panels must be inspected in accordance with ASTM E1417 and the following:

- Use Type 1, Method A or D, Level 2, 3 or 4 sensitivity penetrant, and form (a) or (d) developer.

NOTE: Ni-Cr tapered panels cleaned with the degreasing solution must have equivalent or better crack resolution than the panels solvent cleaned. The grit blasted portion of the TAM panel cleaned with degreasing solution must exhibit no greater background than the panel cleaned by solvent degreasing when examined by a Level II or III penetrant inspector. Photographic documentation must be obtained.



Nickel and Chrome Test Panels
Figure 201

(13) Method No. 204N: Cleaning Prior to Adhesive Bonding Test.

(a) Lap sheer specimens must be prepared and tested in accordance with ASTM D 1002 and the following:

- Adhesive to be used in testing must be in accordance with MM-A-132 Type I Class 3 Form P Group 1 (EA 9394, available from Dexter Adhesives and Structural Materials Division, or equivalent meeting specification requirements).

- The materials must be mixed in accordance with the manufacturer's recommendations. All adhesives must be within shelf life limits provided by the manufacturer. All adhesives used for one test (both degreased with the material under test and baseline panels) must come from the same adhesive lot.

(b) Adherent to be 2024 T4 or T6 aluminum prepared as follows:

1 Anodize in accordance with MIL-A-8625, Type II, Class 1, or AMS 2471.

2 Dip in lubricating oil (MIL-L-7808 or MIL-L-23699) and let set for 24 hours minimum.

3 Degrease.

4 Let dry.

(c) Degreasing prior to bond must be done at the time, concentration, and temperature to be used in production. Baseline test pieces must be solvent degreased.

(d) Material must be bonded using a 0.005 ±0.002 inch (0.13 ±0.05 mm) bond line.

(e) Material must be cured at 77 ±5°F (25 ±3°C) for 5 days minimum.

(f) Test must be performed in accordance with ASTM D 1002 with the following exceptions:

- Only 2024 aluminum must be tested.

- Total number of specimens for each test product must be ten.

- The ten specimens must represent at least two different adhesive joints.

(g) The average tensile lap shear strength must not decrease by more than 15% when using the test product compared to those solvent degreased.

(14) Method No. 204P: Effectiveness of Cleaning Metals (Except Magnesium Alloys) Prior to Painting Test.

(a) Four 2024-T6-aluminum panels must be processed in accordance with MIL-C-5541, Class 3, or AMS 2474. After coating and prior to painting, the panels must be dipped in lubrication oil such as Farbest 7220, or any other product approved in accordance with MIL-C-16173, Grade 3, and allowed to set for a minimum of 24 hours prior to cleaning.

1 Clean two of the panels with the test cleaner and two control panels with methyl-ethyl-ketone (MEK).

(b) Paint panels in accordance with maintenance manual painting procedures for components for which cleaner is being tested. (Use primer and topcoat, which are currently being used to coat Honeywell hardware.)

(c) After processing, dry tape adhesion test must be performed as follows:

1 Make two parallel, scratch marks on test panel approximately 1.00 inch (25.4 mm) apart from one another.

2 Wipe test panel clean using isopropyl alcohol in accordance with ASTM D 770. Allow the test area to dry completely (approximately 30 seconds).

3 Remove two complete laps of approximately 1.00 inch (25.4 mm) wide tape. Remove an additional length at a steady (not jerked) rate and cut a piece of tape approximately 4.00 inches (101.6 mm) long.

NOTE: Tape used for testing must be rubber or acrylic adhesive backed tape with a minimum peel adhesion of 60 oz/inch (16.68 joules/meter) width when tested according to ASTM D 3330, Method A.

4 Fold the last inch (25.4 mm) of one end of the tape back upon itself (adhesive against adhesive) to create a tab approximately .50 inch (12.7 mm) long.

5 Apply tape to test panel so that tape is aligned perpendicular to scratch marks. Smooth tape into place with finger. Use firm hand pressure to make sure good contact has been made.

6 Within 1 to 2 minutes, remove tape by pulling it rapidly (but not jerked) at an angle of approximately 180º to test panel.

(d) Panels cleaned with the test cleaner must have the same or better adhesion properties as control panels MEK cleaned.

(15) Method No. 204Q: Effectiveness of Cleaning Magnesium Alloys Prior to Painting Test.

(a) Four AZ31 magnesium panels must be processed in accordance with AMS-M-3171, Type VI. After coating and prior to painting, the panels must be dipped in lubrication oil such as Farbest 7220, or any other product approved in accordance with MIL-C-16173, Grade 3, and allowed to set for a minimum of 24 hours prior to cleaning. Clean two of the panels with the test cleaner and two panels with methyl-ethyl-ketone (MEK).

(b) Seal and paint panels in accordance with maintenance manual sealing and painting procedures for components for which cleaner is being tested. (Use sealant, primer, and topcoat, which are currently being used to coat Honeywell production hardware.)

(c) After processing, dry tape adhesion test must be performed as follows:

1 Make two parallel, scratch marks on test panel approximately 1.00 inch (25.4 mm) apart from one another.

2 Wipe test panel clean using isopropyl alcohol in accordance with ASTM D 770. Allow the test area to dry completely (approximately 30 seconds).

3 Remove two complete laps of approximately 1.00 inch (25.4 mm) wide tape. Remove an additional length at a steady (not jerked) rate and cut a piece of tape approximately 4.00 inches (101.6 mm) long.

NOTE: Tape used for testing must be rubber or acrylic adhesive backed tape with a minimum peel adhesion of 60 oz/inch (16.68 joules/meter) width when tested according to ASTM D 3330, Method A.

4 Fold the last inch (25.4 mm) of one end of the tape back upon itself (adhesive against adhesive) to create a tab approximately .50 inch (12.7 mm) long.

5 Apply tape to test panel so that tape is aligned perpendicular to scratch marks. Smooth tape into place with finger. Use firm hand pressure to make sure good contact has been made.

6 Within 1 to 2 minutes, remove tape by pulling it rapidly (but not jerked) at an angle of approximately 180º to test panel.

(16) Method No. 204R: Dissimilar Metals Corrosion Test.

(a) Cleaning product must be tested in accordance with MIL-R-81294.

(b) Following testing, panels must be free from pitting, etching, and corrosion.

(17) Method No. 204S: Sodium Hydroxide Base Rust Remover.

(a) Cleaning product must meet requirements specified in AMS 1380.

SECTION III – INSPECTION

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SECTION III – INSPECTION

1. Standard Inspection Practices

A. General

The methods and procedures presented are recommended by the manufacturer to facilitate repair of a unit. The information is presented as a supplement to the knowledge acquired by competent personnel engaged in the overhaul activities of organized facilities and to the applicable model-specific inspection manuals (zero-time) and workscope planning guides (continuous-time). Processes or procedures, which are considered general or commonplace, are omitted. However, due to the precision equipment involved, it is necessary that all instructions detailed herein be carefully evaluated and closely followed.

- Frequent reference must be made to Fits and Clearances in the applicable inspection manuals/workscope guides for unit being repaired, during inspection, repair, and replacement procedures, to determine if parts can meet minimum or maximum limits of fit tolerances.
- Dimensional inspections are required for critical parts subject to wear as specified by the applicable manuals/workscope guides. However, if visual inspection shows no indication of damage or wear, dimensional inspection requirements may be left to the judgment of inspection personnel.
- Long life and continued efficient operation of the unit depend upon the care and accuracy with which inspections are conducted, repairs, and replacements accomplished, and calibration performed.
- Finished part dimensions are dimensions, which define the finished part and must be met when the part is free from external forces, except when restraint of part is specifically required by the applicable manual covering the part.
- Dimensions and surface texture apply after plating, anodic coating, hard anodizing, metal spraying or plasma spraying has been completed.
- Finished part dimensions apply prior to all other coatings, such as paint or dry film lubricants, unless otherwise specified by the applicable manual covering the part.
- Table 309 provides a list of equipment and materials that may be needed for inspection.

B. General Inspection Procedures

CAUTION: AFTER INSPECTION, ALL STEEL PARTS MUST BE COATED WITH CORROSION-PREVENTIVE COMPOUND (MIL-C-6529, TYPE III) (SECTION VII).

(1) Check instrumentation.

All micrometers, gages, indicators, other measuring instruments, or test equipment must be checked periodically and calibrated accurately in accordance with applicable manufacturer recommendations and internal processes.

(2) Provide inspection records and tags.

Good shop practices include the compilation of complete and accurate inspection records. Such records expedite reworking of equipment, and lend assurances of a complete and thorough overhaul.

(a) It is suggested that inspection records be based on the requirements presented in this section, and that parts requiring rework or replacement be tagged and a notation of the disposition of these parts be entered on the inspection records.

(b) Records of rework, rework method and inspection thereof, must be maintained in the event that such rework results in adverse conditions. Only rework procedures specified by the unit manufacturer must be utilized. The same method is suggested for parts requiring special treatment, such as magnetic particle or fluorescent penetrant inspections, painting, cadmium plating, etc.

C. Magnetic Particle Inspection

NOTE: If no criteria is provided in the CMM or drawing, no cracks are allowed.

(1) Magnetic particle inspection must be per the requirements of ASTM E1444 using the fluorescent wet continuous method.

D. Fluorescent Penetrant Inspection

NOTE: If no criteria is provided in the CMM or drawing, no cracks are allowed.

(1) Scope – Fluorescent penetrant inspection (Type 1), referenced in this manual, must be performed in accordance with this document and either ASTM E1417 or AMS 2647 which detail the minimum requirements. Refer to the component section of the manual for specific instruction and/or acceptance criteria.

(2) Etching – Pre-penetrant etching must be performed when specified.

(3) Areas of components containing coatings, plating, etc (such as in OEM applied) usually prevent inspection of the substrate and are not to be considered for inspection. Inspections must be performed with these surface conditions in place unless otherwise specified.

(4) Focused Inspection – Where a focused penetrant inspection is specified, the component must be globally inspected, followed by careful re-examination of the critical features identified in the manual or inspection procedure using 10X magnification.

(5) Penetrant System – Type II (Visual penetrant) and Type III (dual mode penetrant) process must not be used on engine components. All penetrant materials must be listed in QPL-SAE-AMS-2644.

(a) Rotating Components – Unless otherwise specified in this manual, the examination of critical rotating components must be performed with Type 1, Method D, Sensitivity Level 4 process. Rotating components are defined as any part that by design experiences rotary motion when in operation (e.g., blades, discs, wheels, impellers, seal plates, spacers, couplings, tie bolts, shafts, and gears, etc).

(b) Non-Rotating Components – Unless otherwise specified in this manual, perform fluorescent penetrant inspection examination of non-rotating components with a Type 1, Method A or D, Sensitivity Level 3. Inspection to a higher sensitivity level than specified is acceptable provided the process yields a satisfactory indication to background contrast. Method D may be substituted for Method A.

(c) Dwell Time – Penetrant dwell time must be 30 minutes minimum when inspecting for service induced defects. For the inspection of processing related defects only, the dwell time may be reduced to 10 minutes minimum.

(d) Developer – Developer is required. Dry powder developer (Form a) is the preferred developer for routine Method A and D inspections. Dry developer dwell time must be 10 minutes minimum to 4 hours maximum.

(e) Method C – Method C process is for localized inspections where it is not feasible to process the entire part, for inspections at remote locations, or when water contact is detrimental. Method C may be substituted for Method A and D for localized inspections, if Method A or D is not feasible. Nonaqueous developer (NAD/Form d) is recommended where part geometry permits a uniform application; otherwise, Form a (dry developer) must be used. NAD dwell time must be 10 minutes minimum, to one hour maximum.

(f) Indication Verification – Indications must be evaluated by wiping the indication with a solvent-dampened swab or brush, allowing the area to dry and redeveloping. Redevelopment time must be at least 10 minutes, except nonaqueous redevelopment must be 3 minutes minimum. If no indication reappears, the original indication is considered false. This procedure may be performed twice for any given original indication.

E. Bearing Inspection

(1) Separable Bearings:

Table 301. Separable Bearing Defect Definitions

Term	Definition (Description of Defect)
Arced	Round pit shaped cavity in a surface from which metal has been removed by electrical arc causing a temper change (softer) in the metal around the pit shaped cavity. It may be caused by a lightning strike or similar electrical occurrence.
Bent	Deformed from original shape or form. An example would be cages that are deformed from improper installation or bearing wear.
Brinelling (True)	True brinelling is plastic flow of metal, characterized by smooth shiny bottomed indentations in raceways or rolling elements usually equally spaced corresponding to rolling element spacing. Caused by impact, improper installation/removal or dropping of the bearing or unit it is installed in. (Refer to Figure 309)
Brinelling (False)	False brinelling is characterized by surface marks or blemishes on raceways or rolling elements usually corresponding to rolling element spacing. The marks or blemishes will normally have a polished or satin finish. It's usually caused by vibration in a non rotating bearing.
Burnishing	Burnishing is a mechanical smoothing of a surface, sometimes resulting in discoloration around the contact area. This is a superficial characteristic that does not have wear.
Burrs/Raised Metal	Burrs/Raised metal is positive displaced metal from original machining or from surface material being displaced because of scratches, scoring, dents etc.
Corrosion	Corrosion is a chemical reaction to the surface of the bearing as a result of moisture or other chemical exposure. It is characterized by a broken, pitted or discolored appearance. The surface might also have an "orange peel" appearance. (Refer to Figure 306)
Cracks	Cracks are separations, fissures, or ruptures characterized by sharp edges and/or sharp changes in direction. The sharp edges can be either jagged or straight but will not have a defined depth or bottom visually.

Table 301. Separable Bearing Defect Definitions (Cont)

Term	Definition (Description of Defect)
Dents	Dents are slight depressions or hollows on the surface made by mechanical deformation of the surface by a blow or pressure caused by an object contacting the surface. They are usually bright bottomed and can be irregular in shape. Raised metal usually accompanies dents. (Refer to Figure 303)
Discoloration (Chemical)	Discoloration is a chemical reaction between two elements. Typically this is seen on cages that have been exposed to hot oil in operation. Sulfides in the oil turn the silver plate on the cages a purple to black color.
Discoloration (Heat)	Heat discoloration of bearing surfaces are due to buildup of heat during engine operation or soak back after engine shutdown. The colors can range from straw, brown, purple, red purple and blue. (Refer to Figure 310, 312 and 313)
Flaking, Peeling and Blistering of Plating	Flaking, peeling and blistering of plating is delaminating of the plating from the parent material. This is caused by improper plating processes such as improper cleaning of the parent metal or plating parameters. (Refer to Figure 315)
Fractures	Refer to Cracks.
Fretting/Fretting Corrosion	Fretting/Fretting Corrosion is rapid oxidation of surfaces in close fitting parts. It is characterized by rusty appearing surfaces ranging from black (well bonded) to fairly bright reddish brown (loosely bonded or free particles). It does not occur in the rolling element area.
Frosting Rolling Elements/Races	Frosting is the early stages of wear or superficial pitting or scoring. Generally cannot be measured unless it has progressed to pitting or scoring. It appears as a whitish or polished band which is made up of many minute indentations.
Functional Surface	Defined as the following: • Total raceway width of straight-through (non-flanged) races of roller bearings. • Load paths on flanged raceways of roller bearings. • Roller OD load path. • Roller corner radius to end face intersection. • Roller bearing raceway guide flange inner surface. • Separator pilot land surface • Balls and ball bearing outer raceway. • Ball bearing loaded raceway half for split inner rings.
Galling	Galling is a condition where there is a significant transfer of metal between surfaces due to welding and break-away of particles. It is caused by excessive sliding between two poorly lubricated surfaces which are forced into contact under high pressure.

Table 301. Separable Bearing Defect Definitions (Cont)

Term	Definition (Description of Defect)
Installation Marks	Installation Marks are scratches, scuffs, galling or dents caused by mating part interface or tool interface during installation or removal. They are usually contained to ID, OD and face.
Nicks	Refer to Dents.
Non-Functional Surface	Defined as any surface that is not functional (Refer to definition of “functional”).
Pits	Pits are small, irregular shaped cavities in a surface from which material has been removed by corrosive action such as chemical or electrolytic attack. (Refer to Figure 303)
Raised Metal	Refer to Burrs.
Rust	Rust is the released particles due to corrosion leaving a reddish or reddish brown deposit on the surface. Refer to corrosion for details.
Scoring	Scoring is a deep single or multiple scratches caused by sliding at the rolling contact surface as the result of foreign particle presence on the ball, roller or raceway.
Scratches and Scuffs	Scratches are narrow, mustow liner abrasions caused by the movement of sharp objects across a surface. Scuffs are multiple scratches aligned in the same direction as a unit.
Silver-plate Flaking	Flaking is separation of silver-plating from the parent material. It is characterized by irregular shaped/sized pieces of silver coming loose. This is generally caused by contaminates during the plating process causing poor adhesion between the silver and parent material.
Silver-plate Pocket Wear	Pocket wear is in the contact of the ball or roller with the working area of the cage causing an indentation or wear of the silver-plating. It is sometimes called silver flow because of silvers soft nature allowing it to appear moved around. The purpose of silver-plating is for lubrication between the rolling element and the cage during conditions of marginal oil lubrication.
Silver-plate Discoloration	Discoloration of the silver plate to a dark color occurs generally from a chemical reaction to cleaning agents or some lubrication oils.
Skidding	Skidding is excessive slipping between balls/rollers and raceways. Skidding is evidenced by a frosted, speckled or burnished ring around the rolling elements or raceways. (Refer to Figure 313)

Table 301. Separable Bearing Defect Definitions (Cont)

Term	Definition (Description of Defect)
Spalling	Spalling is caused by fatigue. Spalling exhibits irregular shaped cavities of flaked out metal from a raceway or rolling element surface with jagged bottoms. (Refer to Figure 307 and 311)
Stains	Stains are harmless surface discolorations which range from black to dark reddish brown in color. Surfaces which have stains will have an intact non-pitted and unbroken appearance. No change in dimensions will occur.
Surface Slag Inclusions	Surfaces Slag Inclusions are foreign materials, embedded in the metal or a cold fold during the pouring of the metal. These are from manufacturer of the bearing material and can appear after bearing use. Generally irregular in shape with sharp features and may appear as dark spots or lines.
Varnishing	Varnishing is a harmless surface discoloration from the breakdown of a lubricant because of temperature, which results in a light brown to black appearance. No change in dimensions will occur.
Wear	Physical diminishing of the surface finish color and/or original machined surfaced. It does not constitute wear until detectable with an applicable stylus. In the early stages it may show up as a polished or bright track between the rolling elements and the race and cannot be measured. Advanced stages of wear may show up as looseness in the bearing, spalling, pitting, fretting or other surface defects. (Refer to Figure 307 and 312).

(a) Make sure adequate inspection facility:

1 Enclosed room with positive pressure.

2 Temperature controlled 65 to 75°F (18 to 24°C).

3 Relative humidity under 45 percent.

4 Lighting of 100 to 150 foot candles (1076 to 1615 lux).

(b) Cleaning and visual check of installed or partially exposed bearings (installed in housings or on shafts/gears/etc) is permitted.

(c) Prior to cleaning, demagnetize bearing so residual magnetism does not exceed five gauss.

(d) Prior to inspection, disassemble and clean bearing components per Method No. 203P.

CAUTION: WHEN HANDLING BEARINGS WHICH ARE CLEANED AND NOT OILED, WEAR EITHER SYNTHETIC RUBBER GLOVES OR NYLON MESH GLOVES WITH POLYETHYLENE PALMS AND FINGERS. IF NOT AVAILABLE, CLEAN COTTON GLOVES MUST BE WORN. DO NOT TOUCH BEARINGS WITH BARE HANDS.

(e) Place bearings in a covered container or plastic bag while awaiting inspection to minimize contamination.

(f) All components of a bearing should be kept together during cleaning and must not become mixed with components of another bearing.

(g) Visually check the bearing. Refer to Table 302 and Figures 301, 302, 305, 308 and 314.

NOTE: Visual inspections must be performed using suitable lighting and an instrument capable of magnifying the bearing surfaces ten times (10-power magnification).

Visual inspection may be supplemented by hand tracing using a precision stylus as descried in Step (e).

Dimensions must be measured in accordance with ABMA Standards, Section 4, Ball and Roller Bearing Standard Gaging Practices (AntiFriction Bearing Mfg. Association, Suite 700, 1101 Connecticut Avenue N.W., Washington, D.C. 20036). Inner and outer diameter measurements must use the average (d_{mp}) of multiple measurements to determine bearing size.

Dimensions must meet the requirements in applicable manual for the engine and bearing in question except when specific deviations are permitted in this publication.

Dimensional inspections are included for critical wear areas. However, if visual inspection shows no indication of wear or damage, dimensional requirements must be left to the judgment of the inspection personnel.

Roller bearings that have a half-complement of rollers with the rollers assembled in alternate cage pockets may be reassembled with the rollers in the unused cage pockets as long as the cage does not have any defects which would be cause for rejection.

NOTE: Inspect the bearing functional surfaces per Table 302 using a precision stylus (Refer to Table 301 for definition of “functional”). When a stylus is used it must have a tip radius as specified in Table 302. The stylus must be held perpendicular to the surface being examined, and the only pressure exerted should be the weight of the stylus. Surface blemishes of acceptable bearings must not exceed the requirements specified in Table 302.

Reassembled bearings must contain only original components and be oriented the same as originally installed, except as noted below:

Half complement roller bearings (unused pockets between each roller) that are worn beyond limits may have the rollers reassembled into unused pockets.

Bearings with cages worn beyond limits on one (1) side of the pocket may have the cage turned 180 degrees to position the unused side of the pocket for use. There is no requirement to re-mark the cage markings on the other side.

(h) Dip bearing in oil (MIL-L-6085, SECTION VII) heated to 120 to 140°F (49 to 60°C) for 5 minutes and allow to drain. Do not oil bearings used in pneumatic valves.

(i) Package bearing and part number identification in heat sealable transparent plastic bag (MIL-B-22191D, SECTION VII). Evacuate air from bag and heat seal shut.

Table 302. Separable Bearing Inspection/Requirements

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1.02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Arcing	Not permitted	Not Applicable	Not Applicable	Not Applicable	Not Permitted
Bent	Not permitted	Not Applicable	Not Applicable	Not Applicable	Not Permitted
Brinelling (True)	Permitted. No raised metal permitted. Stone to remove raised metal.	.020 inch (0.51 mm)	.030 inch (0.76 mm)	.040 inch (1.02 mm)	Not Applicable
Brinelling (False)	Permitted. No raised metal permitted. Stone to remove raised metal.	.020 inch (0.51 mm)	.030 inch (0.76 mm)	.040 inch (1.02 mm)	Not Applicable
Bronze Wear (Separator)	Wear permitted up to 20% of rolling element diameter in a radial direction. Contact or wear that extends to the edges of the pockets is not permitted. Pitting or pullout is not permitted.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Burnishing	Permitted if step is not detectable with applicable stylus.	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1.02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/ DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Burrs	Not permitted. Use stone to remove burr. Refer to appropriate defect this table causing burr.	Not Applicable	Not Applicable	Not Applicable	Not permitted. Use stone to remove burr. Refer to appropriate defect this table causing burr.
Corrosion	Not permitted. Remove corrosion. Refer to appropriate defect this table.	Not Applicable	Not Applicable	Not Applicable	Not permitted. Remove corrosion. Refer to appropriate defect this table.
Cracks (All Components)	Not permitted. (Visual check).	Not Applicable	Not Applicable	Not Applicable	Not permitted. (Visual check).
Deformation Separator Silver-plate or Bronze	Not permitted.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Dents	Permitted. No raised metal permitted. Stone to remove raised metal.	.020 inch (0.51 mm)	.030 inch (0.76 mm)	.040 inch (1.02 mm)	Permitted. No raised metal permitted. Stone to remove raised metal. 0.125 inch (3.17 mm) defect permitted.

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1.02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Discoloration (Chemical)	Permitted.	Not Applicable	Not Applicable	Not Applicable	Permitted.
Discoloration (Heat)	Straw or brown color permitted. Red-purple, purple, blue are permitted if RC 58 minimum is met when checked three (3) places each on inner & outer race faces. Stone to remove raised metal from hardness test.	Not Applicable	Not Applicable	Not Applicable	Straw or brown color permitted. Red-purple, purple, blue are permitted if RC 58 minimum is met when checked three (3) places each on inner & outer race faces. Stone to remove raised metal from hardness test.
Discoloration (Separator) Silver-plate and Bronze	Permitted. Must meet all other criteria.	Not Applicable	Not Applicable	Not Applicable	Permitted.
Flaking Separator Silver-plate	Not permitted.	Not Applicable	Not Applicable	Not Applicable	Not permitted.
Fractures	Not permitted. (Visual check).	Not Applicable	Not Applicable	Not Applicable	Not permitted. (Visual check).

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1.02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Fretting/Fretting Corrosion	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Permitted if less than 30% of surface is affected.
Frosting Rolling Elements/Races	Permitted if not detectable with applicable stylus.	Not Applicable	Not Applicable	Not Applicable	Not Applicable.
Galling	Not permitted. No transfer of metal is permitted.	Not Applicable	Not Applicable	Not Applicable	Permitted. No raised metal permitted. Stone to remove raised metal.
Installation Marks OD, ID & Faces	Permitted. Refer to appropriate defect this table.	Not Applicable	Not Applicable	Not Applicable	Permitted. No raised metal permitted. Use stone to remove raised metal. Defect size of 0.125 inch (3.175 mm) depth maximum permitted.

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1.02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Nicks	Permitted. No raised metal permitted. Use stone to remove raised metal.	.020 inch (0.51 mm)	.030 inch (0.76 mm)	.040 inch (1.02 mm)	Permitted. No raised metal permitted. Use stone to remove raised metal. Defect size of 0.125 inch (3.175 mm) depth maximum permitted.
Pits Races & Rolling Elements	Permitted. No more than 3 defects within a .250 inch (6.35 mm) diameter circle.	.010 inch (0.25 mm)	0.14 inch (3.56 mm)	.018 inch (0.48 mm)	Permitted if no more than 5 defects of 0.060 inch (1.52 mm) size on one surface. Not permitted in radii or chamfers.
Pits Separators Silver-plate or Bronze	Permitted. .020 inch (0.51 mm) maximum size.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Rust	Not permitted. Remove rust. Refer to appropriate defect this table.	Not Applicable	Not Applicable	Not Applicable	Remove rust. Refer to appropriate defect this table.

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1.02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Scoring	Permitted. Single defect in 0.500 (12.7 mm) Dia. circle. No raised metal permitted, stone to remove.	Max. length equal to rolling element Dia.	Max. length equal to rolling element Dia.	Max. length equal to rolling element Dia.	Not Applicable
	Multiple defects in 0.500 (12.7 mm) Dia circle. No raised metal permitted, stone to remove.	Three maximum, individual defect length half or less of rolling element Dia.	Three maximum, individual defect length half or less of rolling element Dia.	Three maximum, individual defect length half or less of rolling element Dia.	Not Applicable
	Circumferential defects. No raised metal permitted, stone to remove.	Three defects maximum, length of rolling elements circumference or less.	Three defects maximum, length of rolling elements circumference or less.	Three defects maximum, length of rolling elements circumference or less.	Not Applicable
	Crossed scoring	Not permitted	Not permitted	Not permitted	Not Applicable

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1. 02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Scratches and Scuffs Balls/Rollers Inner/Outer Races	Permitted.				Not Applicable
	Single defect in 0.500 (12.7 mm) Dia. circle. No raised metal permitted, stone to remove.	Max. length equal to rolling element Dia.	Max. length equal to rolling element Dia.	Max. length equal to rolling element Dia.	Not Applicable
	Multiple defects in 0.500 (12.7 mm) Dia. circle. No raised metal permitted, stone to remove.	Three maximum individual defect length half or less of rolling element Dia.	Three maximum individual defect length half or less of rolling element Dia.	Three maximum individual defect length half or less of rolling element Dia.	Not Applicable

Table 302. Separable Bearing Inspection/Requirements (Cont)

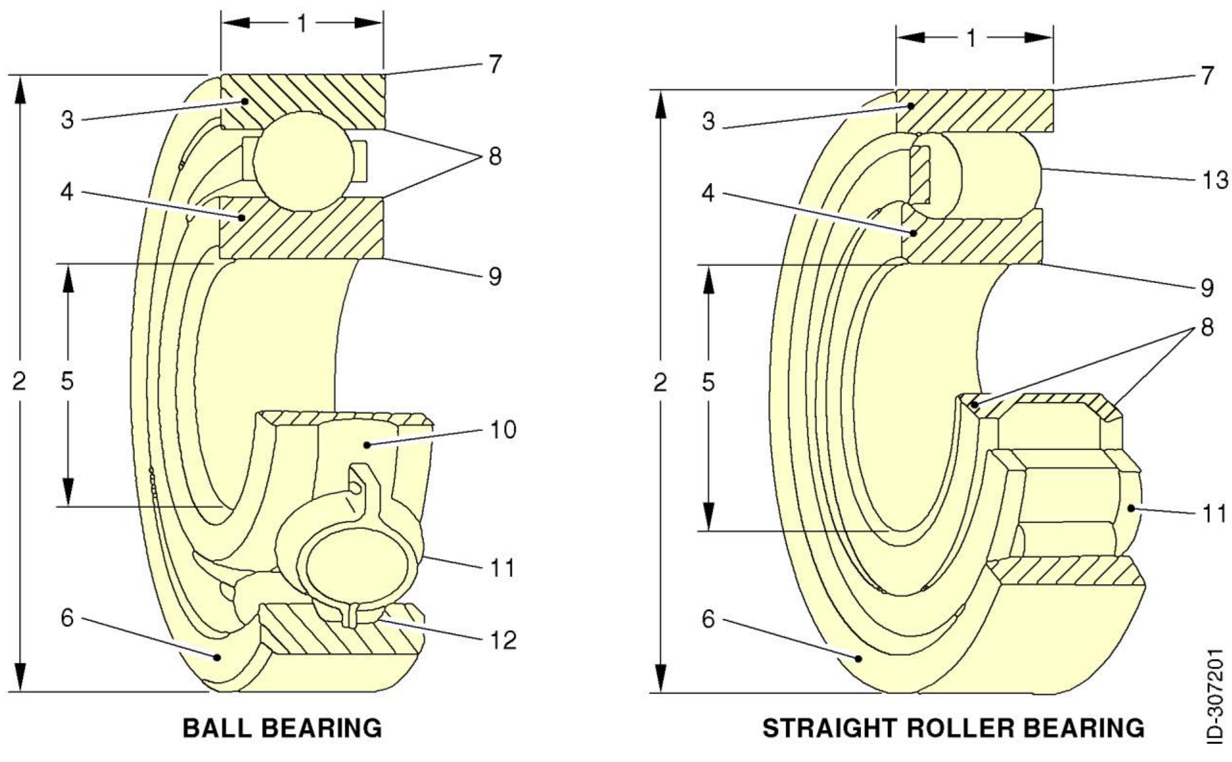
ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1. 02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Scratches and Scuffs Balls/Rollers Inner/Outer Races (Cont)	Circumferential defects. No raised metal permitted, stone to remove.	Three defects maximum, length of rolling elements circumference or less.	Three defects maximum, length of rolling elements circumference or less.	Three defects maximum, length of rolling elements circumference or less.	Not Applicable
	Crossed scratches and scruffs.	Not permitted	Not permitted	Not permitted	Not Applicable
Skidding	Permitted. No raised metal permitted. Use stone to remove raised metal.	.020 inch (0.51 mm)	.030 inch (0.76 mm)	.040 inch (1.02 mm)	Not Applicable

Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1. 02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Spalling	Not permitted.	Not Applicable			Not Applicable
Stains	Permitted surface discoloration only, if felt with applicable stylus bearing must be cleaned again.	Not Applicable			Not Applicable
Surface Slag Inclusions	No slag inclusions permitted on functional surfaces.	Not Applicable			Not Applicable
Varnishing	Permitted surface discoloration only, if felt with applicable stylus bearing must be cleaned again.	Not Applicable	Not Applicable	Not Applicable	Permitted surface discoloration only, if felt with applicable stylus bearing must be cleaned again.

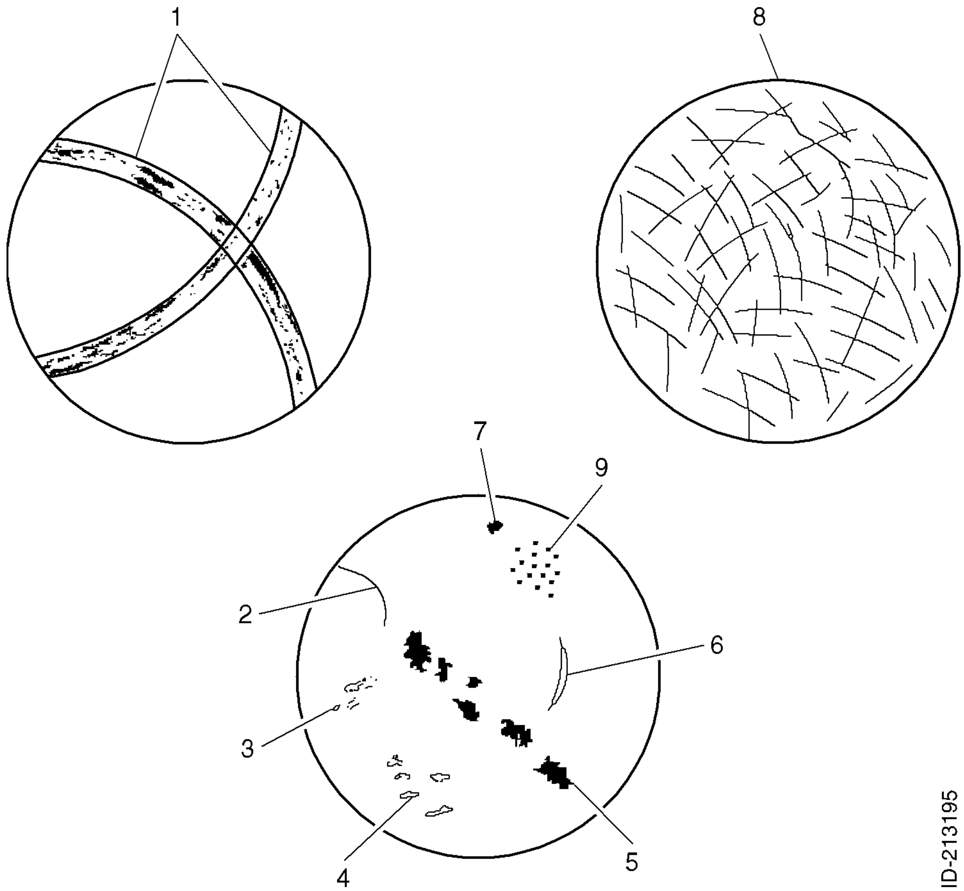
Table 302. Separable Bearing Inspection/Requirements (Cont)

ROLLING ELEMENT DIAMETER SIZE TO DETERMINE DEFECT SIZE PERMITTED		.50 inch (12.7 mm) or less	Over .50 inch (12.7 mm) to 1.00 inch (25.4 mm)	Over 1.00 (25.4 mm)	
STYLUS TIP RADIUS USED TO DETECT DEFECT		.040 inch Rad (1. 02 mm)	.080 inch Rad (2.03 mm)	.120 inch Rad (3.05 mm)	
CONDITION/DEFECT	FUNCTIONAL SURFACE REQUIREMENTS	FUNCTIONAL SURFACE DEFECT SIZE			NON-FUNCTIONAL SURFACE
Wear (Roller Bearing)	Wear is permitted only on each end from center out, 50% of roller end area.	Step not permitted between rolling element path and raceway. Corner Radius wear not permitted.	Step not permitted between rolling element path and raceway. Corner Radius wear not permitted.	Step not permitted between rolling element path and raceway. Corner Radius wear not permitted.	Permitted if within tolerance (average) of ID, OD or face.
Wear, Pocket Silver-plate (Separator)	Permitted wear at contact between rolling element and cage cannot be more than .080 inch (2.032 mm) maximum in size, any shape.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Wear, Pocket Bronze (Separator)	Permitted wear at contact between rolling element and cage cannot be more than .080 inch (2.032 mm) maximum in size, any shape.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Wear, Separator OD/ID Guide Silver-plate	Permitted. No wear through to parent material.	Not Applicable	Not Applicable	Not Applicable	Not Applicable



1. WIDTH
2. OUTSIDE DIAMETER
3. OUTER RING
4. INNER RING
5. BORE
6. FACE
7. O.D. CORNER RADIUS
8. SHOULDERS, FLANGES, RAILS
9. BORE CORNER RADIUS
10. INNER RING BALL RACE
11. RETAINER
12. OUTER RING BALL RACE
13. ROLLER

Ball and Roller Bearing Nomenclature
Figure 301



1. CIRCUMFERENTIAL BANDS
2. CRACKED
3. HARD PARTICLE INDENTS
4. RUST
5. FATIGUE SPALLING
6. DENTED
7. INCLUSION
8. MATTED SURFACE
9. PITTING

(Refer to the following NOTE for Figure 302.)

Ball Defects
Figure 302

NOTE: Typical ball defects not permitted (refer to Table 302):

1 Circumferential bands.

a Continuous heavy thrust loading without ball changing axis of rotation, crushing of the microscopic high spots. Refer to Figure 302.

2 Cracked.

NOTE: Cracks are due to forming laps that were missed in manufacturing operation.

a Dark line. A scratch is easily mistaken for a crack.

3 Hard particle indents.

NOTE: Often called spalling.

a Surface indications that were caused by hard contaminants.

4 Rust.

a Brown stains and hemispherical pits.

5 Fatigue spalling.

a Irregular sharp edged holes. Metal has broken out.

6 Dented.

a Crescent shaped depression. Mustow and rounded. Assembly/disassembly damage. Cut by inner or outer raceway edge. Refer to Figure 303.

7 Inclusion.

a Void with flush edges, slag or forging flaw.

8 Matted surface.

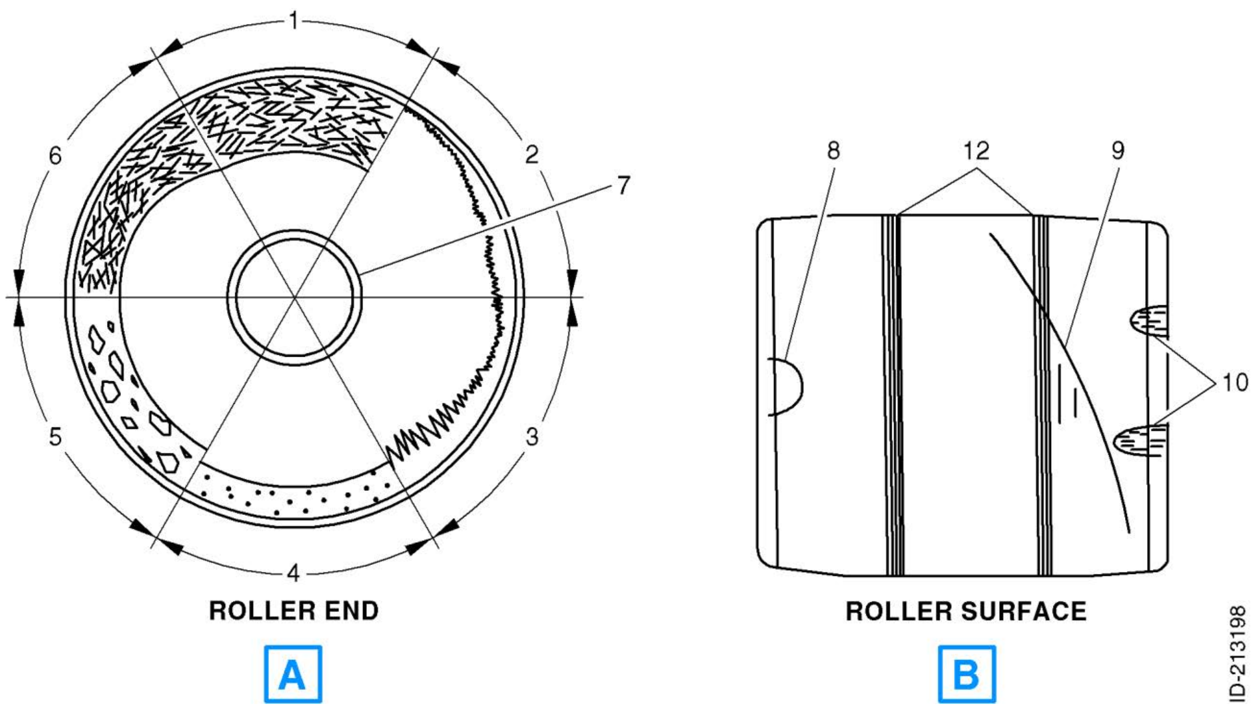
a A multitude of criss crossing scratches. Caused by abrasive contaminants lodged in separator ball pockets.

9 Pitted.

a Refer to Figure 304.

Ball Dent
Figure 303

Ball Pitting
Figure 304



1.	WIDE OR HEAVY WEAR	7.	ROLLER END RINGS
2.	ECCENTRIC BUFF	8.	CRACKED
3.	WIDE BUFF	9.	SPIRAL GROOVE
4.	FATIGUE PITTING	10.	SMEARED AND RAISED METAL
5.	SPALLING	11.	INDENT LINES
6.	ECCENTRIC WEAR	12.	RINGS, SCRATCHES

(Refer to the following NOTE for Figure 305.)

Typical Roller Defect
Figure 305

NOTE: Typical roller defects not permitted (refer to Figure 305 and Table 302):

1 Wide or heavy wear.

a Misaligned – inner to outer rings.

b Guide flange deformed by clamping.

2 Eccentric buff.

a Roller end radius is not concentric or roller is slightly off square.

3 Wide buff.

a Typical wear condition on high time rollers that have had a normal operating life.

4 Fatigue pitting/frosting.

a This condition is in the after buff stage. Common to high time rollers.

5 Spalling.

a Heavy distress on roller end usually a wide band.

6 Eccentric wear.

a Same as Step 1, except that the roller is off square as well.

7 Roller end rings.

a Hard particles lodged in roller separator pocket.

8 Cracked.

NOTE: Cracks on rollers are always a manufacturer's defect.

a Forging lap that became evident in service.

9 Spiral groove (causes).

a Roller dislodged during assembly.

b Outer race was forced on by screwing its lead in corner over the roller. Thus, leaving a groove.

10 Smeared and raised metal.

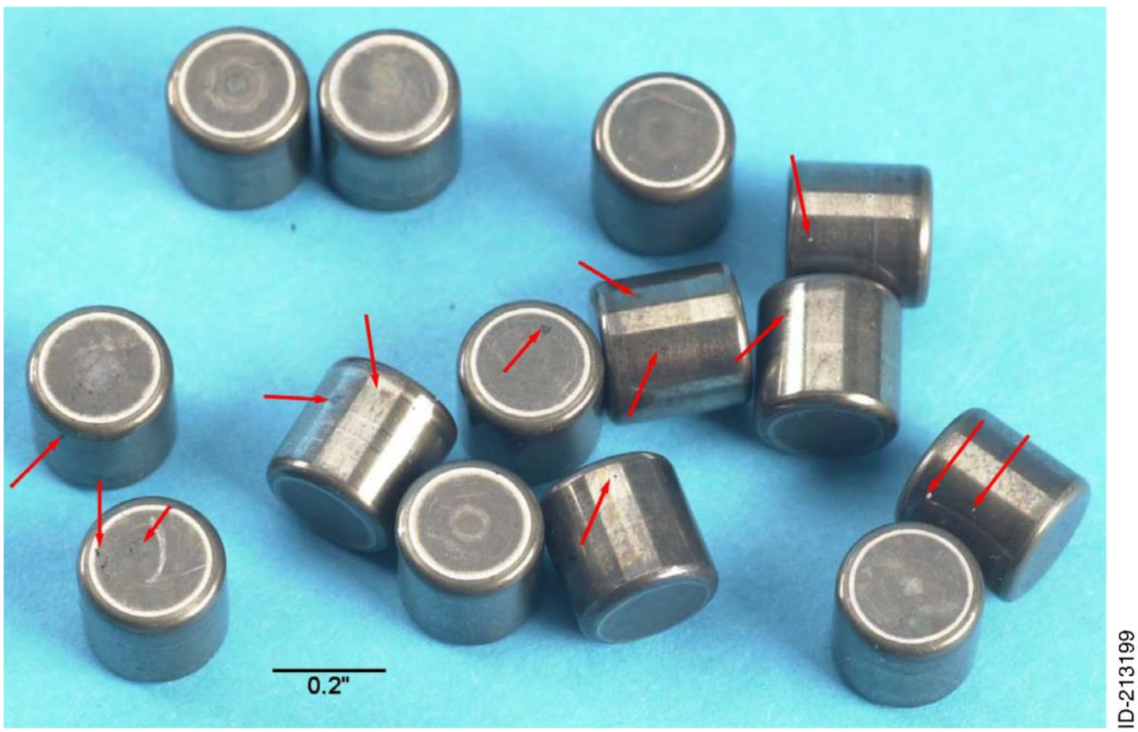
a Forceful assembly.

11 Indent lines.

a Hung rollers similar to spiral groove.

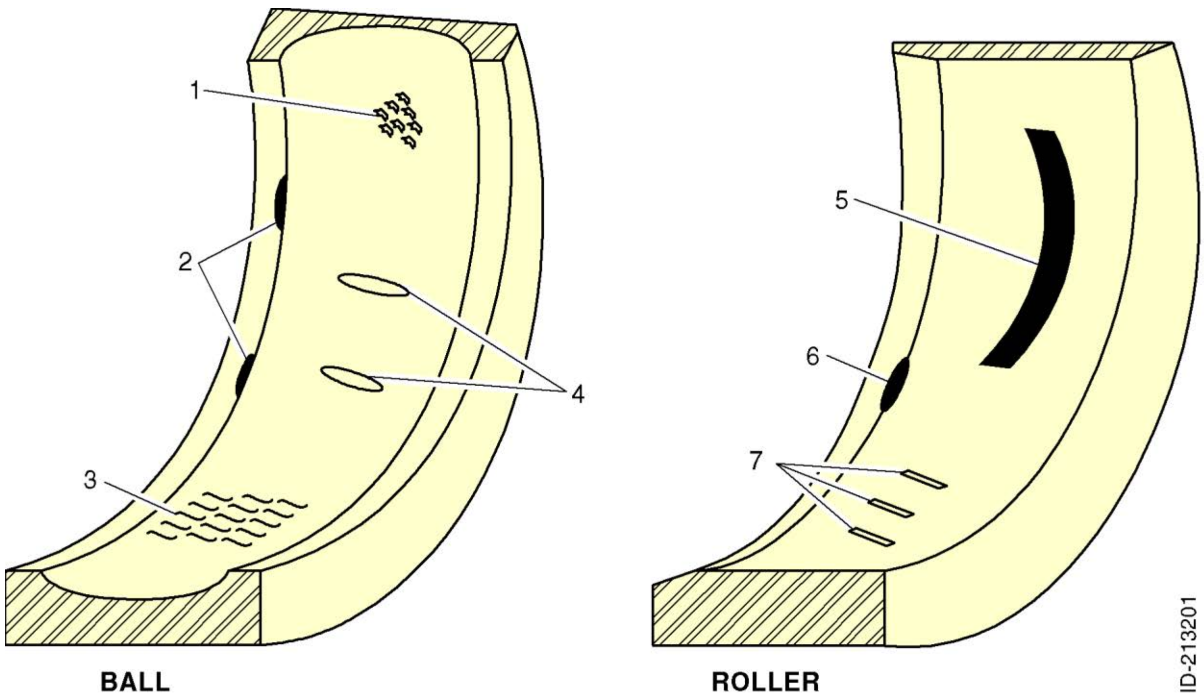
12 Rings, scratches.

a Same as Step 7.



Roller Corrosion
Figure 306

Roller Spalling
Figure 307



1. STARBURST
2. BALL CORNER FLAT
3. ACTIVE SURFACE CRACKS
4. BRINELLS MOUNTING
5. ROLLER SKIDDING
6. ROLLER CORNER FLAT
7. FALSE BRINELLING

(Refer to the following NOTE for Figure 308.)

Outer Raceway Defects
Figure 308

NOTE: Outer raceways defects not permitted (refer also to Figure 308 and Table 302).

1 Starburst.

a Hard brittle particle damage deformed surface appearance.

2 Ball corner flat.

a Ball with crescent shaped indent.

3 Active surface cracks.

a Spalling will follow typical on tube stolic outer race.

4 Brinells mounting.

a Static loading the balls into the raceway.

5 Roller skidding.

a The surface lay will be smeared.

6 Roller corner flat.

a Damage on roller is present.

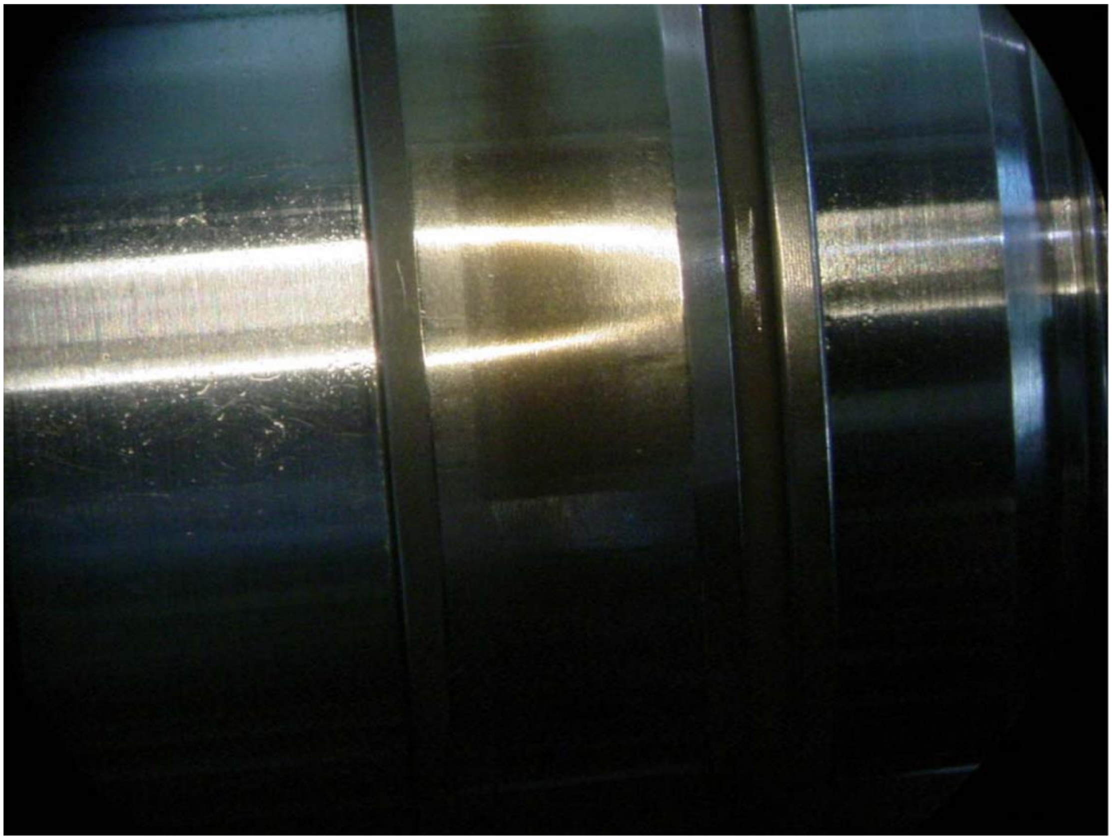
7 False brinelling.

a Brown iron oxide residue and equidistant fret lines.

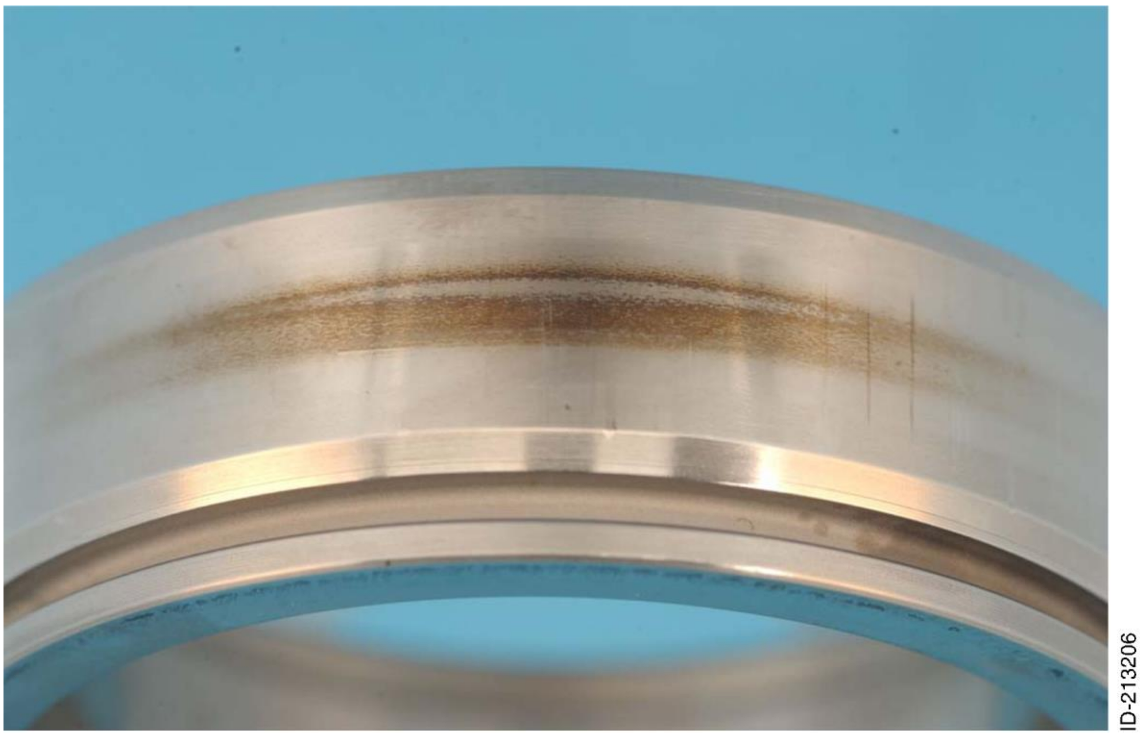
Ball Raceway True Brinell
Figure 309

Ball Raceway Discoloration
Figure 310

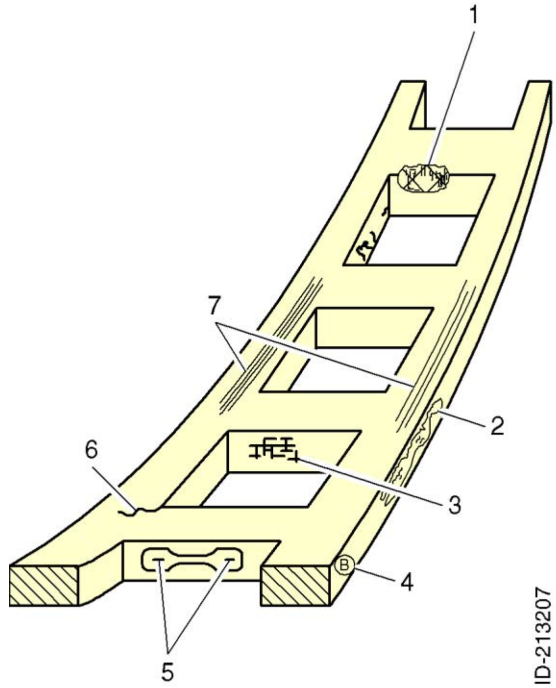
Roller Raceway Spalling
Figure 311



Roller Raceway Discolor
Figure 312



Roller Raceway Skidding
Figure 313



1. SILVER FLOW, HEAVY
2. FLAKING
3. HARD PARTICLES
4. CIRCLE “B” INDICATES BALANCE
5. EXPOSED BASE METAL
6. CRACKED
7. HEAVY WEAR

(Refer to the following NOTE for Figure 314.)

Separator Defects
Figure 314

NOTE: Separator defects not permitted (refer to Figure 314 and Table 302).

1 Silver flow, heavy.

a Typical on high time and excessive silver plate.

2 Flaking.

a Poor plating adhesion.

3 Hard particles.

a Lodged in separator pocket.

4 Circle “B” indicates balance.

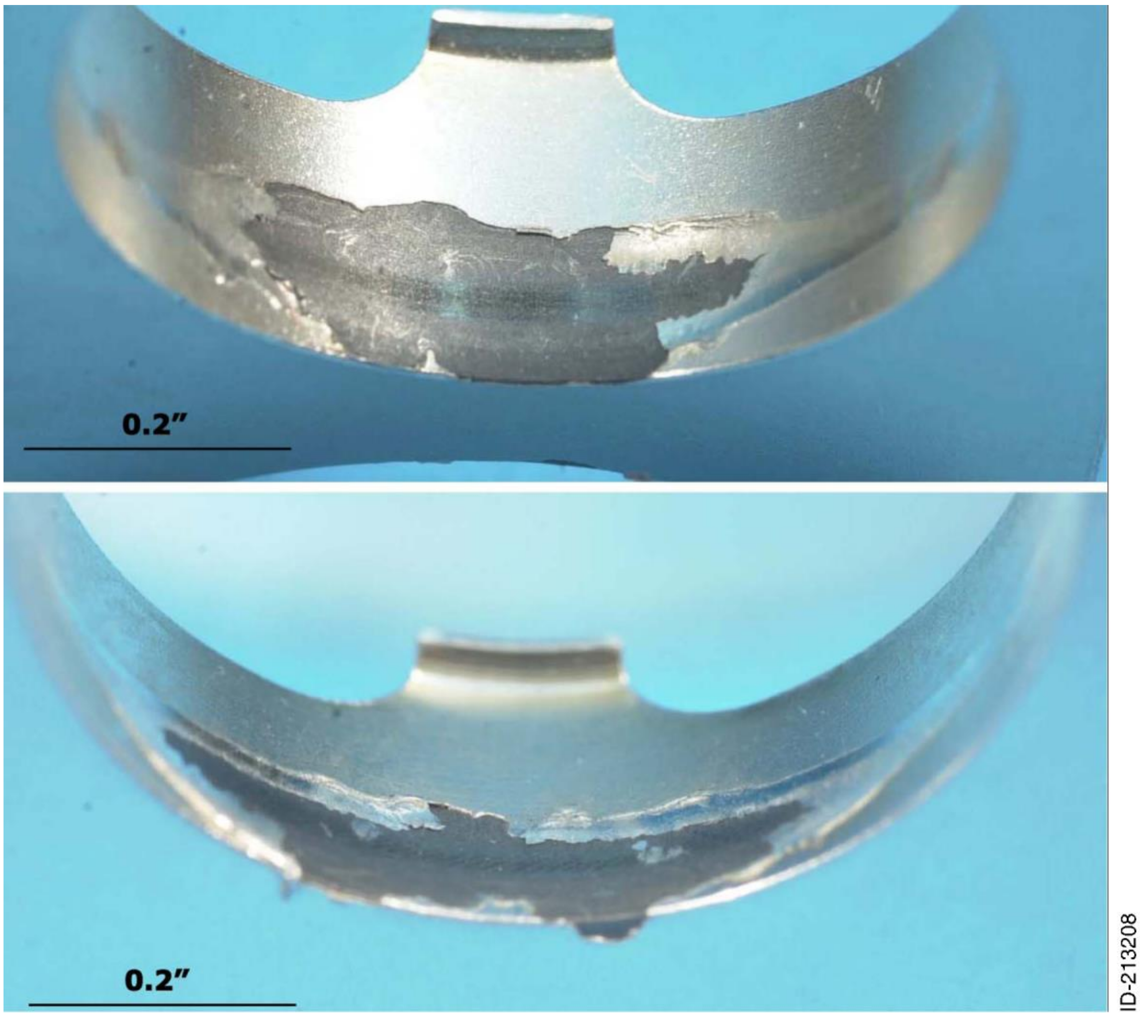
5 Exposed base metal.

6 Cracked.

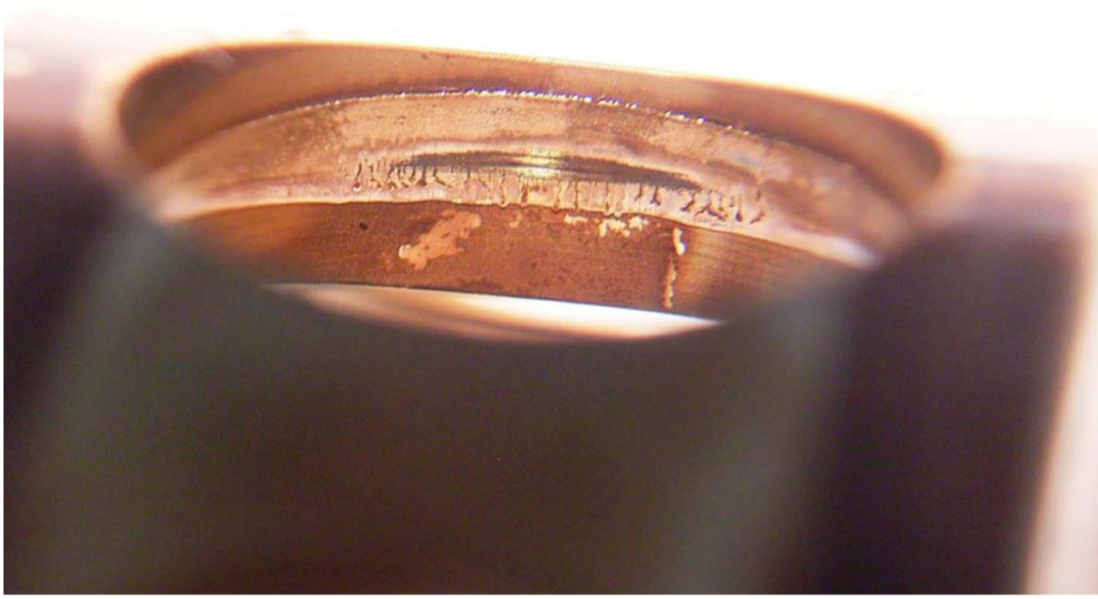
a Extreme opposed loads. On ball type separator the cracking is due to misalignments.

7 Heavy wear.

a Cage is out of balance.



Ball Separator Pocket Plate Adhesion
Figure 315



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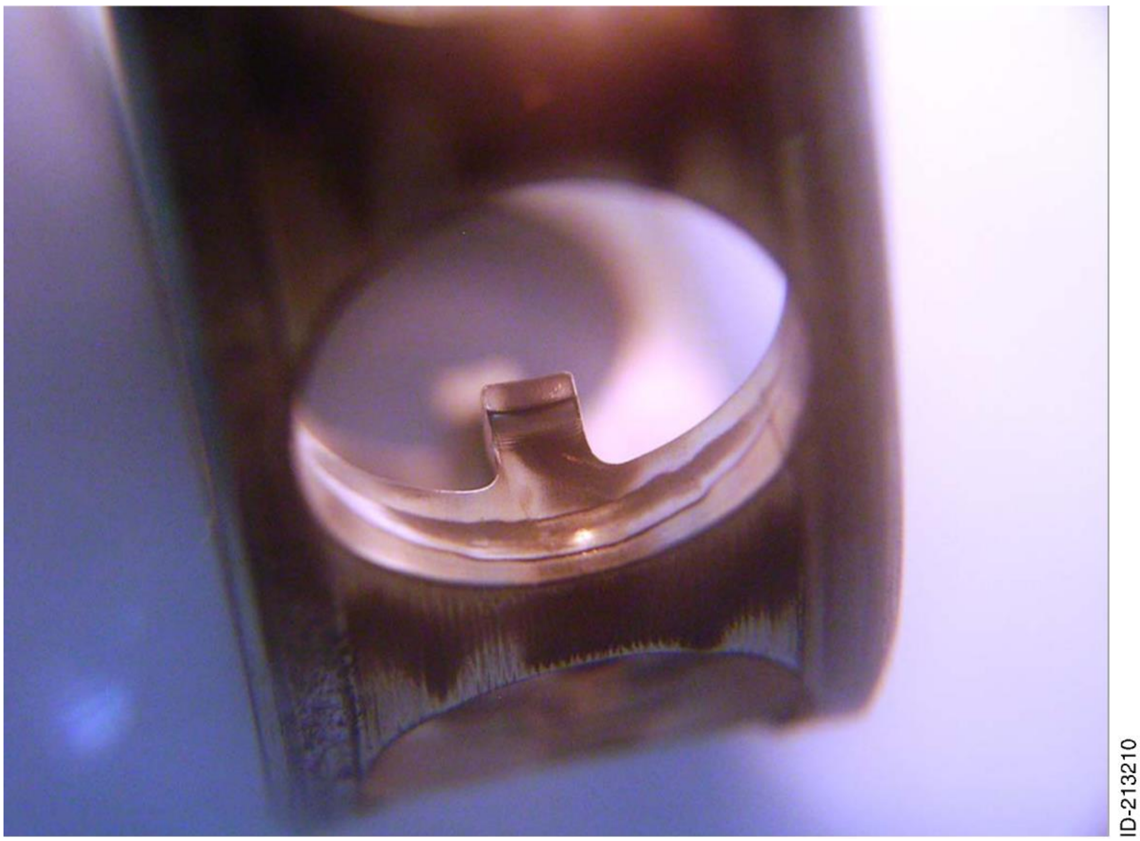
Ball Separator Wear
Figure 316



Ball Separator Wear
Figure 317

(2) Non-Separable Bearings:

Table 303. Non-Separable Bearing Defect Definitions

Terms	Definition (Description of Defect)
Arcing	Round pit shaped cavity in a surface from which metal has been removed by electrical arc causing a temper change (softer) in the metal around the pit shaped cavity. It may be caused by a lightning strike or similar electrical occurrence. This typically appears as excessive noise on the analyzer.
Bent	Deformed from original shape or form. An example would be cages that are deformed from improper installation or bearing wear. This typically appears as excessive noise on the analyzer.
Brinelling (True)	True brinelling is plastic flow of metal, characterized by smooth shiny bottomed indentations in raceways or rolling elements usually equally spaced corresponding to rolling element spacing. Caused by impact, improper installation or dropping of the bearing or unit it is installed in. This typically appears as excessive noise on the analyzer. (Refer to Figure 309).
Brinelling (False)	False brinelling is characterized by surface marks or blemishes on raceways or rolling elements usually corresponding to rolling element spacing. The marks or blemishes will normally have a polished or satin finish. It is usually caused by vibration in a non rotating bearing. False brinelling will not typically appear as excessive noise on the analyzer.
Burnishing	Burnishing is a mechanical smoothing of a surface, sometimes resulting in discoloration around the contact area. This is a superficial characteristic that does not have wear.
Burrs/Raised Metal	Burrs/Raised metal is positive displaced metal from original machining or from surface material being displaced because of scratches, scoring, dents etc. This typically appears as excessive noise on the analyzer.
Corrosion	Corrosion is a chemical reaction to the surface of the bearing as a result of moisture or other chemical exposure. It is characterized by a broken pitted or discolored appearance. The surface might also have an “orange peel” appearance. (Refer to Figure 306).
Cracks	Cracks are separations, fissures, or ruptures characterized by sharp edges and/or sharp changes in direction. The sharp edges can be either jagged or straight but will not have a defined depth or bottom visually.
Dents	Dents are slight depressions or hollows on the surface made by mechanical deformation of the surface by a blow or pressure caused by an object contacting the surface. They are usually bright bottomed and can be irregular in shape. Raised metal usually accompanies dents. This typically appears as excessive noise on the analyzer. (Refer to Figure 303).

Table 303. Non-Separable Bearing Defect Definitions (Cont)

Terms	Definition (Description of Defect)
Discoloration (Chemical)	Discoloration is a chemical reaction between two elements. Typically this is seen on cages that have been exposed to hot oil in operation. Sulfides in the oil turn the silver plate on the cages a purple to black color.
Discoloration (Heat)	Heat discoloration of bearing surfaces are due to buildup of heat during engine operation or soak back after engine shutdown. The colors can range from straw, brown, purple, red purple and blue. This typically appears as excessive noise on the analyzer. (Refer to Figures 310 and 312).
Flaking, Peeling and Blistering of Plating	Flaking, peeling and blistering of plating is delaminating of the plating from the parent material. This is caused by improper plating processes such as improper cleaning of the parent metal or plating parameters. This typically appears as excessive noise on the analyzer. (Refer to Figure 315).
Fractures	Refer to Cracks.
Fretting/Fretting Corrosion	Fretting/Fretting Corrosion is rapid oxidation of surfaces in close fitting parts. It is characterized by rusty appearing surfaces ranging from black (well bonded) to fairly bright reddish brown (loosely bonded or free particles). It does not occur in the rolling element area.
Frosting Rolling Elements/Races	Frosting is the early stages of wear or superficial pitting or scoring. It appears as a whitish or polished band which is made up of many minute indentations. This typically appears as excessive noise on the analyzer.
Functional Surface	Defined as the following: • Total raceway width of straight-through (non-flanged) races of roller bearings. • Load paths on flanged raceways of roller bearings. • Roller OD load path. • Roller corner radius to end face intersection. • Roller bearing raceway guide flange inner surface. • Separator pilot land surface. • Balls and ball bearing outer raceway. • Ball bearing loaded raceway half for split inner rings.
Galling	Galling is a severe condition where there is significant transfer of metal between surfaces due to welding and break-away of particles. It is caused by excessive sliding between two poorly lubricated surfaces which are forced into contact under high pressure. This typically appears as excessive noise on the analyzer.
Installation Marks	Installation Marks are scratches, scuffs, galling or dents caused by mating part interface or tool interface during installation or removal. They are usually contained to ID, OD and face.

Table 303. Non-Separable Bearing Defect Definitions (Cont)

Terms	Definition (Description of Defect)
Nicks	Refer to Dents.
Non-Functional Surface	Defined as any surface that is not functional (Refer to definition of “functional”).
Pits	Pits are small, irregular shaped cavities in a surface from which material has been removed by corrosive action such as chemical or electrolytic attack.
Raised Metal	Refer to Burrs.
Rust	Rust is the released particles due to corrosion leaving a reddish or reddish brown deposit on the surface. Refer to corrosion for details.
Scoring	Scoring is a deep single or multiple scratches caused by sliding at the rolling contact surface as the result of foreign particle presence on the ball, roller or raceway.
Scratches and Scuffs	Scratches are narrow, mustow liner abrasions caused by the movement of sharp objects across a surface. Scuffs are multiple scratches aligned in the same direction as a unit.
Silver-plate Flaking	Flaking is separation of silver-plating from the parent material. It is characterized by irregular shaped/sized pieces of silver coming loose. This is generally caused by contaminates during the plating process causing poor adhesion between the silver and parent material. (Refer to Figure 315).
Silver-plate Pocket Wear	Pocket wear is the contact of the ball or roller with the working area of the separator causing an indentation or wear of the silver plating. The purpose of silver plating is to provide lubricant between rolling element and separator if oil lubrication is marginal.
Silver-plate Discoloration	Discoloration of the silver plate to a dark color occurs generally from a chemical reaction to cleaning agents or some lubrication oils.
Skidding	Skidding is excessive slipping between balls/rollers and raceways. Skidding is evidenced on non-separable bearings typically appears as looseness and excessive noise on the analyzer. (Refer to Figure 313).
Spalling	Spalling is caused by fatigue. Spalling on non-separable bearings typically appears as roughness and excessive noise on the analyzer. (Refer to Figure 311).
Stains	Stains are harmless surface discolorations which range from black to dark reddish brown in color. Surfaces which have stains will have an intact non-pitted and unbroken appearance. No change in dimensions will occur.

Table 303. Non-Separable Bearing Defect Definitions (Cont)

Terms	Definition (Description of Defect)
Surface Slag Inclusions	Surfaces Slag Inclusions are foreign materials, embedded in the metal or a cold fold during the pouring of the metal. These are from manufacture of the bearing material and can appear after bearing use. Generally irregular in shape with sharp features and may appear as dark spots or lines.
Varnishing	Varnishing is a harmless surface discoloration from the breakdown lubricant because of temperature, which results in a light brown to black appearance. No change in dimensions will occur.
Wear	Physical diminishing of the surface finish and/or original machined surfaced. It does not constitute wear until detectable on the analyzer as excessive noise.

(a) Make sure adequate inspection facility:

1 Enclosed room with positive pressure.

2 Temperature controlled 65 to 75°F (18 to 24°C).

3 Relative humidity under 45 percent.

4 Lighting of 100 to 150 foot candles (1076 to 1615 lux).

(b) Visual check of installed or partially exposed bearings (installed in housings or on shafts/gears/etc) is permitted. Sealed bearings are checked without closures (shield, seals) or enclosed lubricant (removed during cleaning).

CAUTION: WHEN HANDLING BEARINGS WHICH ARE CLEANED AND NOT OILED, WEAR EITHER SYNTHETIC RUBBER GLOVES OR NYLON MESH GLOVES WITH POLYETHYLENE PALMS AND FINGERS. IF NOT AVAILABLE, COTTON GLOVES MUST BE WORN. DO NOT TOUCH BEARINGS WITH BARE HANDS.

(c) Prior to cleaning demagnetize bearing so residual magnetism does not exceed five gauss.

(d) Prior to inspection, clean bearings per Method No. 203P.

(e) Place bearings in a covered container or plastic bag to minimize contamination.

(f) Prior to test, lubricate bearing to be checked using filtered oil (MIL-L-6085) (SECTION VII).

(g) Visually check bearing. Refer to Table 303.

(h) Perform bearing analyzer check on non-separable bearing as follows:

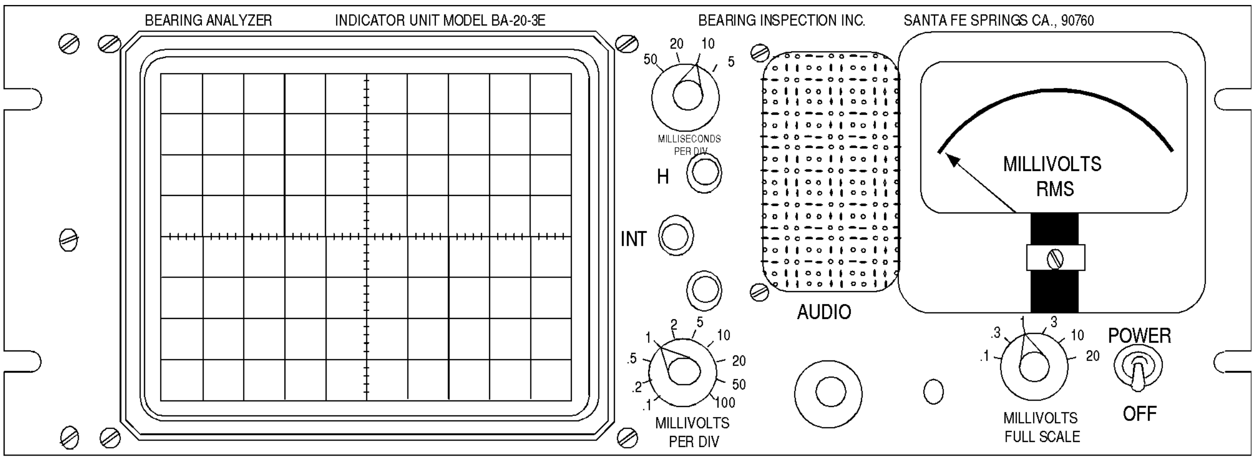
NOTE: The following procedures apply only when using Bearing Analyzer (Electronic Bearing Analyzer). (Refer to Figure 318).

Master Bearing is obtained from Bearing Inspection Inc., (SECTION VII). Master Bearing is used to calibrate the analyzer in accordance with manufacturer instructions.

(i) Bearing must conform to limits in Figure 318 and Table 304.

(j) Dip bearing in oil (MIL-L-6085) (SECTION VII) heated to 120 to 140°F (49 to 60°C) for 5 minutes and allow to drain. Do not oil bearings used in pneumatic valves. For sealed bearings, replace enclosed lubricant and reinstall closures (shields, seals) per applicable manual.

(k) Package bearing along with part number identification in heat sealable transparent plastic bag (MIL-B-22191D) (SECTION VI). Evacuate air from bag and heat seal shut.



NOTES: (1) BEARING ANALYZER EQUIPMENT CONSISTS OF THE FOLLOWING OR EQUIVALENT:
- -BEARING ANALYZER DRIVE UNIT MODEL BA-20-3D
- -BEARING ANALYZER INDICATOR UNIT MODEL BA-20-3E
- -BEARING ANALYZER WHEEL CONTROL MODEL BA-20-3DC
- -INTERFACE UNIT MODEL BA-96-2

(2) GENERAL PROCEDURES (REFER TO ANALYZER MANUFACTURER INSTRUCTIONS FOR DETAILS):
- -SELECTOR SWITCH SETTINGS FOR ANALYZER OPERATION
- -SET MILLIVOLTS FULL SCALE SELECTOR TO 1
- -SET MILLIVOLTS PER DIVISION SELECTOR TO 1
- -SET MILLISECONDS PER DIVISION SELECTOR TO 10

(3) ALL NON-SEPARABLE BEARINGS ARE TO BE INSPECTED WITH WEIGHTS INSTALLED ON THE BEARING. WEIGHTS PER GSE PN 3737475-1 THRU -21 (OR EQUIVALENT) DETERMINED BY BEARING OD SIZE. REFER TO FIGURE 318A AND TABLE 305.

(4) NON-SEPARABLE BEARING NOISE INSPECTION ACCEPTANCE CRITERIA FOR NON-SEPARABLE BEARING:

Bearing OD	RMS Limit	Peak to Peak Limit	Drive Wheel RPM
3.00 inch (76.2 mm) or under	0.4 millivolt	4.0 millivolt	300 RPM
Over 3.00 inch (76.2 mm)	0.5 millivolt	5.0 millivolt	300 RPM

(5) REFER TO FIGURE 304 FOR OTHER NON-SEPARABLE BEARING CHECK REQUIREMENTS.

Bearing Analyzer
Figure 318

Table 304. Non-Separable Bearing Check Requirements

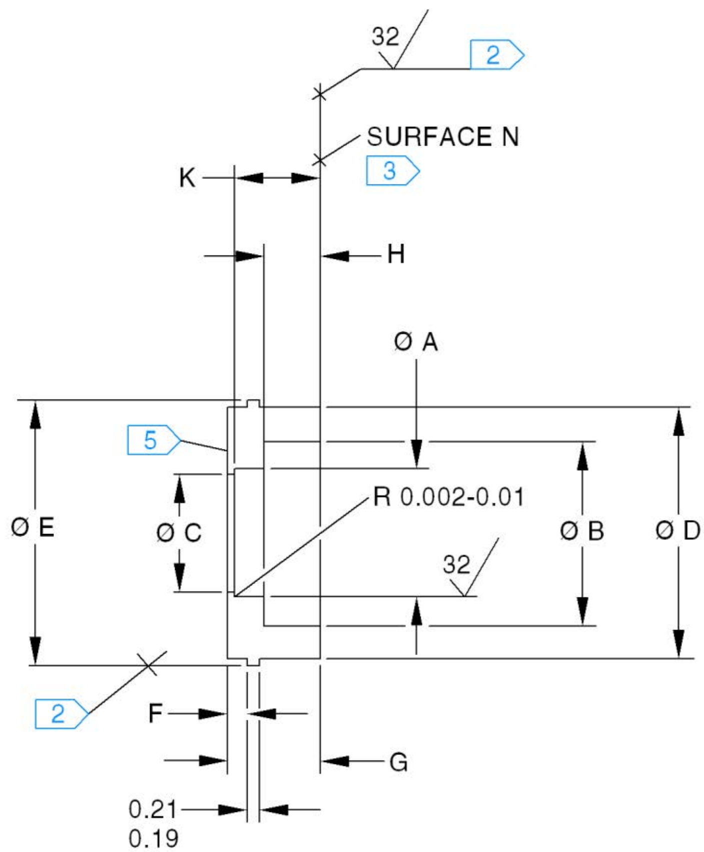
Condition/Defect	Functional Surface Requirements	Non-Functional Surface Requirements
Arcing	Not permitted.	Not permitted.
Bent	Not permitted.	Not applicable.
Brinelling (true)	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	Not applicable.
Brinelling (false)	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	Not applicable.
Burnishing	Permitted. If not visible will be checked during Bearing Analyzer check.	Not applicable.
Burrs	Not permitted. If not visible will be checked during Bearing Analyzer check.	No raised metal permitted. Use stone to remove raised metal. Defect size of 0.125 inch (3.18 mm) max. permitted.
Corrosion	Not permitted. If not visible will be checked during Bearing Analyzer check.	Remove corrosion. Resulting defect size of 0.125 inch (3.18 mm) max. permitted.
Cracks (All components)	Not permitted. If not visible will be checked during Bearing Analyzer check.	None permitted (visual check).
Deformation Separator Silver-plate or Bronze	Not permitted.	Not applicable.
Dents	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	No raised metal permitted. Use stone to remove. 0.125 inch (3.18 mm) max. defect size permitted.
Discoloration (Heat)	Straw or brown color permitted. Red-purple, purple, blue permitted if RC 58 minimum is met when checked 3 places each on inner and outer races.	Straw or brown color permitted. Red-purple, purple, blue permitted if RC 58 minimum is met when checked 3 places each on inner and outer races.
Discoloration (Chemical)	Permitted.	Not applicable.
Discoloration (Separator) Silver-plate or Bronze	Permitted. Must meet all other criteria.	Permitted.

Table 304. Non-Separable Bearing Check Requirements (Cont)

Condition/Defect	Functional Surface Requirements	Non-Functional Surface Requirements.
Flaking, Peeling and Blistering of Plating	Not permitted.	Not applicable.
Fractures	Not permitted. If not visible will be checked during Bearing Analyzer check.	Not permitted (visual check).
Fretting/Fretting Corrosion	Not applicable.	Permitted if 30% or less of surface is affected.
Galling	Not permitted. If not visible will be checked during Bearing Analyzer check.	No raised metal permitted. Use stone to remove. No transfer of metal is permitted.
Installation Marks OD, ID and Faces	Not applicable.	No raised metal permitted. Use stone to remove. 0.125 inch (3.18 mm) defect depth max.
Nicks	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	No raised metal permitted. Use stone to remove. 0.125 inch (3.18 mm) defect size permitted.
Pits Races and Rolling Elements	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	No raised metal permitted. Use stone to remove. 0.125 inch (3.18 mm) max. defect size permitted.
Pits Separators Silver-plate or Bronze	Permitted 0.020 inch (0.51 mm) max. size.	Not applicable.
Rust	Not permitted (visual check).	Remove rust. Resulting defect size of 0.125 inch (3.18 mm) max. permitted.
Scoring	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	No raised metal permitted, use stone to remove. 0.125 inch (3.18 mm) resulting defect size permitted.
Scratches and Scuffs/ Rollers/Balls	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	Not applicable.
Scratches and Scuffs/ Inner/Outer Races	Permitted if passes Bearing Analyzer Check. If not visible will be checked during Bearing Analyzer check.	Not applicable.

Table 304. Non-Separable Bearing Check Requirements (Cont)

Condition/Defect	Functional Surface Requirements	Non-Functional Surface Requirements.
Silver-plate Flaking	Not permitted	Defects in plating from handling, adhesion testing, or balance stock removal is permitted.
Silver-plate Discoloration	Permitted. Silver-plate must meet all other criteria.	Permitted.
Spalling	Not permitted. If not visible will be checked during Bearing Analyzer check.	Not applicable.
Condition Defect	Functional Surface Requirements	Non-Functional Surface Requirements.
Stains	Permitted.	Permitted.
Surface Slag Inclusions	Not permitted. If not visible will be checked during Bearing Analyzer check.	0.125 inch (3.18 mm) max. defect size permitted.
Varnishing	Permitted.	Permitted.
Wear	Checked with Bearing Analyzer.	Permitted face, OD and ID within tolerance average.
Wear Separator Silver-plate or Bronze	Permitted if silver-plate is worn through to parent material at rolling element and cage contact area. It cannot be more than 0.080 inch (2.03 mm) max. in size.	Not applicable.



NOTES:

1. Material: Alloy steel 9310 PER AMS6260.
2. Carburize per ams 2759/7 type 1 60 min HRC 1008-018 case depth optional other surfaces.
3. Adjust to specified L weight by removing material from N surface. Resulting change in G and H dimensions is permissible.
4. Break edges 0.01-0.03.
5. Mark part number per AS478 (1B1, 1C, 1B2).

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*Refer to Table 305 in conjunction with this figure.

Non-Separable Bearing Test Weights
Figure 318A

Table 305. Non-Separable Bearing Test Weight Requirements

PART NO.	BRG O.D.	A DIA	B DIA	C DIA	D DIA	E DIA	F DIM.	G DIM.	H DIM.	K DIM.	L LBS
3727475-1	.750 IN.	.7502-.7507	2.445-2.455	.651-.661	2.660-2.670	2.860-2.870	.297-.307	1.356-1.366	.845-.855	1.059-1.069	.9 – 1.1
3727475-2	32 MM	1.2600-1.2605	2.803-2.813	1.093-1.103	3.295-3.305	3.495-3.505	.292-.302	1.039-1.049	.445-.455	.834-.844	1.5 – 1.7
3727475-3	35 MM	1.3782-1.3787	2.981-2.991	1.195-1.205	3.483-3.493	3.683-3.693	.302-.312	1.089-1.099	.475-.485	.884-.894	1.6 – 1.8
3727475-4	55 MM	2.1657-2.1662	3.095-3.105	1.995-2.005	4.295-4.305	4.485-4.495	.320-.330	1.557-1.567	.945-.955	1.452-1.462	3.7 – 3.9
3727475-5	62 MM	2.4412-2.4417	3.095-3.105	2.235-2.245	4.795-4.805	4.985-4.995	.230-.240	1.195-1.205	.625-.635	1.090-1.100	3.9 – 4.1
3727475-6	68 MM	2.6775-2.6780	2.837-2.847	2.445-2.455	4.795-4.805	4.985-4.995	.379-.389	1.165-1.175	.475-.485	1.060-1.070	3.9 – 4.1.
3727475-7	72 MM	2.8350-2.8355	3.095-3.105	2.595-2.605	4.795-4.805	4.985-4.995	.330-.340	1.425-1.435	.755-.765	1.220-1.230	4.4 – 4.6
3727475-8	75 MM	2.9535-2.9540	2.995-3.005	2.715-2.725	4.245-4.255	4.445-4.455	.307-.317	1.595-1.605	.870-.880	1.490-1.500	2.9 – 3.1
3727475-9	110 MM	4.3320-4.3330	4.340-4.350	4.085-4.095	5.745-5.755	5.985-5.995	1.055-1.065	2.440-2.450	.745-.755	1.810-1.820	8.4 – 8.6
3727475-10	22 MM	.8663-.8668	2.795-2.805	.785-.795	3.295-3.305	3.485-3.495	.160-.170	1.285-1.295	.905-.915	1.185-1.195	1.4 – 1.6
3727475-11	24 MM	.9451-.9456	2.795-2.805	.865-.875	3.295-3.305	3.485-3.495	.175-.185	1.395-1.405	1.055-1.065	1.295-1.305	1.4 – 1.6
3727475-12	26 MM	1.0238-1.0243	2.695-2.705	.915-.925	3.295-3.305	3.485-3.495	.155-.165	1.115-1.125	.695-.705	1.015-1.025	1.4 – 1.6
3727475-13	28 MM	1.1026-1.1031	2.895-2.905	1.015-1.025	3.295-3.305	3.485-3.495	.185-.195	1.555-1.565	1.175-1.185	1.455-1.465	1.4 – 1.6
3727475-14	30 MM	1.1813-1.1815	2.995-3.005	1.095-1.105	3.295-3.305	3.485-3.495	.353-.363	1.283-1.293	.745-.755	1.025-1.035	1.4 – 1.6
3727475-15	40 MM	1.5750-1.5755	2.995-3.005	1.415-1.425	3.795-3.805	3.985-3.995	.235-.245	.935-.945	.355-.365	.835-.845	1.9 – 2.1

Table 305. Non-Separable Bearing Test Weight Requirements (Cont)

PART NO.	BRG O.D.	A DIA	B DIA	C DIA	D DIA	E DIA	F DIM.	G DIM.	H DIM.	K DIM.	L LBS
3727475-16	42 MM	1.6537-1.6542	3.095-3.105	1.535-1.545	3.795-3.805	3.985-3.995	.245-.255	1.705-1.715	1.285-1.295	1.605-1.615	2.4 – 2.6
3727475-17	47 MM	1.8506-1.8511	3.095-3.105	1.735-1.745	3.795-3.805	3.985-3.995	.704-.714	1.614-1.624	.745-.755	1.065-1.075	2.9 – 3.1
3727475-18	52 MM	2.0475-2.0480	3.095-3.105	1.745-1.755	3.620-3.630	3.745-3.755	.745-.755	1.885-1.895	.745-.755	1.235-1.245	2.9 – 3.1
3727475-19	80 MM	3.1500-3.1510	3.170-3.180	2.985-2.995	4.795-4.805	4.985-4.995	.365-.375	1.365-1.375	.745-.755	1.265-1.275	3.9 – 4.1
3727475-20	95 MM	3.7405-3.7415	3.745-3.755	3.575-3.585	4.795-4.805	4.985-4.995	.740-.750	1.940-1.950	.745-.755	1.445-1.455	3.9 – 4.1
3727475-21	100 MM	3.9375-3.9385	3.945-3.955	3.625-3.635	5.745-5.755	5.985-5.995	.748-.758	2.010-2.020	.745-.755	1.570-1.580	7.9 – 8.1

F. Gear and Spline Inspection

(1) Check gear and spline teeth as follows:

(a) Perform visual check using a strong light and a minimum of 5 times magnification. Refer to Figure 319 and Table 306 for typical examples of gear and spline wear.

(b) Visually check part for evidence of excessive spalling, fretting, surface flaking, chipping, splitting, rubbing, chafing, corrosion or other defects per Figure 319 and Table 306. If any of the defects specified are evident, replace part.

(c) Visually check part for evidence of excessive corner loading. If wear pattern indicates corner loading of less than three-fourths of the normal length of tooth bearing contact area, replace part.

(d) Visually check part for evidence of metal displacement. If metal displacement is to the extent that sub-surface damage is probable, replace part.

NOTE: Healed scuffing of tooth involute surfaces is evidenced by a matted gray finish or localized burnished appearance, which usually results from wearing off raised metal. This condition is acceptable provided the scuffed area does not exceed 30 percent of the indicated pattern width, and the involute contour visually appears unaltered and no spalling or fretting exists.

(e) Visually check part for evidence of healed scuffing of tooth involute surface.

NOTE: Magnetic Particle Inspection (MPI) is not required if the applicable IRM/EM provides an alternate inspection method (FPI, eddy current etc.) or specifically indicates MPI is not required.

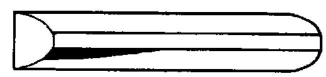
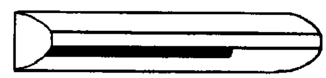
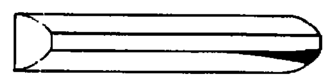
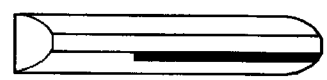
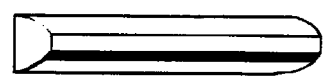
(f) Check parts for cracks by performing magnetic particle inspection (SECTION III). No cracks are permissible.

(g) Visually check part for evidence of overheating discoloration. If overheating discoloration of metal is evident, replace part, unless otherwise noted in applicable manual containing inspection criteria for the part.

(h) Visually check teeth for evidence of abnormal or deep wear patterns. If visual check reveals abnormal or deep wear patterns, dimensionally check part by measuring gear teeth, over or between, pins or balls, placed in wear area, in accordance with applicable manual, containing inspection criteria for the part.

(i) If overheating discoloration is evident, check gear hardness as specified in applicable manual to determine if gear is acceptable for further use.

(j) Refer to applicable manual for wear limits of splines.

TYPE	WEAR PATTERN LOCATION	END VIEW	SIDE VIEW
A	EXTERNAL END ENGAGEMENT		
B	PARTIAL SPLINE ENGAGEMENT		
C	INTERNAL END ENGAGEMENT		
D	PARTIAL ENGAGEMENT WEAR		
E	FULL ENGAGEMENT WEAR		

SB-2480

Typical Spline Wear Patterns and Locations
Figure 319

Table 306. Gear and Spline Teeth Physical Conditions

Term	Definition	Probable Cause
Broken	Missing piece or pieces of a part.	Careless handling.
Chipped	Missing piece or pieces of a part.	Careless handling.
Cracked	A partial failure	Excessive stress due to shock, overloading or faulty processing; extension of a nick or scratch; defective material; overheating.
Frosted	Appearance of micropitting. Normal wear pattern appears frosted; the normal polish of surface has an etch-like finish: under magnification, the surface appears to be a field of very fine micro-pits less than 0.0001 in. (0.00254 mm) deep.	Excessive heat generation in the gear mesh, from marginal lubrication.
Pitted	Surface fatigue characterized by small pits of 0.015 in. (0.38 mm) deep.	Material has gone past its endurance limit.
Scored	Radial gear marks on tooth wear pattern, which are produced by metal-to-metal contact.	Excessive heat generation in the gear mesh that causes lubrication breakdown, which produces metal-to-metal contact.

G. Visual Inspection

(1) General Information

(a) Visual inspection involves viewing the part for general appearance in an effort to locate conditions, which cause or indicate abnormal wear. Whenever these conditions exist, the inspector must refer to dimensional inspection requirements in the applicable manual related to damaged part to decide if rework is feasible.

(b) Where no evidence of damage or wear is present, the inspector must determine if dimensional inspection is required. After a decision has been reached, the part must be tagged accordingly in the manner utilized by the particular overhaul facility. The disposition of the part must then be noted on the inspection records.

(c) Parts, which are normally replaced at each overhaul, must be given cursory inspection, since damage to these parts may sometimes reflect malfunction of other components. This is not only a good assumption to make about parts normally replaced, but must be considered when any part has been damaged. Certain special visual inspections, required for some parts, are reflected in the following steps.

(d) Information in this section supplements model-specific visual inspection requirements in the applicable inspection manual and/or workscope planning guide.

(2) Inspect parts in accordance with the following procedures:

- Threaded parts
  - Check threaded parts for stripped, galled, or crossed threads.
- Threaded inserts
  - Check thread inserts for security and condition of threads.
- Threaded Keensert inserts
  - Check thread insert for security and condition of threads.
- Threaded Keensert studs
  - Check threaded portion for stripped, galled or crossed threads.
  - Check stud for security. Axial movement of stud must not exceed 0.0076 inch (0.193 mm). No rotational movement of stud is allowed.
  - If axial movement of stud exceeds limits specified in Sub-step (b) above, refer to Repair, SECTION IV.
- Bearing bores and diameters
  - Check all bearing bores and diameters for corrosion, wear and scoring.

- All bearing bores and diameters must be free of obvious damage. Radial scoring lines not exceeding 0.005 inch (0.13 mm) in width or 0.005 inch (0.13 mm) in depth, which do not cover more than 30 percent of bearing surface and do not penetrate protective coating, dry-film lubricant, or other finishes applied to base metal of the bore or diameter, are acceptable.

- Plated surfaces
  - Check dry-film lubricated, plated, anodized, and painted parts for wear through to base metal.
- Press-fitted parts
  - Visually check press-fitted bearings, bushings, pins, plugs, sleeves, spacers, and restrictors for security and condition.
- Sealing surfaces and flanges
  - Visually check all sealing surfaces and flanges for nicks, dents, and scratches.
- Passageways
  - Visually check all air and oil passageways for corrosion and foreign obstructions.
- Coil springs
  - Check coil springs for alignment of coils by rolling spring across a smooth, flat surface and observing misalignment or distortion of coils.
  - Check for cracks, deformation, and elongation.
- Welded and riveted parts
  - Visually check all welded and riveted parts for security of weld and rivets.
- Flexible couplings
  - Visually check for physical damage that would impair function.
  - Inspect swaged assemblies for flange appearance. A raised impression of the holding block split line may be visible. If the impression is 0.002 inch (0.05 mm) or less, the assembly is acceptable.
  - Using a straight edge, check flatness of the flange face. Out of flatness beyond 0.010 inch (0.25 mm) is not acceptable.
  - The tube must be free of nicks and scratches, except there will be slight traces of the circular flange groove pattern in the ID of the tube in the swaged area as well as traces along the tube axis indicating the last point of advance of the expander roll.
  - Perform pressure test in accordance with applicable manual.

H. Electrical Component Inspection

CAUTION: REFER TO APPLICABLE MANUAL PRIOR TO PERFORMING ANY ELECTRICAL CHECKS TO MAKE SURE THAT CHECKS WILL NOT DAMAGE EQUIPMENT.

(1) Check continuity of circuits.

(a) Check continuity of wiring from termination point to termination point in accordance with applicable manual.

(2) Check dielectric strength of electrical solenoids.

CAUTION: REFER TO APPLICABLE MANUAL TO MAKE SURE THAT CONNECTOR BEING CHECKED DOES NOT HAVE AN INTERNALLY GROUNDED PIN.

(a) Connect all non-grounded pins (refer to CAUTION) of connector together electrically, then connect to one side of a 750 VAC power source. Connect other side of power source to case of connector.

(b) Apply 750 VAC (rms) for 1 minute. There must be no evidence of arcing or sparking and current drain should not exceed 2.0 milliamperes.

(3) Check insulation resistance of electrical solenoids.

CAUTION: REFER TO APPLICABLE MANUAL TO MAKE SURE THAT CONNECTOR BEING CHECKED DOES NOT HAVE AN INTERNALLY GROUNDED PIN.

(a) Connect all non-grounded pins (refer to CAUTION) of connector together electrically, then connect to one side of a 500 VDC power source. Connect other side of power source to case of connector.

(b) Apply 500 VDC for 1 minute. Measure insulation resistance. The resistance between pins and case should not be less than 100 megohms.

(4) Check pins in wiring harness for security as follows:

(a) Check security of loose 20 ga. Pins using Contact Retention Test Tool (ACT-3075) or equivalent. If loose pins are indicated, refer to repair.

(b) Check security of loose 16 ga. Pins using Contact Retention Test Tool (ACT-3075) or equivalent t. If loose pins are indicated, refer to repair.

(c) Check security of loose 12 ga. Pins using Contact Retention Test Tool (ACT-3075) or equivalent. If loose pins are indicated, refer to repair.

I. Curvic Coupling Inspection

NOTE: Nomenclature for curvic coupling is provided in Figure 320.

(1) Inspect components with curvic coupling halves.

NOTE: The importance of thoroughly cleaning the curvic coupling teeth prior to inspection cannot be over emphasized. Make sure fluorescent penetrant check has been performed and the part has been visually checked for cracks. Clean per CLEANING Section, 203K.

(a) Visually check (in a well lighted area) curvic coupling teeth for nicks or metal buildup.

(b) Remove nicks or metal buildup using Arkansas polishing stone ((white) SECTION VII). Return part to Honeywell for check and possible rework if curvic coupling damage is more severe.

NOTE: Two separate sets of curvic coupling gages are recommended; one set for checking tooth bearing pattern, and the other set for checking curvic coupling runout requirements.

(c) Prior to checking face and radial runout, verify master control coupling setup is within limits. Refer to Figure 321.

(d) Check radial and face runout of curvic couplings using appropriate curvic coupling gages specified in applicable manual and a curvic coupling checking machine (Gleason No. 19) (SECTION VII). Refer to Figure 322 for parts with single curvic coupling, and Figure 323 for parts with two curvic couplings. Refer to the applicable manual for inspection features and acceptance criteria.

- If results are not acceptable, take bearing pattern by completing Step (f).
- If results are acceptable, bearing pattern check in Step (f) is not required.

(e) Check tooth bearing pattern on curvic couplings.

1 Polish each curvic coupling tooth using soft rubber abrasive (Brightboy No. ST70AL0612) (SECTION VII).

NOTE: Too heavy or unevenly applied coating of marking compound (Orange Gleason Fluid) (SECTION VII), or marking compound (Dykem Hi-Spot Blue, No. 107) (SECTION VII), may cause false tooth bearing pattern indication.

2 Apply trace of marking compound (Orange Gleason Fluid) (SECTION VII) to teeth of curvic coupling.

3 Apply trace of marking compound (Dykem Hi-Spot Blue, No. 107) (SECTION VII) to teeth of appropriate curvic coupling gage or gages, specified in applicable manual, using a one-inch diameter soft bristled brush.

4 Position appropriate curvic coupling gage or gages and curvic coupling in place on fixture specified in applicable manual, exercising care to provide proper concave and convex match of curvic coupling teeth.

5 Apply regulated air pressure, as specified in applicable manual, to tooth pattern fixture to establish tooth bearing color transfer. If air pressure is not specified, use Table 306A.

Table 306A. Pattern Check Tooling Pressure Requirements

Part Curvic OD	<6.0 in. (152.4 mm)	≥6.0 in. (152.4 mm)
Air pressure applied to fixture*	68 PSIG (469 kPa)	90 PSIG (621 kPa)

* ±2.0 PSIG (13.8 kPa)

NOTE: Pressure is applicable to Honeywell Fixture PN 289452-1 only.

CAUTION: MINOR NICKS, CONTAMINATION AND RAISED METAL WILL ADVERSELY AFFECT RUNOUT AND PATTERN INSPECTION. REFER TO STEP (c) FOR REMOVAL OF THESE CONDITIONS.

NOTE: Some inspection requirements specify a "Partial" curvic pattern, which in technical terms is the same as a "localized" curvic pattern. When a Partial curvic pattern is specified, use the Localized Tooth Bearing Pattern Acceptance Specification requirements (Figure 325). On an attrition basis, the inspection procedures in the referencing manuals will be updated to use the term "localized" instead of "Partial".

6 Remove curvic coupling from tooth pattern tooling and check tooth bearing pattern for conformance to requirements specified in Figure 324 and Figure 325.

- If tooth bearing pattern is not acceptable, check for contamination, minor nicks or raised material. Repeat Steps (c) and (e).
- If runout check is still unacceptable, refer to the applicable REPAIR section or replace the part.

2 Apply trace of marking compound (Orange Gleason Fluid) (SECTION VII) to teeth of curvic coupling.

3 Apply trace of marking compound (Dykem Hi-Spot Blue, No. 107) (SECTION VII) to teeth of appropriate curvic coupling gage or gages, specified in applicable manual, using a one-inch diameter soft bristled brush.

4 Position appropriate curvic coupling gage or gages and curvic coupling in place on fixture specified in applicable manual, exercising care to provide proper concave and convex match of curvic coupling teeth.

5 Apply regulated air pressure, as specified in applicable manual, to tooth pattern fixture to establish tooth bearing color transfer. If air pressure is not specified, use Table 306A.

Table 306A. Pattern Check Tooling Pressure Requirements

Part Curvic OD	<6.0 in. (152.4 mm)	≥6.0 in. (152.4 mm)
Air pressure applied to fixture*	68 PSIG (469 kPa)	90 PSIG (621 kPa)

* ±2.0 PSIG (13.8 kPa)

NOTE: Pressure is applicable to Honeywell Fixture PN 289452-1 only.

CAUTION: MINOR NICKS, CONTAMINATION AND RAISED METAL WILL ADVERSELY AFFECT RUNOUT AND PATTERN INSPECTION. REFER TO STEP (c) FOR REMOVAL OF THESE CONDITIONS.

NOTE: Some inspection requirements specify a "Partial" curvic pattern, which in technical terms is the same as a "localized" curvic pattern. When a Partial curvic pattern is specified, use the Localized Tooth Bearing Pattern Acceptance Specification requirements (Figure 325). On an attrition basis, the inspection procedures in the referencing manuals will be updated to use the term "localized" instead of "Partial".

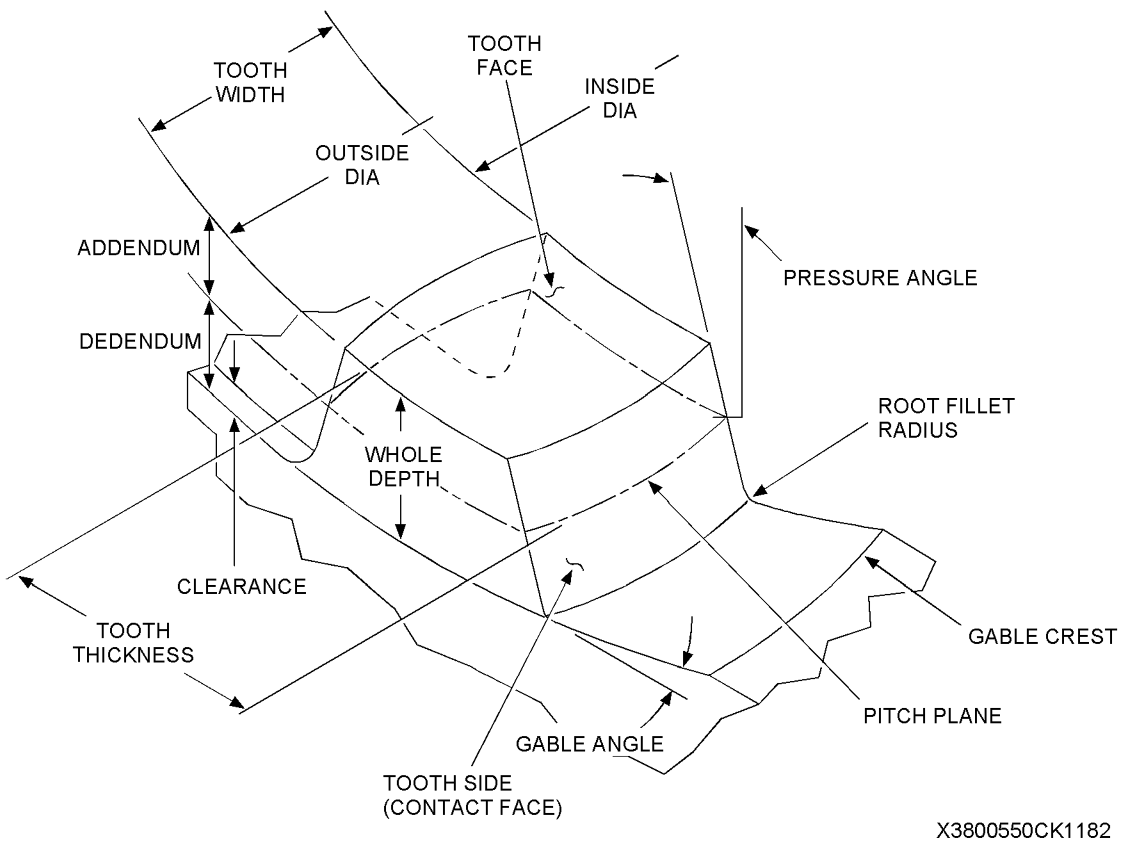
6 Remove curvic coupling from tooth pattern tooling and check tooth bearing pattern for conformance to requirements specified in Figure 324 and Figure 325.

- If tooth bearing pattern is not acceptable, check for contamination, minor nicks or raised material. Repeat Steps (c) and (e).
- If runout check is still unacceptable, refer to the applicable REPAIR section or replace the part.

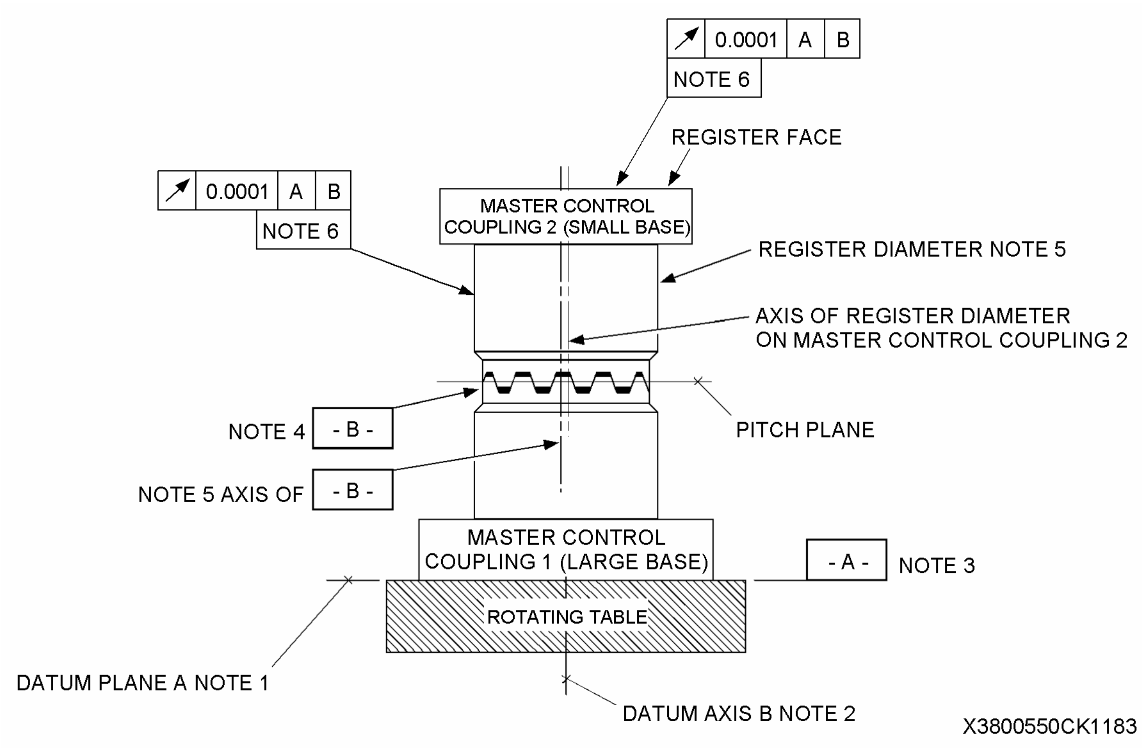
WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

7 Clean marking compound (Dykem Hi-Spot Blue, No. 107) (SECTION VII) and marking compound (Orange Gleason Fluid) (SECTION VII) from curvic coupling teeth and tooling using solvent (Federal Specification P-D-680, Type I) (SECTION VII) and a suede brush.

8 Place curvic coupling in appropriate container to protect from damage.



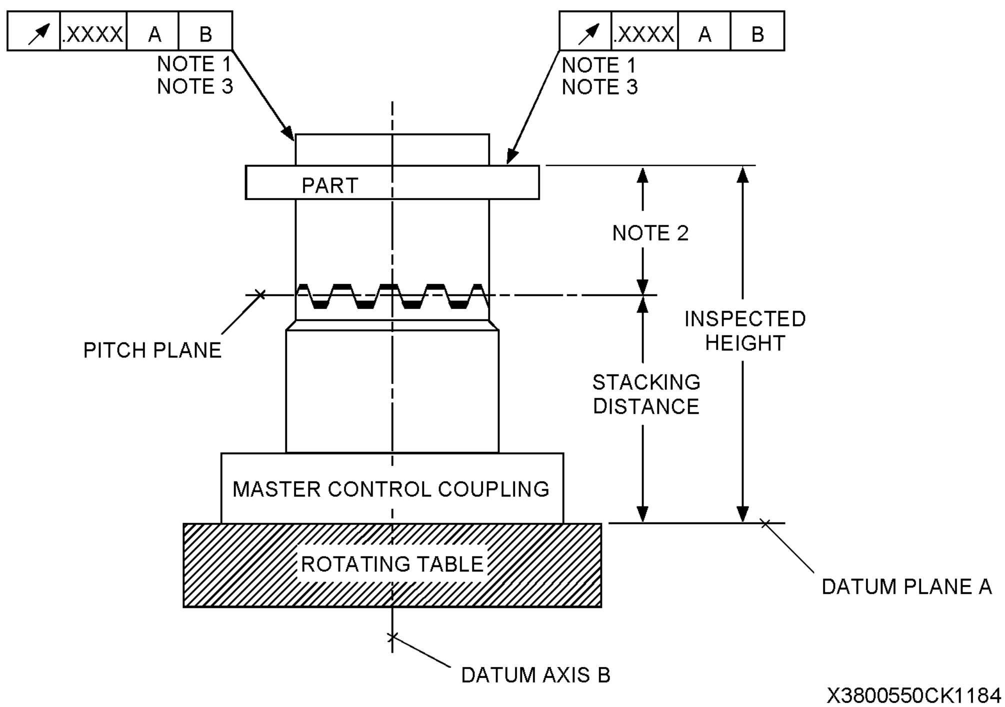
Curvic Coupling Nomenclature
Figure 320



DIMENSIONAL LIMITS

NOTE:
1. Datum plane A is the surface of the rotating table which master coupling 1 is installed.
2. Datum axis B is the axis of rotation of the table.
3. -A- (Primary Datum Feature A) is the register face on master control coupling 1.
4. -B- (Secondary Datum Feature B) is the curvic coupling on master control coupling 1.
5. Master control coupling 2 is used to align the axis of the secondary datum feature B with datum axis B. The alignment is correct when master control coupling 2 is rotated to four approximately equally spaced locations and the radial runout of its register diameter is constant at all four locations.
6. Required to verify master control coupling 1 setup.

Runout and Tooth Bearing Pattern Check
(Master Control Coupling Set-up Inspection Specifications)
Figure 321



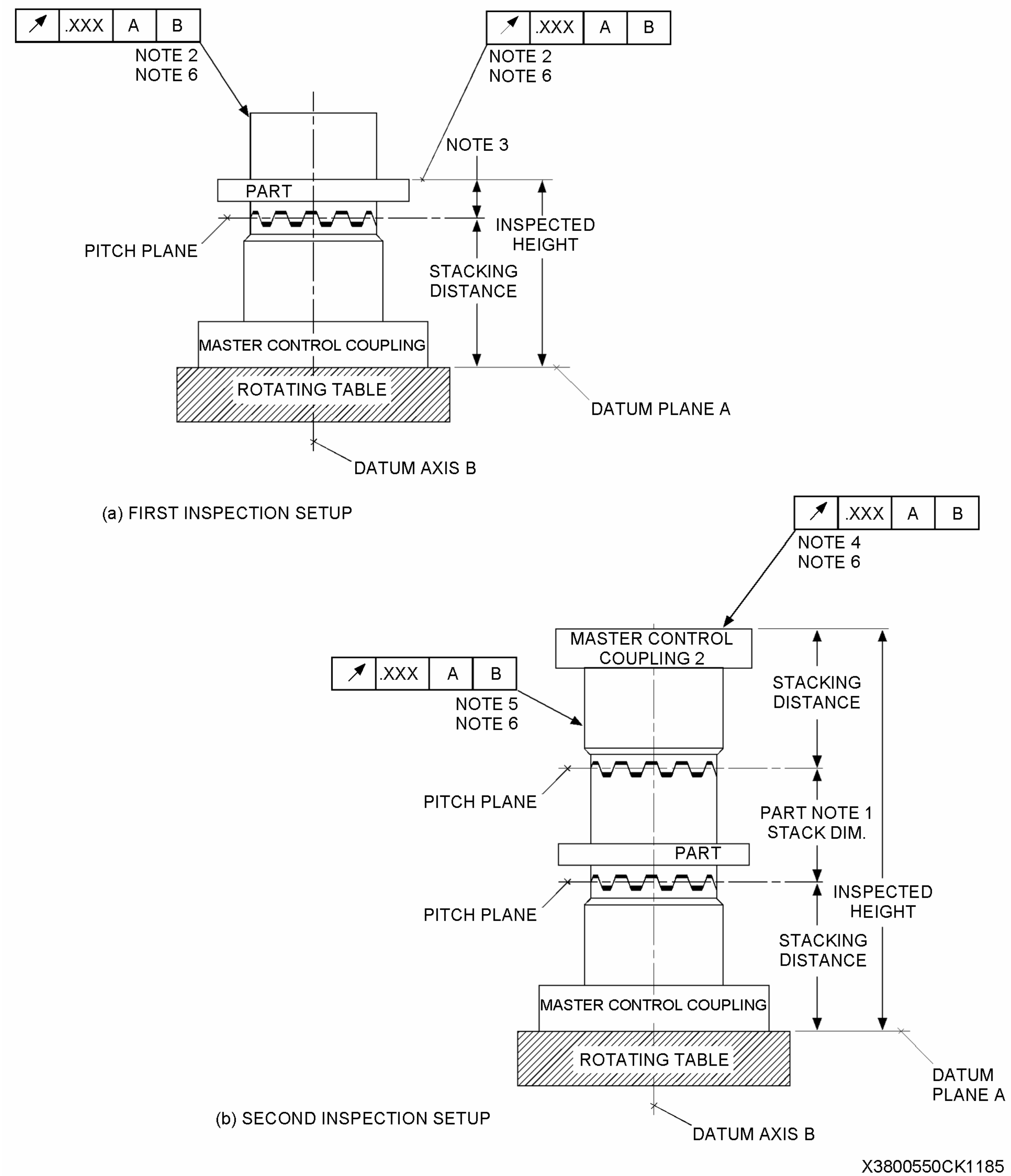
DIMENSIONAL LIMITS

NOTE: 1. Applies to face and radial runout as specified in the applicable manual.

2. Find the location of face(s) dimensioned to the curvic coupling by subtracting the master control coupling stacking distance from the inspected height.

3. Inspect the face runout and radial runout with the part rotated to four approximately equally spaced locations.

Runout Check
(Inspection Specifications for Single Curvic Couplings)
Figure 322

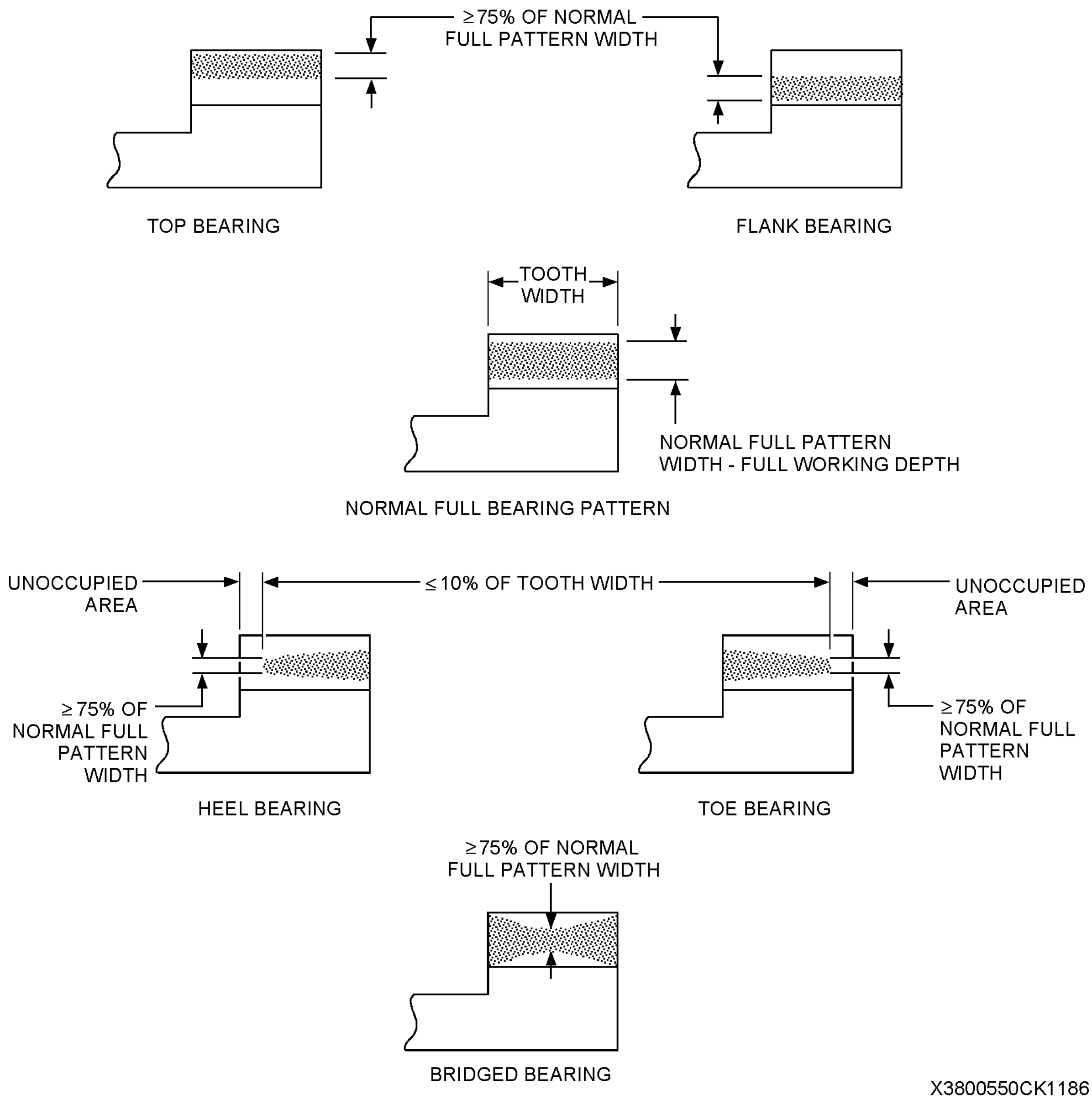


Runout Check
(Inspection Specifications for Two Curvic Couplings)
Figure 323

DIMENSIONAL LIMITS FOR FIGURE 323

NOTE:

1. Find the part stack dimension between coupling pitch planes by subtracting the sum of the two master control coupling stacking distances from the inspected height.
2. Relationship of first curvic coupling to part feature datums.
3. Find the location of faces dimensioned to lower curvic coupling by subtracting the lower master control couplings stacking distance from the inspected height.
4. Find the coupling to coupling face runout.
5. Find the coupling to coupling radial runout.
6. Inspect the face runout and radial runout with the part rotated to four approximately equally spaced locations.



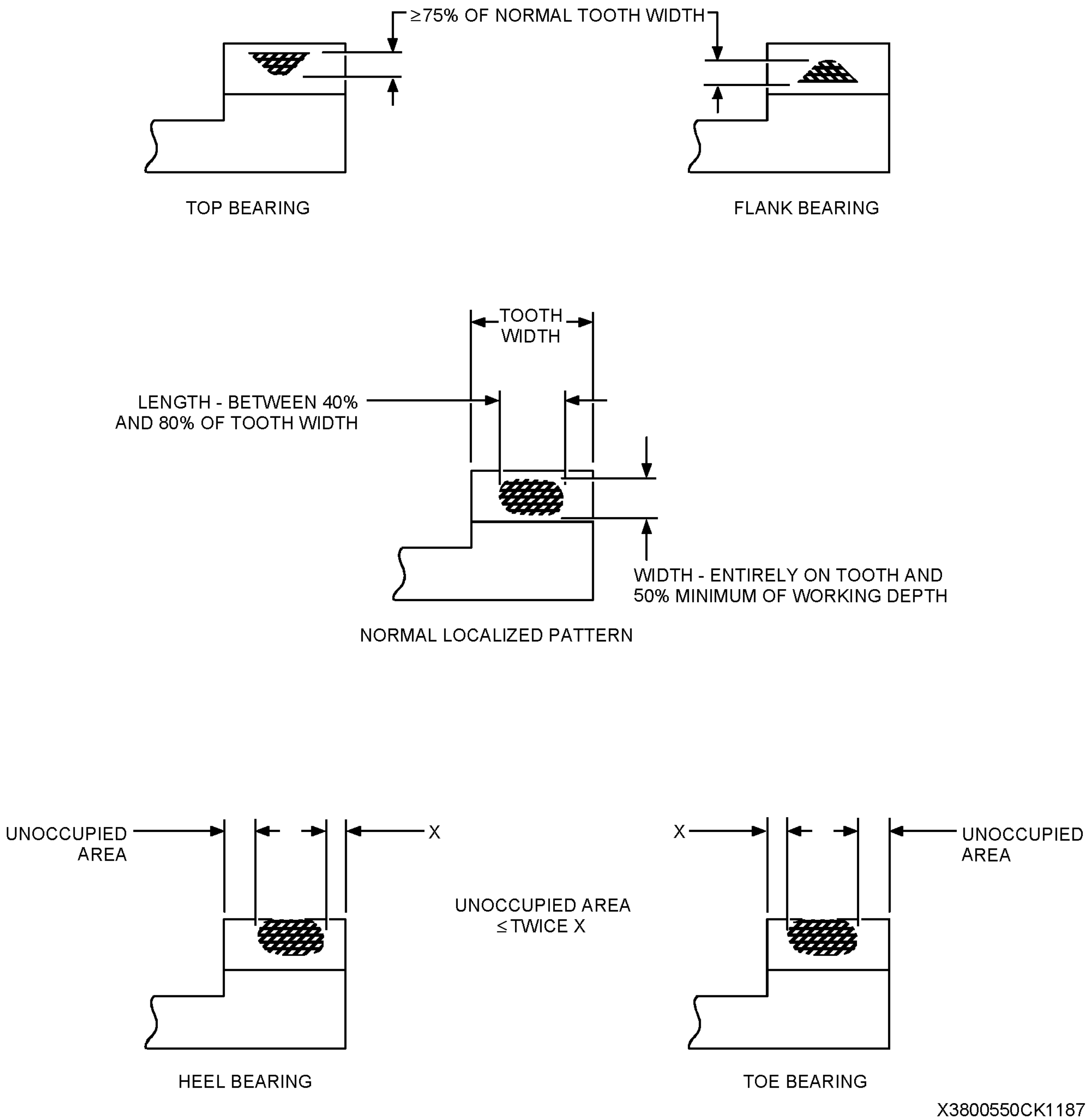
NOTES:

(1) Pronounced pitted areas covering over 50 percent of the tooth bearing pattern on more than two adjacent teeth or more than 30 percent of the total number of tooth bearing surfaces are not acceptable.

(2) Tooth bearing pattern must be visible on at least 90 percent of the total number of teeth.

(3) Lack of tooth bearing pattern must not occur on any two adjacent teeth.

Tooth Bearing Pattern Check
(Full Tooth Bearing Pattern Acceptance Specifications)
Figure 324



NOTES:

(1) Pronounced pitted areas covering over 50 percent of the tooth bearing pattern on more than two adjacent teeth or more than 30 percent of the total number of tooth bearing surfaces are not acceptable.

(2) Tooth bearing pattern must be visible on at least 90 percent of the total number of teeth.

(3) Lack of tooth bearing pattern must not occur on any two adjacent teeth.

Tooth Bearing Pattern Check
(Localized Tooth Bearing Pattern Acceptance Specifications)
Figure 325

J. Abraded, Plasma Spray, or Metal Spray Surfaces Inspection

Refer to applicable manual for unit in work.

K. Bubble Point Check for Filters

(1) Perform bubble point test on filter in accordance with MIL-F-5504B.

(a) The largest pore size of filter media can be experimentally determined by a Bubble Point Test. This is accomplished by measuring the pressure necessary to force air through media submerged in a known fluid. The surface tension of the fluid covering each pore prevents an indiscriminate permeation of the element.

(b) The Bubble Point Test apparatus must be similar to that illustrated in Figure 326. A filter element is submerged approximately 0.5 inch (12.7 mm) below the surface of a test fluid. The media is subjected to air pressure, which is increased in small steps until bubbles emanate from a point on the media surface.

(c) The element is rotated 360 degrees about its longitudinal axis at each increment of air pressure so the entire element can be observed for the appearance of the first bubble, at which time the manometer reading is taken. The pore size is inversely proportional to the pressure at the point the bubble appears and is determined by the following formula:

$$\text{Pore Size - Microns} = \frac{\text{Fluid Constant, microns / in. H20}}{\text{Fluid Pressure - Depth between fluid surface and media (in. H20}}$$

(d) Test fluids most commonly used are Solox 190, ethyl alcohol, methyl alcohol, and red oil (MIL-H-5606). Red oil (MIL-H-5606) is used when paper media is being tested to prevent swelling or other damage to the media. Constants for various test fluids have been determined as follows:

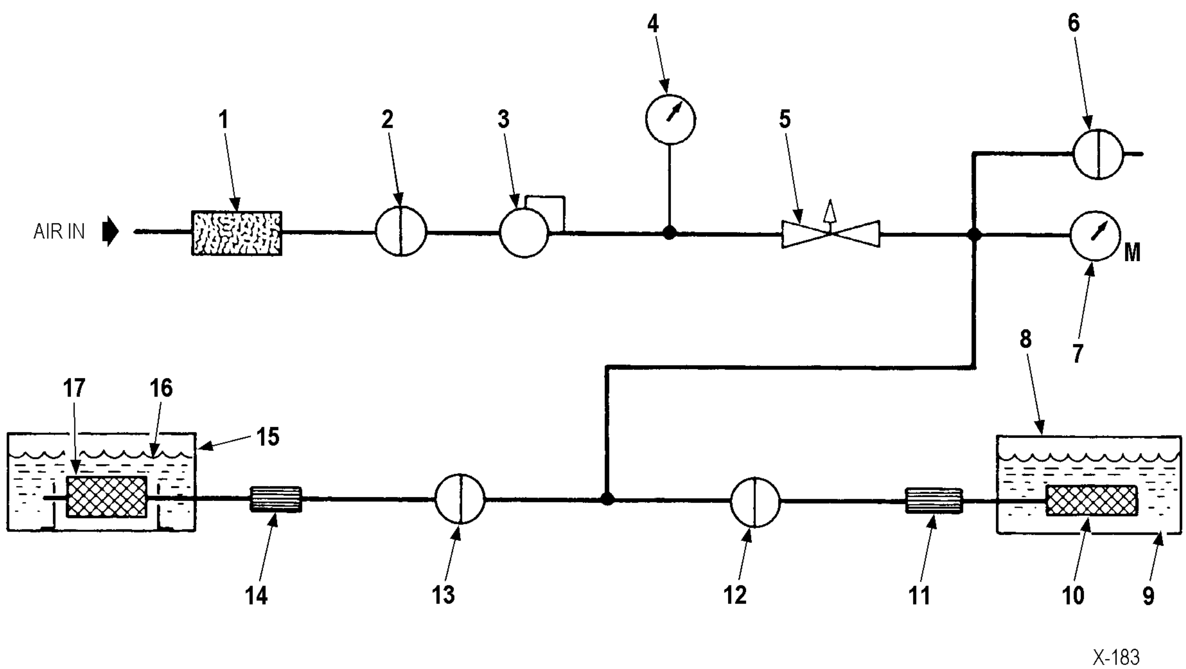
Solox 190	356	Methyl Alcohol	231
Ethyl Alcohol	238	MIL-H-5606	265

Table 307. Filtration Terms and Definitions

Term	Explanation
Absolute	The minimum particle size which is collected 100 percent by the filter.
Affluent	Fluid entering the filter.
Bubble Test	A method for locating and measuring the largest pore through a filter media by determining the minimum pressure required to force air through the media wetted by a specified fluid.
Capacity-Dirt Holding	The amounts of specified test contaminant, usually measured by weight in grams, required to produce a given pressure drop under specified test conditions.
Capacity-Input	Refer to capacity-dirt holding.
Configuration	The shape of the filter housing.
Contaminant	The foreign matter or particles in a fluid.
Cryogenics	The science of super cold liquids such as liquid oxygen, liquid nitrogen, and liquid hydrogen.
Effluent	Fluid that passes a filter.
Element	Filter media and support as used in the filter assembly. Characterized by construction, pleating configuration, and size.
Filter	The filter assembly, consisting of a housing and element.
Filter Area-Effective	The area of media that is useable for filtration.
Filtration-Degree of	The level of cleanliness of a fluid measured in terms of microns.
Filtration-Depth Type	Filtration which is accomplished in depth. The actual pore size of a media may be larger than the desired degree of filtration, but because of its depth, it provides a tortuous path with many entrapments to catch foreign particles.
Filtration-Edge Type	Fluid filters comprised of notched, flat discs or wires of trapezoidal, triangular, or related cross section where contaminants are entrapped at the edges of the media.
Flow Rate	The rate at which a fluid or gas is passed through a filter or system.
Line Size	The type and size of fluid line used in a system.
LOX	Liquid oxygen.
LOX Cleaning	The process of degreasing or making a component completely free of any hydrocarbons and foreign particles.
Media	A material or controlled pore size or mass through which a fluid is passed to remove foreign particles held in suspension. A part of the filter element.
Metal-Sintered	Porous metals made of powdered stainless steel, nickel, bronze, nickel silver, gold, silver, or other metals.

Table 307. Filtration Terms and Definitions (Cont)

Term	Explanation
Micron	One millionth of a meter or 0.000039 of an inch (0.00099 mm).
Migration-Abrasion	Dirt, generated by poorly designed parts that rub together and wear during vibration or shock, which enters the system fluid stream.
Migration-Media	Break away of the filter material, which travels downstream.
Nominal	An adjective relating to contaminant particle size. Filters are normally assigned a nominal efficiency rating which implies that a given percentage of nominal size particles, or those of greater size, will be removed by the filter when tested with a specified test contaminant under specified test conditions. In assigning a nominal rating to a filter media, glass beads and AC Fine Test Dust are usually specified as the test contaminant.
Pressure-Burst	The maximum design condition of the housing before failure.
Pressure Drop-Clean	The differential pressure drop across a clean filter at rated flow measured in pounds per square inch.
Pressure Drop-Maximum Allowable	The maximum pressure differential of a filter under specified fluid and flow conditions.
Pressure-Maximum Differential	The highest pressure differential which filter element is required to withstand without failure or collapse.
Pressure-Maximum Operating	The maximum operating pressure through the system.
Pressure-Operating	The normal pressure at which fluid or gas moves through a system.
Pressure-Proof	The maximum pressure that a filter can withstand without damage or leakage of the media.
Pressure-Surge	The peak system pressure experienced because of varied operating conditions, such as initial start up.
Service Life	The length of time a filter will remain on stream before it exceeds the maximum allowable pressure drop.



1. AIR FILTER
2. SHUTOFF VALVE
3. AIR PRESSURE REGULATOR
4. AIR PRESSURE GAGE
5. NEEDLE VALVE
6. SHUTOFF VALVE (BLEED)
7. MANOMETER (0 TO 24 IN. H_2O) (609.6 MM H2O)
8. TANK (TRANSPARENT) (12 IN. X 8 IN. X 8 IN.) (305 MM X 203 MM X 203 MM)
9. FLUID CONFORMING TO MIL-H-5608
10. LINE-TYPE ELEMENT
11. ELEMENT ROTATION KNOB
12. SHUTOFF VALVE
13. SHUTOFF VALVE
14. ELEMENT ROTATION KNOB
15. TANK (TRANSPARENT) (12 IN. X 10 IN. X 8 IN.) (305 MM X 254 MM X 203 MM)
16. FLUID (SOLEX 190) (TYPICAL)
17. RESERVOIR-TYPE ELEMENT

Bubble Point Test Diagram
Figure 326

L. Pressure Drop Check: Cleaned Metallic Filter Elements

Check pressure drop of cleaned filter element as follows:

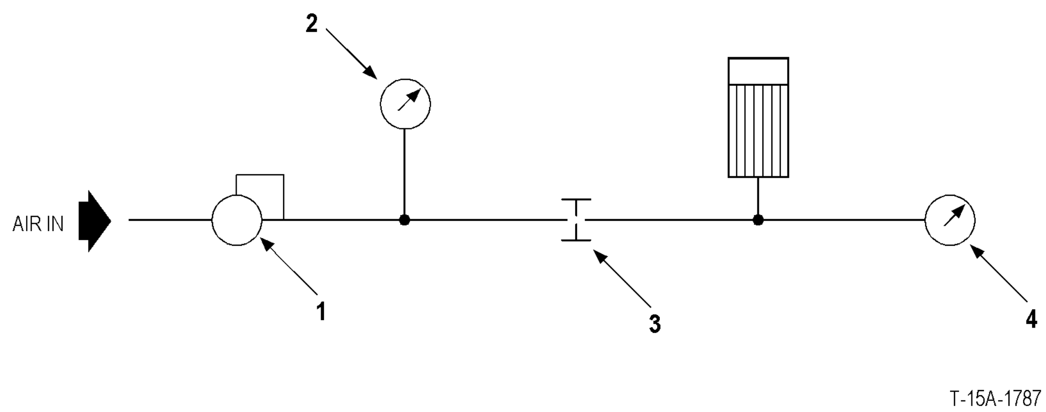
NOTE: Check pressure drop of a new filter element to establish baseline data for use during checking of cleaned filter elements.

(1) Install filter element in test setup similar to that shown in Figure 327.

(2) Adjust regulator (1) to apply an inlet air pressure of 20 PSIG (138 kPa) as indicated on inlet pressure gage (2).

(3) Pressure indicated on downstream pressure gage (4) should not exceed pressure measured for a new filter element.

(4) Replace filter element if pressure is excessive.



1. AIR PRESSURE REGULATOR (0 TO 30 PSIG) (0 TO 207 KPA)
2. INLET PRESSURE GAGE (0 TO 30 PSIG) (0 TO 207 KPA)
3. RESTRICTOR UNIT (0.042 INCH (1.07 MM) DIAMETER ORIFICE)
4. DOWNSTREAM PRESSURE GAGE (0 TO 30 PSIG) (0 TO 207 KPA)

Test Setup of Filter Elements
Figure 327

M. Thermocouple Simulators for Calibration and Checkout of Electronic Equipment

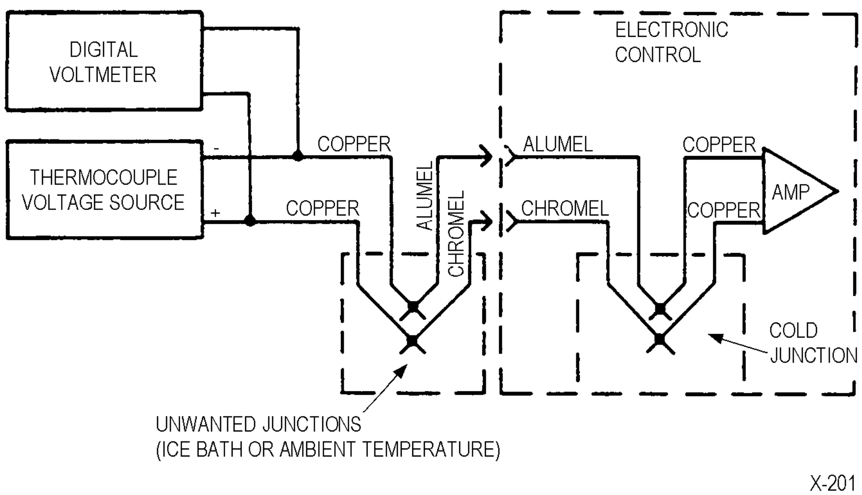
(1) For test purposes in simulating a thermocouple, a common and recommended method is shown in Figure 328 and Figure 330. Note that the voltmeter must be connected to the copper leads of the voltage source and not to the alumel and chromel input wires to the electronic control. The thermocouple junctions created by the thermocouple voltage source connections to the alumel-chromel wire are compensated by means of the ice bath. This is because the alumel-chromel thermocouple tables are based on an unwanted junction (reference junction or cold junction) at 32°F (0°C) the temperature of melting ice. The input leads to the electronic control are alumel and chromel wire, therefore, there are no thermocouple junctions, due to dissimilar metals, at the interface to the electronic control. A comparison of this thermocouple simulation to a typical thermocouple temperature measurement installation is shown in Figure 328.

(2) Temperature simulation without using an ice bath or other compensation is used but must be well understood in order to avoid unwanted errors. The temperature of the unwanted junction, which is room temperature, must be measured accurately, and then used to correct the simulated input voltage.

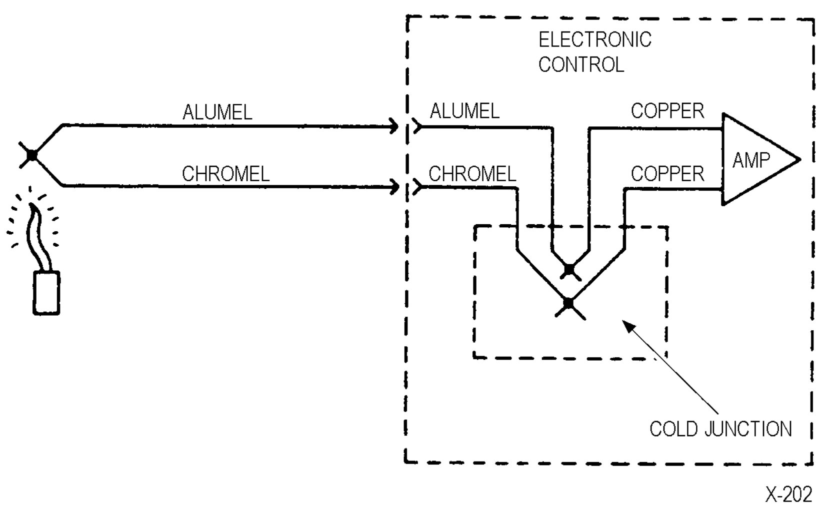
(3) Using Figure 328 as an acceptable setup where the unwanted copper-alumel and chromel-copper junctions are at ambient temperature, then any voltage input from the thermocouple voltage source must be corrected for this existing ambient temperature input. Note that an ice bath was used for the junction temperature in the previous example.

(4) For example, suppose the input required is 1200°F (648.9°C), and the room temperature is 77°F (25°C). To determine what voltage would be required from the thermocouple voltage source in Figure 328, refer to an alumel-chromel thermocouple table. The voltage for 77°F (25°C) is 1.000 millivolt, and 1200°F (648.9°C) is 26.975 millivolts. Since the circuit of this figure, with zero thermocouple source voltage, is inputting 1.000 millivolt (ambient of 77°F (25°C)), then the input required to simulate 1200°F (648.9°C) (26.975 millivolts) is:

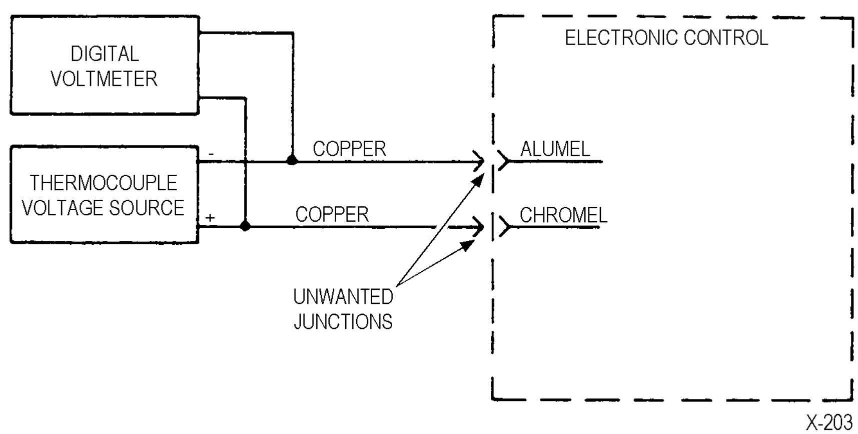
$$26.975\text{mv}\begin{pmatrix}\text{Desired}\\ \text{Input}\\ \text{1200F}\end{pmatrix} - 1.000\text{mv}\begin{pmatrix}\text{Existing}\\ \text{Input}\\ \text{from}\\ \text{Unwanted}\\ \text{Junction}\end{pmatrix} = 25.975\text{mv}\begin{pmatrix}\text{Input}\\ \text{from}\\ \text{Thermocouple}\\ \text{Voltage}\\ \text{Source}\end{pmatrix}$$



Test Setup of Thermocouple Simulation
Figure 328



Typical Thermocouple Installation
Figure 329



Uncompensated Cold Junction Thermocouple Simulation
Figure 330

(5) In previous example the desired input voltage (temperature) was known and the unwanted junction voltage was subtracted from the desired input in order to obtain the correct voltage for the thermocouple voltage source. In the following example, Equation 2, the voltage of the thermocouple voltage source is known, such as when a temperature switch point is being checked, and the temperature associated with it is to be determined. In Equation 1 the desired input is Equation 2’s “unknown input”.

- Equation 1

$$\begin{pmatrix} \text{Desired} \\ \text{Input} \\ \text{Temp} \\ \text{Voltage} \end{pmatrix} - \begin{pmatrix} \text{Existing} \\ \text{Input} \\ \text{from} \\ \text{Unwanted} \\ \text{Junction} \end{pmatrix} = \begin{pmatrix} \text{Input} \\ \text{from} \\ \text{Thermocouple} \\ \text{Voltage} \\ \text{Source} \end{pmatrix}$$

- Equation 2

$$\begin{pmatrix} Unknown \\ Input \\ Temp \\ Voltage \end{pmatrix} = \begin{pmatrix} Existing \\ Input \\ from \\ Unwanted \\ Junction \end{pmatrix} + \begin{pmatrix} Input \\ from \\ Thermocouple \\ Voltage \\ Source \end{pmatrix}$$

(6) Most electronic control temperature tolerances are on the order of ±20 to ±40°F (±11.1 to ±22.2°C). The temperature simulation circuit should be 10 times more accurate than the allowable tolerances for the electronic control. This means that the temperature simulation circuit should be accurate to within ±2 to ±4°F (±1.1 to ±2.2°C). This includes the errors in measurement of the room temperature for the cold junction voltage.

(7) Referring to an alumel-chromel thermocouple table, note that the millivolt reading for 1000°F (537.8°C) is 22.251 mv and for 1001°F (538.3°C) is 22.274 mv. The difference for this 1°F (-17.2°C) Delta is 0.023 millivolts or 23 microvolts. This indicates that the voltmeter used for the thermocouple simulation voltage should have an accuracy and resolution of 0.01 millivolts or 10 microvolts. With such an accurate voltmeter, more error 1-1/2 to 3-1/2°F (-16.9 to -15.8°C) is allowed for the room temperature reading errors. Note that a 4°F (-15.6°C) error in measuring the room temperature means a 4°F (-15.6°C) error in calibrating the control.

N. Composite Material Components

(1) Check per Table 308.

Table 308. Inspection/Check Criteria and Repair Limits for Composite Material Components

MATERIAL COMPOSITION OR ITEM/TYPE OF DAMAGE	USABLE LIMITS	MAXIMUM REPAIR LIMITS
LAMINATE		
Delamination	None permitted.	All must be repaired. Maximum repair limits: 25% of component total area.
Cuts, Scratches, Blemishes	Any that does not expose fiber reinforcement.	All cuts that penetrate fiber reinforcement, or are visible or require further processing are repairable.
Cracks	None permitted.	Surface resin crack that does not penetrate fiber reinforcement. Cracks in reinforcement are not acceptable.
Frayed Surface	None permitted.	All must be repaired. Maximum repair limits: 25% of component total area.
Punctured	None	None
SEALS (SILICONE RUBBER)		
Disbonded	None permitted.	Any amount.
Torn	None permitted.	Not repairable.
Cuts/Gouges	Less than 0.100 in.> (2.54 mm) in length and depth.	Not repairable.
Missing	None permitted.	Not applicable.
RIVETS/STRAPS/NUT PLATES		
Loose/Damaged/ Missing	None permitted.	Any amount.
BRACKETS/MACHINED BOSS		
Cracked	None permitted.	Any amount.
Disbonded	None permitted.	Any amount.
Loose	None permitted.	Any amount.

O. Equipment and Materials

Table 309 lists equipment and materials that may be required for inspection. Equivalent equipment and materials may be substituted for them.

Table 309. Equipment and Materials

Equipment/Material	Description/Manufacturer
NOTE: Equivalent equipment/material can be used for items shown.	
Abrasive cloth (Scotch-Brite)	3M Abrasive Systems Div, 3M Center, Bldg 223-6N-01, St. Paul, MN 55144-1000 Phone: 800-742-9546 (612-737-6501)
Actual mass flow computer	Commercially available
Aqueous cleaner (Daraclean 282)	Magnaflux, 3600 West Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160
Arkansas polishing stone (White)	Norton Co, Coated Abrasive Div, 10th Ave, and 25th St, Watervliet, NY 12189 Phone: 518-266-2200
Calibrated orifice	Commercially available
Capillary leak detector (Part No. 3791761-1)	Honeywell Ground Support Solutions, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Contact retention test tool (ACT-3075 for 20 ga. pin) (ACT-3076 for 20 ga. pin) (ACT-3077 for 20 ga. pin)	Astro Tool Corp, 21615 SW Tualatin Valley Hwy, Beaverton, OR 97006-1329 Phone: 503-642-9853 Fax: 503-591-0748
Curvic coupling checking machine (Gleason No. 19)	Gleason Works, 1000 University Ave, Rochester, NY 14607-1239 Phone: 585-461-8168
Demagnetizing unit (Model SB2824T)	Magnaflux, 3600 W. Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160

Table 309. Equipment and Materials (Cont)

Equipment/Material	Description/Manufacturer
Digital temperature indicator	Commercially available
Electrical harness	Customer furnished
Filter (10 milli-microns)	Commercially available
Filtered calibrating fluid (MIL-PRF-7024, Type II)	Commercially available
Flow restrictor	Honeywell Ground Support Solution, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Flow regulating valve	Commercially available
Fluorescent penetrant unit (Model ZA-28)	Magnaflux, 3600 W. Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160
Fuel pressure gage	Range: 0 to 300 PSIG (0 to 2068 kPa) Commercially available
Fuel pressure gage	Range: 5 to 50 PSIG (34.5 to 345 kPa) Commercially available
Fuel pressure gage	Range: 50 to 250 PSIG (345 to 1724 kPa) Commercially available
Fuel spray angle protector	Range: 50 to 130 degrees Commercially available
Inlet pressure transducer digital readout	Commercially available
Leak detection compound (Leak Tec Formula 277C, MIL-PRF-25567, Type I)	American Gas and Chemical Co. Ltd., 220 Pegasus Ave, Northvale, NJ 07647-1904 Phone: 201-767-7300
Magnetic base oil (Magnaglo Carrier II)	Magnaflux, 3600 W. Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160

Table 309. Equipment and Materials (Cont)

Equipment/Material	Description/Manufacturer
Magnetic particles compound (Magnaglo Dry Concentrate No. 14A)	Magnaflux, 3600 W. Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160
Magnetizing unit (Model H720)	Magnaflux, 3600 W. Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160
Marking compound (Dykem Hi-Spot Blue, No. 107)	The Dykem Co, 8501 Delport Dr, St Louis, MO 63114-5905 Phone: 314-423-0100
Marking compound (Gleason Fluid, Orange)	Gleason Works, 1000 University Ave, Rochester, NY 14607-1239 Phone: 585-461-8168
Master curvics	Honeywell Ground Support Solution, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Megohmmeter	Commercially available
Multimeter-digital (Fluke Model 8000A)	Fluke Corporation, 6920 Seaway Blvd, Everett, WA 98203-5829 Phone: 425-347-6100
Multimeter	Simpson Electric Co, Simpson Instruments Div, 853 Dundee Ave, Elgin, IL 60120-3090 Phone: 847-697-2260
Manometer (2 ea required)	Range: 0 to 60 in. Hg G (0 to 152 cm Hg G) with an accuracy of ±0.1 in. Hg G (2.5 mm Hg G) Commercially available
Oscilloscope (Tektronix Model 535)	Tektronix Inc, 4900 SW Griffith Dr, Beaverton, OR 97077 Phone: 800-426-2200
Pressure regulator	Range: 0 to 60 in. Hg (0 to 152 cm Hg) Commercially available

Table 309. Equipment and Materials (Cont)

Equipment/Material	Description/Manufacturer
Pressure regulating valve	Commercially available
Pressure gage	Range: 0 to 100 PSIG (0 to 689 kPa) Commercially available
Pressure transducer	Commercially available
Pressure regulator	Range: 0 to 100 PSIG (0 to 689 kPa) Commercially available
Runout fixtures	Honeywell Ground Support Solutions, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Solvent (MIL-PRF-680, Type I or II)	Commercially available

P. Thermal Insulation Blanket Set Inspection

(1) Check per Table 310.

Table 310. Inspection/Check Criteria and Repair Limits for Thermal Insulation Blankets

Type of Damage	Usable Limit	Maximum Repair Limit
Cuts, tears and punctures	None permitted.	Maximum length of 1.50 inches (38.1 mm) is repairable. Replace part exceeding repair limit.
Loose or missing lockwire buttons	None permitted.	Replace part.
Dents, creases and bends	Any amount.	Not applicable.

SECTION IV – REPAIR

TABLE OF CONTENTS

SECTION PAGE

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SECTION IV – REPAIR

1. Standard Repair Practices

   A. General

   The methods and procedures presented are recommended by the manufacturer to facilitate overhaul and repair of a unit. The information is presented as a supplement to the knowledge acquired by competent personnel engaged in the overhaul activities of organized facilities.

   Typical examples used in this section do not replace specific instructions provided in applicable manuals.

   Plating processes and applicable specifications are listed in Table 401.

   Stop-drilling is not considered a standard repair practice as the process details will vary from part to part, but the use of stop-drilling is permitted where/as indicated by the specific part coverage in the applicable IRM, WPG, or Engine Manual.

   Other elementary repairs are authorized by this manual:

   - Restoring (chasing) internal and external threads on non-rotating parts.
   - Replacing gaskets and packings (O-rings).
   - Replacing bushings not requiring machining (sizing) operations.

Table 401. Plating Processes and Applicable Specifications

Process	Specification and Method
Anodic Treatment for Magnesium	AMS 4375, AMS 4376, AMS 4377, AMS 2476 or ASTM D1732
Black Oxide on Steel	MIL-C-13924, Class 1, AMS 5046 or AMS 6350, or AMS 2485
Cadmium Plate	AMS QQ-P-416, Type I and II, AMS 5046, or AMS 6350, or AMS 2400
Chemical Conversion Coating	MIL-DTL-5541, Class 1A, AMS 4041
Chromic Anodize	MIL-A-8625, Type I, Class 1, AMS 4041, or AMS 2470
Chromium Plate	AMS QQ-C-320, Class 2, AMS 5046, AMS 6350, or AMS 6250, or AMS 2406, AMS 2438
Copper Plate	AMS 2418, or AMS 5046 or AMS 6350
Electrolyses Nickel	AMS 5046 or AMS 6350, or AMS 2404, AMS 2405, or AMS 2433
Hard Anodize	MIL-A-8625, Type III, AMS QQ-A-250/4 and AMS QQ-A-250/11, or AMS 2469
Plasma Spray	AMS 2437
Shot Peening	AMS 2430
Silver Plate	ASTM B700, Type I, II and III, Grade B, AMS 5046 or AMS 6350, or AMS 2410, AMS 2411 and AMS 2412
Surface Treatment of Magnesium	AMS-M-3171, Type III

2. Preparation of Solutions

WARNING: SOLUTIONS USED FOR CLEANING ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

A. Method No. 402A: Alkaline Cleaning Solutions Mixing Instructions

WARNING: USE THE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

Prepare alkaline cleaner solution as follows:

(1) Dissolve 4 to 6 ounces (118 to 177 mL) of alkaline cleaner C04-0011 or C04-0013 each gallon (3.79 L) of distilled water C04-0047 or de-ionized water C04-0048.

(2) Keep solution at 130 to 180˚F (54 to 82˚C) in an air agitated tank.

B. Method No. 402B: Anodize Stripper Mixing Instructions

WARNING: USE THE CORRECT PERSONAL PROTECTION. ANODIZE STRIPPER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

Prepare anodize stripper solution as follows:

(1) Dissolve 1 pound (0.45 kg) of anodize stripper C04-0020 in each gallon (3.79 L) of distilled water C04-0047 or de-ionized water C04-0048.

(2) Keep solution at 180 to 190˚F (82 to 88˚C) in an air agitated tank.

C. Method No. 402C: De-oxidizer Mixing Instructions

WARNING: USE THE CORRECT PERSONAL PROTECTION. DE-OXIDIZER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

Prepare de-oxidizer solution as follows:

(1) Dissolve 8 to 16 ounces (237 to 0.473 mL) of de-oxidizer C03-0003 in 1 gallon (3.79 L) of distilled water C04-0047 or de-ionized water C04-0048.

(2) Keep solution at 65 to 95˚F (18 to 35˚C) in an agitated tank.

D. Method No. 402D: Rust Stripper Mixing Instructions

WARNING: RUST STRIPPER SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES, DUST, OR MIST. USE OF A RESPIRATOR IS STRONGLY RECOMMENDED. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

CAUTION: EXERCISE EXTREME CAUTION WHEN PREPARING RUST STRIPPER SOLUTION. MIXING MAY PRODUCE TEMPERATURES EXCEEDING THE BOILING POINT OF THE SOLUTION. ADD OAKITE RUST STRIPPER WHILE AGITATING SOLUTION AS A MEANS TO PREVENT LOCALIZED OVERHEATING.

Prepare rust stripper solution as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(1) Dissolve 3 to 5 pounds (1.36 to 2.27 kg) of generic cleaner powder C04-0027 in each gallon (3.79 L) of distilled water C04-0047 or de-ionized water C04-0048.

(2) Keep solution at 160 to 200˚F (71 to 93˚C) in an air agitated tank.

E. Method No. 402E: Aluminum Touch-up Mixing Instructions

Prepare aluminum touch-up acid-based solution as follows:

WARNING: USE EXTREME CAUTION TO PREVENT CONTACT WITH SKIN. IF POWDER OR MIXED SOLUTION COMES IN CONTACT WITH SKIN, FLUSH OFF IMMEDIATELY WITH WATER. DO NOT INHALE DUST FROM POWDERS OR VAPORS FROM THE SOLUTION.

CAUTION: MATERIALS SATURATED WITH SOLUTION CONSTITUTE A FIRE HAZARD IF ALLOWED TO DRY. RINSE MATERIALS THOROUGHLY IN TAP WATER IMMEDIATELY AFTER USE.

(1) Mix 4 ounces (118 mL) of chromate conversion coating C03-0002 in each gallon (3.79 L) of distilled water C04-0047 or de-ionized water C04-0048.

(2) Keep pH of 0.9 to 1.1 by adding chromic acid C04-0023 and nitric acid C04-0032 as required.

NOTE: Make adjustments of pH with chromic acid, because excessive use of nitric acid will precipitate the treatment chemicals in the form of sludge.

(3) Keep solution at room temperature.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(4) Let solution stand at least 2 hours before use.

F. Method No. 402F: Chromic-acid Pickle Mixing Instructions

WARNING: USE THE CORRECT PERSONAL PROTECTION. CHROMIC-ACID PICKLE SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION AND USE, WASH HANDS AND FACE THOROUGHLY.

Prepare chromic-acid pickle solution as follows:

(1) Dissolve 16 ounces (454 g) of chromic acid flake C04-0023 in each gallon (3.79 L) of distilled water C04-0047 or de-ionized water C04-0048.

(2) Keep solution at 70 to 80˚F (21 to 27˚C).

G. Method No. 402G: Magnesium Touch-up (Dow 1) Mixing Instructions

CAUTION: DO NOT ALLOW TOUCH-UP SOLUTION (DOW 1) TO CONTACT ANODIC TREATED SURFACES. A RAPID DETERIORATION OF THE COATING WILL OCCUR.

Prepare magnesium touch-up solution (Dow 1) as follows:

(1) Mix 1.5 pounds (0.68 kg) of sodium dichromate C04-0036 and 1.5 pints (710 mL) of nitric acid C04-0032 with enough water to make 1 gallon (3.79 L) of solution.

(2) Let solution stand for one to two minutes before use.

H. Method No. 402H: Magnesium Touch-up (Dow 19) Mixing Instructions

WARNING: USE EXTREME CAUTION TO PREVENT CONTACT WITH SKIN. IF POWDER OR MIXED SOLUTION COMES IN CONTACT WITH SKIN, FLUSH OFF IMMEDIATELY WITH WATER. DO NOT INHALE DUST FROM POWDERS OR VAPORS FROM THE SOLUTION.

Prepare magnesium touch-up solution (Dow 19) as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(1) Mix 1.3 ounces (36.9 g) of chromic acid flake C04-0023 and 1 ounce (29.6 mL) of calcium sulfate C04-0022 with enough distilled water C04-0047 or de-ionized water C04-0048 to make 1 gallon (3.79 L) of solution.

(2) Mix solution with force for at least 15 minutes to make sure saturation of the solution with calcium sulfate.

(3) Keep solution at 70 to 90˚F (21 to 32˚C).

I. Method No. 402J: Primer Mixing Instructions

Prepare primer as follows:

(1) Mix equal parts, by volume, of primer C03-0007 or C03-0015. Refer to manufacturer's instructions.

(2) Let stand 30 minutes before use.

J. Method No. 402K: Color-coat Mixing Instructions

Prepare color-coat as follows:

(1) Light Green Coating

(a) Mix equal parts, by volume, of paint, light green C03-0006. Refer to manufacturer's instructions.

(b) Let stand 30 minutes before use.

(2) Gloss Blue Coating

(a) Mix equal parts, by volume, of paint, gloss blue C03-0005. Refer to manufacturer's instructions.

(b) Let stand 30 minutes before use.

(3) Black Coating

(a) Mix equal parts, by volume, of paint, gloss black C03-0004 or C03-0016. Refer to manufacturer's instructions.

(b) Let stand 30 minutes before use.

(4) Yellow Coating

(a) Mix equal parts, by volume, of paint, gloss yellow C03-0011 or C03-0012. Refer to manufacturer's instructions.

(b) Let stand 30 minutes before use.

(5) Red Coating

(a) Mix equal parts, by volume, of paint, gloss red C03-0013 or C03-0014. Refer to manufacturer's instructions.

(b) Let stand 30 minutes before use.

3. Repair and Application of Protective Coatings and Plating

A. Method No. 403A: Anodized Aluminum and Aluminum-Alloy Repair

Repair anodized aluminum and aluminum-alloy parts as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(1) Remove anodize as follows:

(a) Clean part with solvent C04-0025, to remove oil and grease contamination.

WARNING: USE THE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(b) Put the part fully into alkaline cleaner solution for 5 minutes maximum. Refer to Method No. 402A.

(c) Use a stiff bristled brush C08-0031, to remove surface contamination.

NOTE: If there are old gaskets or sealing compound, use a knife blade to remove it from the surface.

(d) Flush the part with water at 80 to 110˚F (27 to 43˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(e) Dry part with low pressure air at 20 PSIG (138 kPa) maximum.

(f) Put the part fully into anodize stripper solution until anodize finish is removed. Refer to Method No. 402B.

(g) Repeat Sub-steps (b), (c) and (d) to clean part.

(2) Apply anodize as follows:

NOTE: This process is for low-stressed aluminum-alloys where a hard wear-resistant coating with corrosion resistance is required and where the loss of fatigue strength, tensile strength, and elongation will not adversely affect service.

CAUTION: DO NOT ALLOW PART TO REMAIN IN CONTACT WITH DE-OXIDIZING SOLUTION LONGER THAN THREE (3) MINUTES OR CHEMICAL ETCHING WILL OCCUR.

(a) Put the part fully into de-oxidizer solution for 1 to 3 minutes. Refer to Method No. 402C.

(b) Repeat Sub-steps (b), (c) and (d) to flush and dry part.

(c) Apply anodize. Refer to AMS 2469 or MIL-A-8625, Class and Type as specified in applicable manual. Refer to applicable manual for necessary plating thickness.

B. Method No. 403B: Hard Chrome Plated Parts Repair

NOTE: Hard chrome plating is used primarily on steel parts for the purpose of increasing abrasion resistance to reduce wear and friction between sliding surfaces. It is also used to recondition worn or over machined areas as a salvage repair.

NOTE: Hard chrome plating is usually relatively thick, ranging from 0.002 to 0.010 inch (0.05 to 0.25 mm), and is applied directly to the base metal.

Repair hard chrome plated parts as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine surface to remove damage and all remaining plating. 100 percent clean up is required.

Make sure all Chrome Plate is removed from surfaces previously plated.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(2) Clean the part. Refer to SECTION II - CLEANING.

(3) Perform magnetic particle or fluorescent penetration inspection. No cracks permitted. Refer to SECTION III-INSPECTION. Refer to applicable manual.

(4) Clean surfaces to be plated. Refer to SECTION II - CLEANING.

NOTE: Make sure all remaining Chrome Plate is removed before new plating is applied.

(5) Mask all areas not to be chrome plated or used for electrical contact.

NOTE: Masking materials used such as adhesive tape C01-0008, C01-0009, C01-0010; masking wax compound C01-0011, C01-0012; lacquer stop-off C01-0013, or various combinations of those materials must be used to mask the part surfaces. Satisfactory bond is required to prevent plating solution leaks into the masking and touch the part surface.

NOTE: When plating external surfaces, internal cavities such as inside diameters must be completely masked, or the end must be caped and sealed to prevent plating solution going into the shaft cavity.

(6) Set the part into the tank for plating.

(a) Do not hit the part with the bus bars or tank walls. If it occurs, make sure the hit action did not break the masking. If masking is broken, remove part from plating process. Clean and remask the area where the masking material is damaged.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) Apply hard chrome plating. Refer to AMS 2460, Class and Type as specified in applicable manual. Refer to applicable manual for necessary plating thickness.

(8) Remove masking material.

(a) Remove all masking material.

(b) Clean part to remove remaining masking material. Refer to SECTION II - CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(9) If required, heat treat part as specified in AMS 2460. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(10) Machine surface to finish dimensions. Refer to applicable manual for repaired limits and surface finish.

(11) Clean part. Refer to SECTION II - CLEANING.

(12) Perform fluorescent penetration inspection. No cracks permitted. Refer to SECTION III - INSPECTION. Refer to applicable manual.

NOTE: Hard chrome plated surfaces often show a zone of hairline cracks. Those indications are typical of chrome plating and are not cause for rejection.

NOTE: Defective plating bonding to the base surface, indicated by chipping, flaking or separation is cause for rejection.

C. Method No. 403C: Thin Dense Chrome Plated Parts Repair

Repair thin dense chrome plated parts as follows:

NOTE: The following instructions are primarily for the application of a thin chromium coating on low-alloy steels and corrosion-resistant alloys to increase wear resistance.

1 Thickness requirements must be as specified in applicable manual, with a maximum thickness of 0.0005 inch (0.013 mm).

2 When plating thickness is not specified, coating must be 0.0001 to 0.0002 inch (0.003 to 0.005 mm) thick.

3 Plating 0.0001 to 0.0002 inch (0.003 to 0.005 mm) thick will provide wear protection for alloys with a hardness of over Rockwell C40, and a plating thickness of 0.0002 to 0.0005 inch (0.003 to 0.013 mm) will protect alloys with hardness less than Rockwell C40.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine surface to remove damage or remaining plating. Surface finish must be 32 microinches (0.81 micrometers) or better.

NOTE: Make sure all Chrome Plate is removed from surfaces previously plated.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(2) Clean the part. Refer to SECTION II - CLEANING.

(3) Perform magnetic particle or fluorescent penetrant inspection. No cracks permitted. Refer to SECTION III - INSPECTION. Refer to applicable manual.

(4) Surfaces to be plated must be chemically cleaned. Refer to SECTION II - CLEANING.

(5) Mask all areas not to be chrome plated or used for electrical contact.

(a) Masking materials used such as adhesive tape C01-0008, C01-0009, C01-0010; masking wax compound C01-0011, C01-0012; lacquer stop-off C01-0013, or various combinations of those materials must be used to mask the part surfaces. Satisfactory bond is required to prevent plating solution leaks into the masking and touch the part surface.

(b) When plating external surfaces, internal cavities such as inside diameters must be completely masked, or the end must be capped and sealed to prevent plating solution going into the shaft cavity.

(6) Set the part into the tank for plating.

(a) Do not hit the part with the bus bars or tank walls. If it occurs, make sure the hit action did not break the masking. If the masking is broken, remove part from plating process. Clean and remask the area where the masking material is damaged.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS PROCEDURE MUST BE DONE BY AN APPROVED PLATING FACILITY. THE CHEMICALS USED IN THIS PROCEDURE CAN CAUSE SKIN, EYE, AND LUNG DAMAGE.

CAUTION: WHEN THE BASE METAL IS ROCKWELL C40 OR HARDER, THE PART MUST BE STRESS-RELIEVED AT 300˚F (149˚C) FOR 2 HOURS PRIOR TO PLATING.

(7) Apply thin chrome plating. Refer to AMS-2460, Class and Type as specified in applicable manual. Refer to applicable manual for necessary plating thickness.

(8) Remove masking material.

(a) Remove all masking material.

(b) Clean remaining masking material. Refer to SECTION II - CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

CAUTION: WHEN THE BASE METAL IS ROCKWELL C40 OR HARDER, THE PART MUST BE HYDROGEN-EMBRITTLEMENT-RELIEVED WITHIN 4 HOURS AFTER PLATING.

(9) If necessary, stress relieve chrome plating on part for 3 hours minimum at 350 to 400˚F (177 to 204˚C). Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(10) Machine part to finish dimensions. Refer to applicable manual for repaired limits.

(11) Clean the part. Refer to SECTION II - CLEANING.

(12) Do reverse plating to get better wear properties after honing. No measurable dimensional change is permitted.

NOTE: For Class A, chrome plate, reverse after eight to 12 seconds in plating bath with the same fixtures used and at the same current density.

(13) If the part is to be stored, apply a thin coat of corrosion-preventive compound C02-0005 to part and wrap in paper, barrier material C01-0004.

D. Method No. 403D: Metal Spray Repair

NOTE: Electric Arc Spray and Oxyacetylene Metallizing for wire and powder may be used as an alternate method to Metal Spray Repair.

Metal spray repairs should be performed as follows:

WARNING: ALL SAFETY PRECAUTIONS MUST BE OBSERVED WHILE PERFORMING THE FOLLOWING PROCEDURES. SPRAY VAPORS ARE TOXIC AND FLAMMABLE. OBSERVE ALL FIRE PRECAUTIONS. SPRAY EQUIPMENT IN OPERATION EMITS GLARE, INCLUDING ULTRAVIOLET LIGHT, AND A HIGH NOISE LEVEL. PROTECTIVE CLOTHING AND EQUIPMENT MUST BE UTILIZED.

(1) Repair worn or damaged seal surfaces.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(a) Machine surfaces to remove damage or all remaining metal spray. 100 percent clean up is necessary.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(b) If required, perform magnetic particle or fluorescent penetrant inspection. No cracks permitted. Refer to SECTION III – INSPECTION.

NOTE: Do these inspection procedures only for rotating components. Refer to applicable manual.

(c) Clean the part. Refer to SECTION II – CLEANING.

CAUTION: EXERCISE CARE IN MASKING AND SEALING OF PARTS TO MAKE SURE THAT ALL AIR/OIL PORTS, STRUCTURAL OPENINGS, AND RELATED SURFACES OF PARTS ARE PROTECTED FROM OVERSPRAY.

(d) Mask all areas of part not to be grit blasted.

WARNING: USE THE CORRECT PERSONAL PROTECTION. GRIT BLAST PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: DO NOT DISTORT PART DURING GRIT BLAST PROCESS.

(e) Grit blast areas to be metal sprayed to a uniform matte finish with aluminum oxide grit C04-0001.

NOTE: Metal spray process must be applied no more than 2 hours after grit blast. If more time passed, grit blast part again.

(f) Clean part to remove blasting material. Refer to SECTION II – CLEANING.

(g) If necessary, mask again all surfaces not to be metal sprayed.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(h) If necessary, preheat part before application of metal spray bond coat. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. METAL SPRAY CAN CAUSE SKIN, EYE, AND LUNG DAMAGE.

CAUTION: IF SURFACES ARE NOT TO BE METAL SPRAYED IMMEDIATELY, BLASTED SURFACES MUST BE PROTECTED FROM CONTAMINATION UNTIL COATING IS APPLIED.

(i) Apply metal spray bond coat to surfaces. Refer to applicable manual for necessary coating thickness. Use a spray gun. Refer to spray gun manufacturer's recommendations.

WARNING: USE THE CORRECT PERSONAL PROTECTION. METAL SPRAY CAN CAUSE SKIN, EYE, AND LUNG DAMAGE.

CAUTION: IF SURFACES ARE NOT TO BE METAL SPRAYED IMMEDIATELY, BLASTED SURFACES MUST BE PROTECTED FROM CONTAMINATION UNTIL COATING IS APPLIED.

(j) Apply metal spray topcoat to surfaces with sufficient thickness for finish machining. Refer to applicable manual for necessary coating thickness. Refer to manufacturer's recommendations for spray gun application.

WARNING: BEFORE REMOVAL OF MASKING MATERIAL, LET TEMPERATURE OF PART TO SLOWLY DECREASE TO ROOM TEMPERATURE OR AS SPECIFIED IN APPLICABLE MANUAL. HEATED PARTS WILL CAUSE BURNS.

(k) Remove masking material.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(l) Machine surface to finish dimensions. Refer to applicable manual for repaired limits.

(m) Deburr and remove all overspray as necessary.

(2) Repair worn or damaged surfaces (other than seal surfaces).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(a) Machine surfaces to remove damage and/or all remaining metal spray. 100 percent clean up is required.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(b) If necessary, perform magnetic particle or fluorescent penetrant inspection. No cracks permitted. Refer to SECTION III – INSPECTION.

(c) Clean the part. Refer to SECTION II – CLEANING.

CAUTION: EXERCISE CARE IN MASKING AND SEALING OF PARTS TO MAKE SURE THAT ALL AIR/OIL PORTS, STRUCTURAL OPENINGS, AND RELATED SURFACES OF PARTS ARE PROTECTED FROM OVERSPRAY.

(d) Mask all areas of part not to be grit blasted.

WARNING: USE THE CORRECT PERSONAL PROTECTION. GRIT BLAST PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: DO NOT DISTORT PART DURING GRIT BLAST PROCESS.

(e) Grit blast areas to be metal sprayed to a uniform matte finish with aluminum oxide grit C04-0001.

NOTE: Metal spray process must be applied no more than 2 hours after grit blast. If more time passed, grit blast part again.

(f) Clean part to remove blasting material. Refer to SECTION II – CLEANING.

(g) If necessary, mask again all surfaces not to be metal sprayed.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(h) If necessary, preheat part before application of metal spray bond coat. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. METAL SPRAY CAN CAUSE SKIN, EYE, AND LUNG DAMAGE.

CAUTION: IF SURFACES ARE NOT TO BE METAL SPRAYED IMMEDIATELY, BLASTED SURFACES MUST BE PROTECTED FROM CONTAMINATION UNTIL COATING IS APPLIED.

(i) Apply metal spray to surfaces with sufficient thickness for finish machining. Refer to applicable manual for necessary coating thickness. Refer to manufacturer's recommendations for metal spray application.

WARNING: BEFORE REMOVAL OF MASKING MATERIAL, LET TEMPERATURE OF PART TO SLOWLY DECREASE TO ROOM TEMPERATURE OR AS SPECIFIED IN APPLICABLE MANUAL. HEATED PARTS WILL CAUSE BURNS.

(j) Remove masking material.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(k) Machine surface to finish dimensions. Refer to applicable manual for repaired limits.

(l) Deburr and remove all overspray as necessary.

E. Method No. 403E: Dry-film Lubricant Repair

Dry-film lubricant repairs should be performed as follows:

CAUTION: DO NOT REMOVE COATING OF THE PART.

(1) Abrade surface to remove remaining dry-film lubricant. Use abrasive cloth C08-0001.

NOTE: Let surface of the part fully dry before continue to Step (2).

(2) Clean abraded surface. Refer to SECTION II-CLEANING.

(3) Procure lubricant specified in applicable manual.

(4) Mix dry-film lubricant. Refer to manufacturer’s recommendations.

(5) Mask all surfaces not to be repaired.

WARNING: USE LUBRICANT IN A WELL-VENTILATED AREA. DO NOT PERMIT CHEMICAL TO TOUCH EYES OR SKIN. DO NOT BREATHE VAPORS. DO NOT USE NEAR OPEN FLAME OR HIGH TEMPERATURES.

(6) Apply dry-film lubricant with thickness and equipment, as specified in applicable manual. Refer to recommendations of the manufacturer.

NOTE: Application of dry-film lubricant must be done within 8 hours after completion of cleaning procedure. If done differently, part must be cleaned again.

(7) Let lubricant dry as specified in applicable manual. Refer to recommendations of the manufacturer.

(8) Cure dry-film lubricant in oven as specified in applicable manual. Refer to recommendations of the manufacturer.

(9) Visually check the repaired part. Refer to applicable manual for repaired limits.

F. Method No. 403F: Plasma Spray Repair

NOTE: Electric Arc Metallizing may be used as an alternative method to Plasma Spray Repair.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine surfaces to remove damage or all remaining plasma spray. 100 percent clean up is necessary.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(2) If necessary, perform magnetic particle or fluorescent penetrant inspection. No cracks are permitted. If you find cracks replace the part. Refer to SECTION III – INSPECTION.

NOTE: Do these inspection procedures only for rotating components. Refer to applicable manual.

(3) Clean the part. Refer to SECTION II – CLEANING.

CAUTION: EXERCISE CARE IN MASKING AND SEALING OF PARTS TO MAKE SURE THAT ALL AIR/OIL PORTS, STRUCTURAL OPENINGS, AND RELATED SURFACES OF PARTS ARE PROTECTED FROM OVERSPRAY.

(4) Mask all areas not to be grit blasted.

NOTE: Do not use metal abrasive alloys for grit blast process.

WARNING: USE THE CORRECT PERSONAL PROTECTION. GRIT BLAST PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET INTO YOUR EYES.

CAUTION: DO NOT DISTORT PART DURING GRIT BLAST PROCESS.

(5) Grit blast areas to be plasma sprayed to a uniform matte finish with aluminum oxide grit C04-0001.

NOTE: Plasma spray process must be applied no more than 2 hours after grit blast. If more time passed, the part must be grit blasted again.

(6) Clean part to remove blasting material. Refer to SECTION II – CLEANING.

(7) If necessary, mask again all surfaces not to be plasma sprayed.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(8) If necessary, preheat part before application of plasma spray bond coat. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PLASMA SPRAY CAN CAUSE SKIN, EYE AND LUNG DAMAGE.

CAUTION: IF SURFACES ARE NOT TO BE PLASMA SPRAYED IMMEDIATELY, BLASTED SURFACES MUST BE PROTECTED FROM CONTAMINATION UNTIL COATING IS APPLIED.

(9) Apply plasma spray to surfaces with sufficient thickness for final machining. Refer to applicable manual for required coating thickness.

WARNING: BEFORE REMOVAL OF MASKING MATERIAL, LET TEMPERATURE OF PART TO SLOWLY DECREASE TO ROOM TEMPERATURE OR AS SPECIFIED IN APPLICABLE MANUAL. HEATED PARTS WILL CAUSE BURNS.

(10) Remove masking material.

WARNING: BEFORE REMOVAL OF MASKING MATERIAL, LET TEMPERATURE OF PART TO SLOWLY DECREASE TO ROOM TEMPERATURE OR AS SPECIFIED IN APPLICABLE MANUAL. HEATED PARTS WILL CAUSE BURNS.

(11) Machine surface to finish dimensions. Refer to applicable manual for repaired limits.

(12) Deburr and remove all overspray as necessary.

G. Method No. 403G: Abradable Coating Surface Wear Repair

NOTE: Refer to manufacturer recommendations to know product shelf life of adhesive C01-0001 and abradable coating compound C03-0001.

NOTE: Discard adhesive and compound that are more than product shelf life or becomes too thick to spread or handle without crumbling.

NOTE: Allow adhesive or compound to warm to room temperature prior to application. Refer to manufacturer recommendations. Discard remaining material, which was heated for application.

Abradable coating surface wear repairs should be performed as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE. OBSERVE FIRE PRECAUTIONS.

(1) Clean uncured adhesive and compound from application equipment. Use Toluene C08-0018.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(2) Machine surfaces to remove damage or remaining abradable coating. 100 percent clean up is necessary.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in the applicable manual.

(3) If necessary, perform magnetic particle or fluorescent penetrant inspection. No cracks permitted. Refer to SECTION III – INSPECTION. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. GRIT BLAST PROCEEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: DO NOT DISTORT PART DURING GRIT BLAST PROCESS.

(4) Grit blast areas to be coated to a uniform matte finish with aluminum oxide grit C04-0001.

(5) Clean part. Refer to SECTION II – CLEANING.

(6) If surfaces are not immediately coated, cover prepared surfaces from contamination with clean paper.

NOTE: Do not touch prepared surface with bare hands.

(7) Apply a thin coat of adhesive, C01-0001 of approximately 0.005 inch (0.13 mm) thick, to prepared surface with a spatula. Coating must have a rough surface texture before you apply the abradable coating compound.

(8) Apply abradable coating compound C03-0001 over adhesive. Use pressure extrusion gun with special fan shaped extrusion nozzle. Apply on repaired surface more than 0.030 inch (0.76 mm) of necessary coating for finish machining.

(9) Lightly press coating surface. Use a spatula moistened with toluene C08-0018. Drag spatula over coating surface at a slight angle.

NOTE: Do this procedure to make sure that there is contact between the abradable coating compound and adhesive.

(10) Cure abradable coating at 225 to 275˚F (107 to 135˚C) for 2 hours. Then cure for one more hour at 325 to 375˚F (163 to 191˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(11) Machine surfaces to finish dimensions. Refer to applicable manual for repaired limits.

(12) Check abradable coating as follows:

(a) Visually check abradable coatings for uniformity in color, texture, and composition.

(b) Check appearance of dark spots or streaks in coating with a metal probe to determine cure. Coatings with soft spots are not permitted.

(c) Visually check coatings for voids. Voids more than one-quarter inch in size maximum or closer than 1 inch (25.4 mm) are not permitted. Groups of smaller voids are acceptable.

(13) Abrade and prepare areas that contain no permitted voids. Use a wire brush.

(14) Clean the part and let dry. Refer to SECTION II – CLEANING.

(15) Use a spatula and fill voids with abradable coating compound C03-0001. Make sure not to collect air. Fill void with sufficient compound for finish machining.

(16) Cure abradable coating at 225 to 275˚F (107 to 135˚C) for 2 hours. Then cure for one more hour at 325 to 375˚F (163 to 191˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(17) Machine repaired surfaces to finish dimensions. Refer to applicable manual for repaired limits.

H. Method No. 403H: Silver Plating Repair

NOTE: If the type of silver plating is not specified in applicable manual, Type I, II, or III is acceptable.

NOTE: Plating thickness, unless otherwise specified in applicable manual, must be 0.0005 inch (0.013 mm) minimum on all surfaces on which silver is functionally necessary.

Silver plating types:

Type I - Matte	Deposits without luster comparable to those normally obtained from silver-cyanide plating solutions operated with brighteners.
Type II - Semi-bright	Semi-lustrous deposits comparable to those normally obtained from silver-cyanide plating solutions operated with brighteners.
Type III - Bright	Sometimes obtained by polishing or by use of brightener.

Silver plating grades:

Grade A	With supplementary tarnish-resistant treatment (chromate treated).
Grade B	Without supplementary tarnish-resistant treatment.

Repair silver plated parts as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine surface to remove damage or all remaining plating. Surface finish must be 80 microinches (2 micrometers) or better.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(2) Clean the part. Refer to SECTION II – CLEANING.

(3) If necessary, perform magnetic particle or fluorescent penetrant inspection. No cracks are permitted. Refer to SECTION III – INSPECTION.

(4) Clean the part. Refer to SECTION II – CLEANING.

(5) Mask all areas not to be silver plated.

CAUTION: WHEN THE BASE METAL IS ROCKWELL C40 OR HARDER, THE PART MUST BE STRESS-RELIEVED AT 300˚F (149˚C) FOR 2 HOURS PRIOR TO PLATING.

(6) Apply silver plating to surfaces of the part. Refer to ASTM B700, for necessary plating thickness.

(7) Remove masking material.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

CAUTION: WHEN THE BASE METAL IS ROCKWELL C40 OR HARDER, THE PART MUST BE HYDROGEN-EMBRITTLEMENT-RELIEVED WITHIN 4 HOURS AFTER PLATING.

(8) Stress relieve silver plating on parts as follows. Refer to applicable manual.

(a) For parts with Rockwell C40-54 hardness, stress relieve for 3 hours at 365 to 385˚F (185 to 196˚C).

(b) For parts with Rockwell C55 and harder, stress relieve for 5 hours at 265 to 285˚F (129 to 141˚C).

(9) Visually check plating for quality, coating thickness, roughness, adhesion, and solderability. Refer to ASTM B700.

(10) Store silver plated part in a container to prevent entrance of sulphur-bearing atmosphere.

I. Method No. 403I: Electroless Nickel Plating

CAUTION: BECAUSE OF MASKING PROBLEMS, IN MANY CASES ELECTROLESS NICKEL PLATE IS NOT THE MOST DESIRABLE REPAIR METHOD. MASKING MUST BE CONSIDERED FIRST.

NOTE: Electroless nickel plate can be used to repair dimensions on parts that are out of manual limits. Refer to AMS 2404, Class as applicable.

NOTE: Nickel plate may be applied to a thickness of 0.0002 to 0.0005 inch (0.005 to 0.013 mm), but if thickness is more than 0.0005 inch (0.013 mm), it is necessary to do additional machining to get the necessary finish dimensions.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine surfaces to remove damage or all remaining abradable plating. 100 percent clean up is necessary.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual. Keep stock removal uniform to facilitate plating.

(2) Clean the part. Refer to SECTION II – CLEANING.

(3) If necessary, perform magnetic particle or fluorescent penetrant inspection. No cracks are permitted. Refer to SECTION III – INSPECTION.

NOTE: Do these inspection procedures only for rotating components. Refer to applicable manual.

(4) Clean the part. Refer to SECTION II – CLEANING.

(5) Mask all areas not to be plated.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) If necessary, preheat part before application of plating as specified in AMS 2404. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS PROCEDURE MUST BE DONE BY AN APPROVED PLATING FACILITY. THE CHEMICALS USED IN THIS PROCEDURE CAN CAUSE SKIN, EYE, AND LUNG DAMAGE.

(7) Apply electroless nickel plating. Refer to AMS 2404, Class as specified in applicable manual. Refer to applicable manual for required plating thickness.

(8) Remove masking material.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(9) If necessary, heat treat the part as specified in AMS 2404. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(10) Machine surface to finish dimensions. Refer to applicable manual for repaired limits and surface finish.

(11) Clean the part. Refer to SECTION II – CLEANING.

J. Method No. 403J: Selective Electroplating

NOTE: If parts out of applicable manual limits, selective plating can be used to repair dimensions. Refer to AMS 2451 applicable specifications.

NOTE: If surface to be to be repaired is in the applicable manual requirements, but out of dimensional limits, selective plating can be applied to a thickness of 0.0002 to 0.010 inch (0.005 to 0.25 mm). If a sequence of grind-plate-grind is to be used, the minimum plate thickness must be 0.001 inch (0.03 mm).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine surfaces to remove damage or all remaining coating. 100 percent clean up is necessary.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual. Keep stock removal uniform to facilitate plating.

(2) If necessary, perform magnetic particle or fluorescent penetrant inspection. No cracks are permitted. Refer to SECTION III – INSPECTION.

NOTE: Do these inspection procedures only for rotating components. Refer to applicable manual.

(3) Clean the part. Refer to SECTION II – CLEANING.

(4) Mask all areas not to be plated.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(5) If necessary, preheat part before application of plating in accordance with AMS 2451. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS PROCEDURE MUST BE DONE BY AN APPROVED PLATING FACILITY. THE CHEMICALS USED IN THIS PROCEDURE CAN CAUSE SKIN, EYE, AND LUNG DAMAGE.

(6) Apply electroless nickel plating. Refer to AMS 2451. Refer to applicable manual for necessary plating thickness.

(7) Remove masking material.

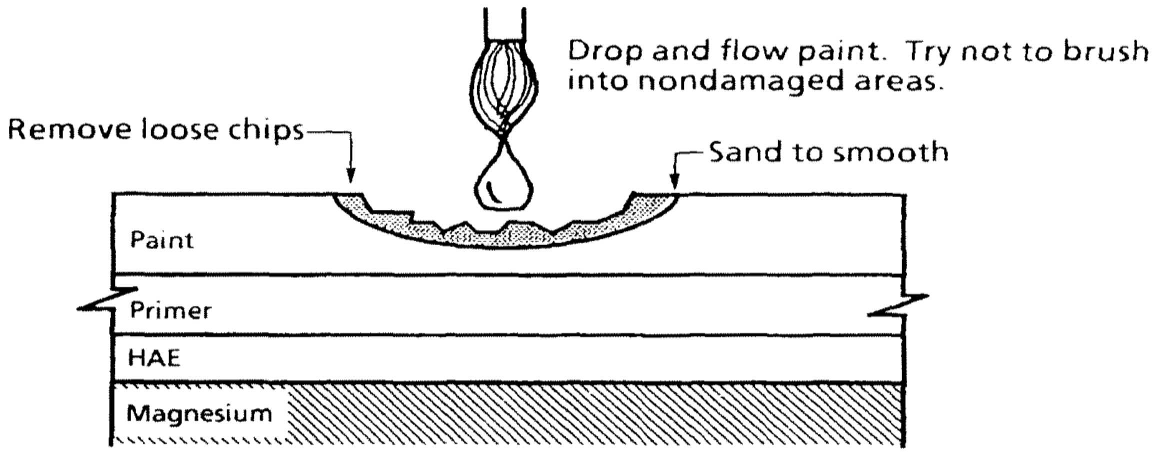
WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(8) If necessary, increase the temperature of the repaired part as specified in AMS 2451. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

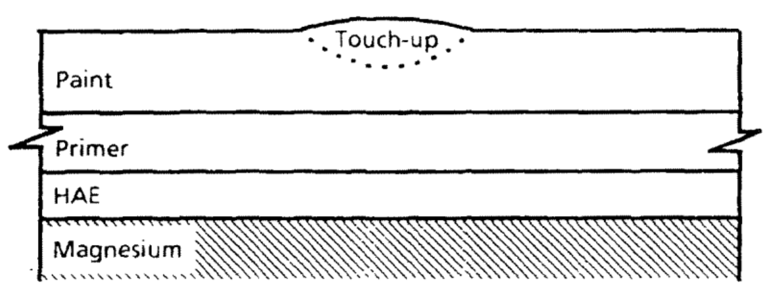
(9) Machine surfaces to finish dimensions. Refer to applicable manual for repaired limits and surface finish.

(10) Clean the part. Refer to SECTION II – CLEANING.



Touch-Up Application
Figure 401

NOTE:
1. Drop and flow paint. Make sure not to brush into other areas.
2. Hand abrade to make surface smooth.
3. Remove loose chips.



Touch-Up Results
Figure 402

K. Method No. 403K: Repair of Damaged Paint Coatings - Epoxy-Amine Systems

(1) Remove loose and chipped paint. Hand abrade with abrasive paper C08-0004.

(2) Remove unwanted dust with dry clean compressed air.

(3) Lightly hand abrade to feather edges of paint. Use 600 grit (wet-or-dry) abrasive paper C08-0022.

(4) Use a cloth soaked with acetone C08-0005 or ketone C04-0003, to clean the surface to be repaired.

CAUTION: POT LIFE OF MIXED MATERIALS IS 8 HOURS. ADHERE STRICTLY TO POT LIFE LIMIT OF MIX; MARK TIME AND DATE ON CUP. ABSOLUTELY DO NOT REFRIGERATE OR ADD SOLVENT TO EXTEND TIME.

(5) Touch-up damaged paint with an airbrush or soft brush. Do not use cotton swabs. Airbrushing is the recommended method. Refer to Figures 401 and 402.

(a) Refer to applicable manual for required paint.

(b) Mix base resin and catalyst thinner fully and let 45 minutes reaction time before you apply the mixture.

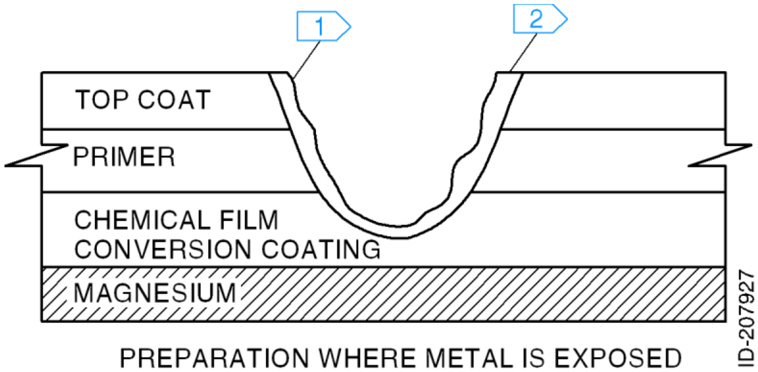
NOTE: For mixture and cure of paint, refer to the applicable paint specification. Mix materials at room temperature (67 to 87°F (19 to 31°C)).

(6) Dry painted part at room temperature for 20 to 30 minutes before curing with a heat gun.

(7) Cure paint with a heat gun.

(a) Let a 10 to 12 inches (254 to 305 mm) distance from the end of the heat gun to the painted surface, at maximum temperature of 200˚F (93˚C).

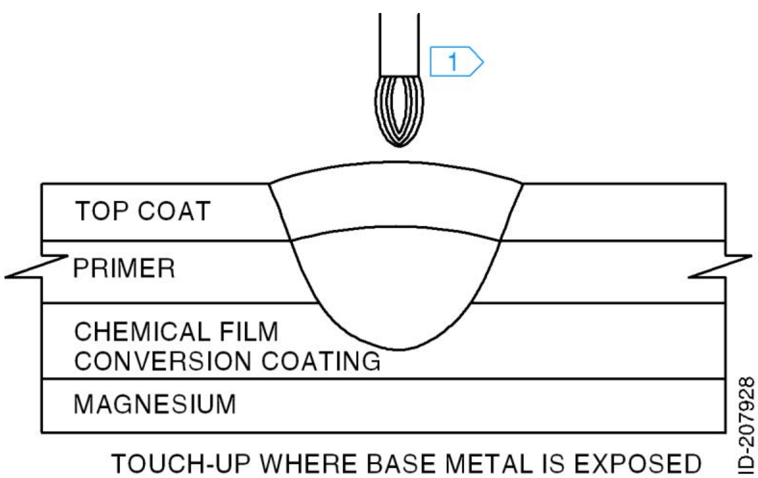
(b) Use heat during 30 to 45 minutes to cure the part. Paint must be fully cured before packaging the part.



NOTE: 1. Remove loose chips.

2. Hand abrade to make surface rough.

Touch-Up Preparation of Damaged Paint Coating, Exposing Bare Magnesium
Figure 403



NOTE: 1. Drop and flow paint. Make sure not to brush into other areas.

Touch-Up Repair of Damaged Paint Coating, Exposing Bare Magnesium
Figure 404

L. Method No. 403L: Repair of Paint Coatings Damaged Through Primer and Paint Topcoat, Exposing Bare Magnesium - Epoxy-Amine Systems

(1) Remove loose and chipped paint to bare metal.

(2) Remove unwanted dust with dry clean compressed air.

(3) Lightly hand abrade edges of paint to make surface rough. Use a 240-grit (wet-or-dry) abrasive paper C08-0021. Refer to Figures 403 and 404.

(4) Use a cloth soaked with acetone C08-0005, or ketone C04-0003, to clean the surface to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(5) Chemical film touch-up bare magnesium surfaces. Refer to Method No. 403O. Apply both Dow-1 and Dow-19 solutions.

CAUTION: POT LIFE OF MIXED MATERIALS IS 8 HOURS. ADHERE STRICTLY TO POT LIFE LIMIT OF MIX; MARK TIME AND DATE ON CUP. ABSOLUTELY DO NOT REFRIGERATE OR ADD SOLVENT TO EXTEND TIME.

(6) Touch-up damaged coatings with an airbrush or soft brush. Do not use cotton swabs. Airbrushing is the recommended method. Refer to Figures 403 and 404.

(a) Refer to applicable manual for required primer and paint topcoat.

(b) Mix base resin and catalyst thinner fully and let 45 minutes reaction time before you apply the mixture.

(c) Apply primer and paint topcoat. Refer to manufacturer recommendations.

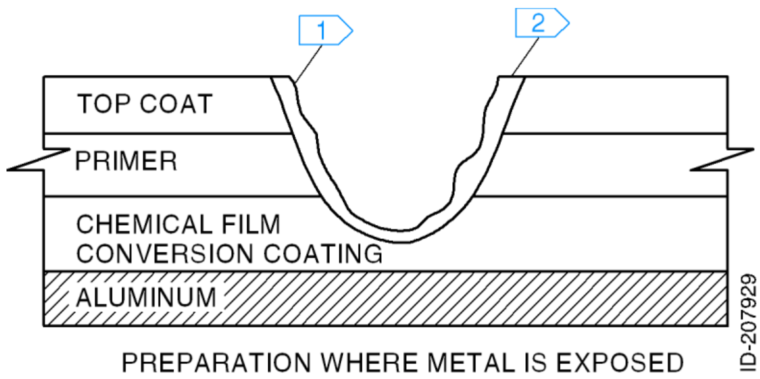
NOTE: For mixture and cure of paint, refer to the applicable paint specification. Mix materials at room temperature (67 to 87°F (19 to 31°C)).

(7) Dry painted part at room temperature for 60 minutes before curing of painted part.

(8) Cure paint with a heat gun.

(a) Let a 10 to 12 inches (254 to 305 mm) distance from the end of heat gun to the painted surface, at maximum temperature of 200˚F (93˚C).

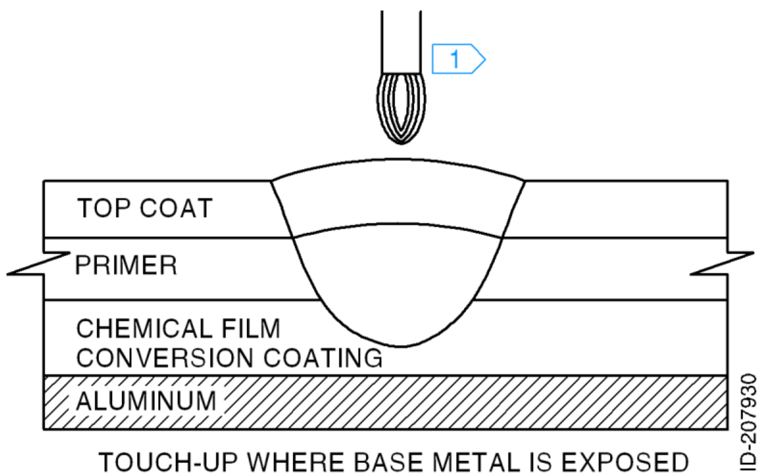
(b) Use heat during 30 to 45 minutes to cure part. Paint must be fully cured before packaging the part.



NOTE: 1. Remove loose chips.

2. Hand abrade to make surface rough.

Touch-Up Preparation of Damaged Paint Coating, Exposing Bare Aluminum
Figure 405



NOTE: 1. Drop and flow paint. Make sure not to brush into other areas.

Touch-Up Repair of Damaged Paint Coating, Exposing Bare Aluminum
Figure 406

M. Method No. 403M: Repair of Paint Coatings Damaged Through Primer and Paint Topcoat, Exposing Bare Aluminum - Epoxy-Amine Systems

(1) Remove loose and chipped paint to bare metal.

(2) Remove unwanted dust with dry clean compressed air.

(3) Lightly hand abrade edges of paint to make surface rough. Use 320 to 600–grit (wet-or-dry) abrasive paper. Refer to Figures 405 and 406.

(4) Use a cloth soaked with acetone C08-0005 or ketone C04-0003, to clean the surface to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(5) Chemical film touch-up bare aluminum surfaces. Refer to Method No. 403N.

CAUTION: POT LIFE OF MIXED MATERIALS IS 8 HOURS. ADHERE STRICTLY TO POT LIFE LIMIT OF MIX; MARK TIME AND DATE ON CUP. ABSOLUTELY DO NOT REFRIGERATE OR ADD SOLVENT TO EXTEND TIME.

(6) Touch-up damaged coatings with an airbrush or soft brush. Do not use cotton swabs. Airbrushing is the recommended method. Refer to Figures 405 and 406.

(a) Refer to applicable manual for required primer and paint topcoat.

(b) Mix base resin and catalyst thinner fully and let 45 minutes reaction time before you apply the mixture.

(c) Apply primer and paint topcoat. Refer to manufacturer recommendations.

NOTE: For mixture and cure of paint, refer to the applicable paint specification. Mix materials at room temperature (67 to 87˚F (19 to 31˚C)).

(7) Dry painted part at room temperature for 60 minutes before curing of painted part.

(8) Cure paint with a heat gun.

(a) Let 10 to 12 inches (254 to 305 mm) distance from end of heat gun to painted surface, at maximum temperature of 200˚F (93˚C).

(b) Use heat for 30 to 45 minutes to cure part. Paint must be fully cured before packaging the part.

N. Method No. 403N: Chemical Film Touch-Up of Aluminum

(1) Remove unwanted dust with dry clean compressed air.

(2) Use a cloth soaked with acetone C08-0005, isopropyl alcohol C04-0004, or ketone C04-0003, to clean the surface to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(3) Apply Aluminum touch-up solution on surface to be painted. Refer to MIL-DTL-5541, Class 1A, or AMS 2473.

(a) Mix chemical conversion material fully. Refer to Method No. 402E.

(b) With an applicator pen or presaturated applicator device, apply chemical solution on bare metal. Refer to manufacturer instructions.

(c) Let coated parts dry at maximum temperature of 140˚F (60˚C) to make sure that the coating application was satisfactory. Refer to manufacturer recommendations.

O. Method No. 403O: Chemical Film Touch-Up of Magnesium

(1) Remove unwanted dust with dry clean compressed air.

CAUTION: METHANOL (METHYL OR WOOD ALCOHOL) MUST NOT BE USED AS A CLEANING AGENT WHEN CLEANING MAGNESIUM PARTS. PROLONGED CONTACT WITH UNPROTECTED MAGNESIUM PARTS WILL DESTROY THE PARTS. USE OF METHANOL WITH MAGNESIUM PARTS IS AUTHORIZED, ONLY AS SPECIFICALLY INSTRUCTED FOR REPAIR OF CORRODED SURFACES.

(2) Use a cloth soaked with acetone C08-0005, isopropyl alcohol C04-0004, or ketone C04-0003, to clean the surface to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(3) Apply magnesium touch-up solution (Dow-1) on surface to be repaired. Refer to AMS-M-3171, Type I.

NOTE: Apply this solution only if it is specified in applicable manual.

(a) Mix chemical conversion material fully. Refer to Method No. 402G.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE, AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(b) With a brush, apply magnesium touch-up solution on bare metal. Refer to manufacturer instructions.

NOTE: Touch-up the surface for 1 to 3 minutes minimum, to make sure that the surface is fully wet.

(c) Flush the surface in running water for 1 minute minimum.

(d) Dry the surface. Refer to Step (5).

(4) Apply magnesium touch-up solution (Dow-19) on surface to be repaired. Refer to AMS-M-3171, Type VI, or FP5003, Type VI.

NOTE: Apply this solution only if it is specified in applicable manual.

(a) Mix chemical conversion material fully. Refer to Method No. 402H.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE, AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(b) With a brush, apply magnesium touch-up solution on bare metal. Refer to manufacturer instructions.

NOTE: Touch-up the surface for 30 seconds to 3 minutes minimum, to make sure that the surface is fully wet.

(c) Flush the surface in running water for 1 minute minimum.

(d) Deleted.

(e) Dry the surface. Refer to Step (5).

(5) Dry the surfaces as follows:

NOTE: Deleted.

(a) Use a heat gun to dry the surface with hot air for 10 to 15 minutes. Make sure that the surface temperature is not more than 250˚F (121˚C).

(b) Dry the part in an oven for 90 minutes minimum. Make sure that the surface temperature is not more than 225 to 275˚F (107 to 135˚C).

P. Method No. 403P: Water Jet Strip (Machine) Thermal Sprayed Coatings from Components.

NOTE: Use equipment manufacture specifications for proper operation and process.

CAUTION: Use care to prevent removal of parent material or damage to the part.

(1) Strip thermal sprayed coatings from component as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT REMOVE MATERIAL WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(a) Place component in restraining fixture.

(b) Mask areas of component not to be sprayed.

(c) Mount the restraining fixture with the component to a variable speed rotating table or horizontal lathe in spray enclosure.

(d) There must be work instructions to define the water jet parameters.

(e) Controls (i.e., inspection, process parameters, training, documented procedures) must be in place to make sure the base material is protected from erosion during coating removal.

NOTE: Stand-off distance and traverse speed vary depending on coating type and size of component.

NOTE: The jet nozzle head (stream) should typically be at, or near, a 90 degree angle to the material being stripped.

(f) The jet nozzle may need to be cycled several passes for even removal. Visually inspect the component between each cycle until all of the coating is removed.

(g) Component dimensional requirements must be maintained.

4. Repairing Aluminum Parts

A. Method No. 404A: Minor Surface Defect Repair

Repair minor surface defects on aluminum-alloy parts as follows:

WARNING: DO NOT BREATHE THE PARTICLES FROM HAND FINISHING OR LET THE PARTICLES TOUCH YOU. PARTICLES FROM HAND FINISHING CAN CAUSE DAMAGE, INJURY, OR IRRITATION. USE PERSONAL PROTECTION EQUIPMENT. USE LOCAL MECHANICAL EXHAUST VENTILATION OR AN APPROVED RESPIRATOR.

CAUTION: BEFORE START WORKING, MAKE SURE THAT THE PART DOES NOT CONTAIN CRACKS. USE THE APPLICABLE FPI OR MPI PROCESS SPECIFIED IN APPLICABLE TECHNICAL MANUAL.

CAUTION: WHEN YOU DO THIS PROCEDURE, MAKE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABUSIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIRED PART.

(1) Blend minor surface burrs, scratches, or galling to provide a smooth transition with the surface. Use an abrasive cloth (C08-0001).

NOTE: Remove minor surface defects only if the defect is detrimental to operation and removal will not cause or increase leakage or compromise sealing functions.

NOTE: Non-toleranced enclosed areas defined in hand finish repairs are to corners, points of tangency between surfaces or at points, opposite one of these locations. Enclosed areas will assume a tolerance of plus 0.125 inch (3.17 mm) in all directions unless adjacent areas are specified as areas where hand finishing is not permitted.

NOTE: Hand finishing can be done with more than one grade of abrasive cloth (coarse to fine, as necessary) to remove damage and get the specified surface finish. Make sure to start with the minimum aggressive abrasive cloth needed to remove the damage.

(2) Hand finish sharp edges with an abrasive cloth C08-0001. Use coarse grades of abrasive cloth for fast metal removal. To give a smooth surface finish to the part use fine grades of abrasive cloth.

NOTE: Refer to the applicable Technical Manual for specific instructions on hand finish limits applicable to each part of the engine.

(a) When hand finishing a cylindrical part, hand finish in a circumferential direction, not along the axis of the part.

(b) When hand finishing on a part involving radius, keep the radius as specified in the applicable Technical Manual. If the radius is not specified, keep it as close as possible to the original contour. If necessary, refer to a similar part to determine original radius.

(3) Treat surfaces where base metal is exposed, as follows:

(a) Clean the part. Refer to SECTION II - CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. ALKALINE CLEANING SOLUTIONS ARE HAZARDOUS. AVOID INHALING FUMES OR MIST. AVOID CONTACT WITH SKIN. AFTER USE, WASH HANDS AND FACE THOROUGHLY.

(b) Put the part fully in alkaline cleaner solution for 10 to 15 minutes. Refer to Method No. 402A.

(c) Scrub surface with a stiff bristled brush C08-0031 to remove surface contamination.

(d) Rinse the part in warm tap water at 80 to 110˚F (27 to 43˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(e) Dry the part with dry, filtered, compressed low pressure air at 20 PSIG (138 kPa) maximum.

(f) Chemical film touch-up areas where base metal is exposed. Refer to Method No. 403N.

(g) Let repaired area to stay wet for 1 minute.

(h) Rinse the part in warm water at 80 to 110˚F (27 to 43˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(i) Dry the part with dry, filtered, compressed low pressure air at 20 PSIG (138 kPa) maximum or oven dry for 30 minutes at 175 to 225˚F (79 to 107˚C).

B. Method No. 404B: Heavy Corrosion, Hard Carbon, Paint, and Scale Removal

Remove heavy corrosion, hard carbon, paint, and scale from aluminum-alloy parts as follows:

CAUTION: MAKE SURE TO TAKE CARE IN MASKING AND SEALING OF PARTS TO MAKE SURE ALL AIR/OIL PORTS, STRUCTURAL OPENINGS, AND RELATED SURFACES OF PARTS ARE PROTECTED FROM OVERBLAST.

(1) Mask all surfaces that can be damaged with the abrasive blasting.

(2) Put the part in a standard sandblast cabinet.

(3) Set sandblast cabinet pressure to 15 to 30 PSIG (103 to 207 kPa).

WARNING: USE THE CORRECT PERSONAL PROTECTION. GRIT BLAST PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: KEEP SANDBLAST NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(4) Sandblast the part with sand blast media C04-0038. Air pressure must be reduced as required to control the action on base metal of part.

(5) Remove the part from sandblast cabinet, remove unwanted sand blast with clean compressed air.

C. Method No. 404C: Gouge and Scoring Repair

Repair gouges, scoring, etc., on aluminum-alloy parts as follows:

CAUTION: THIS REPAIR METHOD MUST NOT BE USED ON ALUMINUM-ALLOY PARTS REQUIRED IN A STRUCTURAL LOCATION.

(1) Hand finish damaged areas to remove raised metal. Refer to Method No. 404A.

(2) Clean part in accordance with SECTION II – CLEANING.

(3) Mask all areas not to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

WARNING: THIS IS IMPORTANT. HEAT BUILD UP DURING OR AFTER MIXING IS NORMAL. DO NOT MIX QUANTITIES GREATER THAN 450 GRAMS AS DANGEROUS HEAT BUILD UP CAN OCCUR CAUSING UNCONTROLLED DECOMPOSITION OF THE MIXED ADHESIVE. TOXIC FUMES CAN OCCUR, RESULTING IN PERSONAL INJURY. MIXING SMALLER QUANTITIES WILL MINIMIZE THE HEAT BUILD UP.

CAUTION: DO NOT EXCEED TEMPERATURE LIMITATIONS DURING CURE PERIOD.

(4) Prior to mixing, make sure that the temperature of the separate epoxy paste adhesive components C01-0002 (Parts A and B) are close to room temperature 77˚F (25˚C). Combine Parts A and B in correct ratio and mix thoroughly.

Mix Ratio	Part A	Part B
By Weight	100	20
Pot Life:	8 hours at 77˚F (25˚C)	

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: MAKE SURE TO TAKE CARE IN APPLYING EPOXY PASTE ADHESIVE TO MINIMIZE THE TRAPPING OF AIR.

(5) Apply epoxy paste adhesive C01-0002 with sufficient thickness for finish machine. Use a spatula for epoxy paste adhesive application.

NOTE: Uncured epoxy paste adhesive C01-0002 can be cleaned from work area and application equipment using denatured alcohol.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) Cure epoxy paste adhesive C01-0002 in an oven for 1 hour at 200˚F (93˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) Machine the part to finish dimensions. Refer to applicable Technical Manual for repaired limits.

(8) Examine machined part as follows:

(a) Examine porosities or voids of 0.015 inch (0.38 mm) minimum diameter only. Do not consider porosities of voids smaller than specified during evaluation.

(b) Porosities or voids of 0.080 inch (2.03 mm) maximum diameter are permitted. Two porosities or voids, or all number of smaller porosities or voids with a combined area no larger than specified in a 0.50 X 0.50 inch (12.7 X 12.7 mm) area are permitted.

(c) No porosities, voids, or chipping down to parent metal is permitted.

(9) Clean the part. Refer to SECTION II – CLEANING.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: MAKE SURE TO TAKE CARE IN APPLYING EPOXY PASTE ADHESIVE TO MINIMIZE THE TRAPPING OF AIR.

(10) If required, apply epoxy paste adhesive C01-0002 to porosity and/or voids with sufficient thickness for finish machine.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

CAUTION: DO NOT EXCEED TEMPERATURE LIMITATIONS DURING CURE PERIOD.

(11) Cure epoxy paste adhesive C01-0002 in an oven for 1 hour at 200˚F (93˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(12) Machine the part to finish dimensions. Refer to applicable Technical Manual for repaired limits.

(13) Chemical film touch-up bare metal surfaces. Refer to Method No. 403N.

D. Method No. 404D: Fuel and Oil Pump Aluminum Housing Surface Repair

Repair worn and/or damaged surfaces on aluminum fuel and oil pump housings as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine the surfaces to remove damage. One-hundred-percent clean up is required.

NOTE: Make sure minimum stock material is removed. Do not machine more than the limits specified in applicable manual.

(2) Clean the part. Refer to SECTION II – CLEANING.

CAUTION: MAKE SURE TO TAKE CARE IN MASKING AND SEALING OF PARTS TO MAKE SURE ALL AIR/OIL PORTS, STRUCTURAL OPENINGS, AND RELATED SURFACES OF PARTS ARE PROTECTED FROM OVER BLAST.

(3) Mask all areas not to be grit blasted.

(4) Put the part in a standard sandblast cabinet.

WARNING: USE THE CORRECT PERSONAL PROTECTION. GRIT BLAST PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: KEEP SANDBLAST NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(5) Grit blast areas to be repaired to a uniform matte finish. Use aluminum oxide grit C04-0002.

NOTE: Air pressure can be reduced as required to control action on base metal.

(6) Clean the part. Refer to SECTION II – CLEANING.

(7) If required, mask again all surfaces not to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

WARNING: THIS IS IMPORTANT. HEAT BUILD UP DURING OR AFTER MIXING IS NORMAL. DO NOT MIX QUANTITIES GREATER THAN 450 GRAMS AS DANGEROUS HEAT BUILD UP CAN OCCUR CAUSING UNCONTROLLED DECOMPOSITION OF THE MIXED ADHESIVE. TOXIC FUMES CAN OCCUR, RESULTING IN PERSONAL INJURY. MIXING SMALLER QUANTITIES WILL MINIMIZE THE HEAT BUILD UP.

CAUTION: DO NOT EXCEED TEMPERATURE LIMITATIONS DURING CURE PERIOD.

(8) Prior to mixing, make sure that the temperature of the separate epoxy paste adhesive components C01-0002 (Parts A and B) are close to room temperature 77˚F (25˚C). Combine Parts A and B in correct ratio and mix thoroughly.

Mix Ratio	Part A	Part B
By Weight	100	20
Pot Life:	8 hours at 77˚F (25˚C)	

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: MAKE SURE TO TAKE CARE IN APPLYING EPOXY PASTE ADHESIVE TO MINIMIZE THE TRAPPING OF AIR.

(9) Apply epoxy paste adhesive C01-0002 with sufficient thickness for finish machine. Use a spatula for epoxy paste adhesive application.

NOTE: Uncured epoxy paste adhesive C01-0002 can be cleaned from work area and application equipment using denatured alcohol.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(10) Cure epoxy paste adhesive C01-0002 in an oven for 1 hour at 200˚F (93˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(11) Machine the part to finish dimensions. Refer to applicable Technical Manual for repaired limits.

(12) Examine machined part as follows:

(a) Examine porosities or voids of 0.015 inch (0.38 mm) minimum diameter only. Do not consider porosities of voids smaller than specified during evaluation.

(b) Porosities or voids of 0.080 inch (2.03 mm) maximum diameter are permitted. Two porosities or voids, or all number of smaller porosities or voids with a combined area no larger than specified in a 0.50 X 0.50 inch (12.7 X 12.7 mm) area are permitted.

(c) No porosities, voids, or chipping down to parent metal are permitted.

(13) Clean the part. Refer to SECTION II – CLEANING.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: MAKE SURE TO TAKE CARE IN APPLYING EPOXY PASTE ADHESIVE TO MINIMIZE THE TRAPPING OF AIR.

(14) If required, apply epoxy paste adhesive C01-0002 to porosity and/or voids with sufficient thickness for finish machine.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

CAUTION: DO NOT EXCEED TEMPERATURE LIMITATIONS DURING CURE PERIOD.

(15) Cure epoxy paste adhesive C01-0002 in an oven for 1 hour at 200˚F (93˚C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(16) Machine the part to finish dimensions. Refer to applicable Technical Manual for repaired limits.

(17) Chemical film touch-up bare metal surfaces. Refer to Method No. 403N.

E. Method No. 404E: Minor Corrosion Repair

Remove minor corrosion from aluminum-alloy parts as follows:

(1) Clean the part. Refer to SECTION II-CLEANING.

(2) Chemical film touch-up corroded surfaces. Refer to Method No. 403N.

(3) If required, paint again the repaired surfaces. Refer to Method No. 409A or 409B.

5. Removing Damage from Steel Parts

A. Method No. 405A: Minor Surface Defect Repair

Repair minor surface defects on steel parts as follows:

NOTE: Remove minor surface defects only if the defect is detrimental to operation and removal will not cause or increase leakage or compromise sealing functions.

WARNING: DO NOT BREATHE THE PARTICLES FROM BLENDING OR LET THE PARTICLES TOUCH YOU. PARTICLES FROM BLENDING CAN CAUSE DAMAGE, INJURY, OR IRRITATION TO YOU. USE PERSONAL PROTECTION EQUIPMENT. USE LOCAL MECHANICAL EXHAUST VENTILATION OR AN APPROVED RESPIRATOR.

(1) Blend minor burrs, galling, pitting, scratches, or sharp edges to get a smooth transition with the surface. Refer to applicable manual for Repaired Limits.

(a) Blend compressor rotor blades, stator vanes, turbine blades, diffuser vanes, and similar parts in a radial direction in relation to the engine.

NOTE: Make sure trailing and leading edges of airfoil section do not become thin or sharp to conform to the original contour.

(b) Blend cylindrical parts in a circumferential direction.

NOTE: Make sure not to blend along the axis of the part.

(2) If the repaired part involves a radius, keep radius as specified in applicable manual.

(3) Provide a surface finish as specified in applicable manual.

B. Method No. 405B: Heavy Corrosion, Hard Carbon, Paint, and Scale Removal

Remove heavy corrosion, hard carbon, paint and scale from steel parts as follows:

(1) Mask any surface that might be damaged by abrasive blasting.

(2) Place part in a standard sandblast cabinet.

WARNING: KEEP SANDBLAST NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(3) Set equipment air pressure at 15 to 30 PSIG (103 to 207 kPa).

NOTE: Air pressure can be reduced as required to control action on base metal of part.

(4) Sandblast only the specified surfaces. Refer to applicable manual. Use sand blast media C04-0038.

(5) Remove part from sandblast cabinet.

(6) Clean the part. Refer to SECTION II - CLEANING.

(7) Visually check blasted surfaces finish to be uniform.

(8) Apply a uniform layer of corrosion-preventive compound C02-0005.

C. Method No. 405C: Seal Diameter (Lip Seal Surface) Repair Using Glass Bead Peening

NOTE: Do not perform the repair if damage cannot be removed without reducing seal diameter to less than minimum specified in applicable manual for unit in work.

Repair damaged or worn lip seal surface to restore sealing surface as follows:

(1) Mask off areas not to be repaired.

(2) Prepare abrasive material as follows:

(a) Mix glass beads C08-0013 with garnet grit C08-0012 in equal parts by volume.

(b) Disperse glass bead and garnet grit mixture in ten times the volume of tap water.

NOTE: Make sure to add 0.25 percent of sodium dichromate C04-0036 to the tap water before mixing with the glass beads and garnet grit mixture.

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS. DO NOT POINT IT AT YOUR SKIN.

(3) Peen sealing surfaces specified in applicable manual. Use peening chamber (Perfecto-Peen Cabinet).

NOTE: The peening process produces a more compatible surface for mating with lip seal and will prolong life and improve function of seal.

(4) Refer to applicable manual to setup, pressure, nozzle distance, rotating speed and impingement time.

(5) Visually check the repaired surface. Surface texture must be uniform, free of wear rings, nicks, dings and gouges. Use a power optical glass 3X to 7X magnification.

(6) Demask and rinse the part in clean water to remove peening material.

(7) Let the part dry to room air.

(8) Dimensionally check peened surfaces. Repaired surfaces must meet dimensional requirement specified in applicable manual.

(9) Apply a uniform layer of lubricating oil C02-0009.

6. Repairing Magnesium Parts

A. Method No. 406A: Minor Damage Repair

NOTE: Refer to Method No. 403L for repair of paint coatings for magnesium parts.

Repair minor damage to magnesium-alloy parts as follows:

WARNING: WHENEVER MAGNESIUM-ALLOY PARTS ARE REWORKED, CARE MUST BE EXERCISED TO REMOVE ALL DUST, FILLINGS, TURNINGS, AND SHAVINGS AS THEY ARE FORMED. MAGNESIUM IN THESE FORMS IS HIGHLY FLAMMABLE, AND UNDER CERTAIN CONDITIONS, EXPLOSIVE. PERSONNEL MUST WEAR PROTECTIVE COVERING AT ALL TIMES.

CAUTION: WHEN YOU DO THIS PROCEDURE, BE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE, ABUSIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIRED PART.

(1) Blend damage with abrasive cloth C08-0001 and oil to remove burrs, scratches and galling.

(2) Repair areas of magnesium parts which are corroded, or where original surface treatment is no longer effective, as follows:

(a) Remove corrosion with wire brush C08-0030 or abrasive cloth C08-0001, where close tolerances are not necessary.

(b) Apply touch-up solution where close tolerances must be observed.

1 Use Chromic-acid Pickle solution. Refer to Method No. 402F for mixing instructions.

2 Increase temperature of solution to 180 to 200°F (82 to 93°C).

(c) Apply touch-up solution on cleaned magnesium parts areas or where original treatment is not effective. Use a brush.

1 Use Dow 19 touch-up solution. Refer to Method No. 402H for mixing instructions.

2 Deleted.

(d) After treating defective surface, fully flush parts with clean tap water.

(e) Immediately dry part in an oven at 250°F (121°C) for 2 hours.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(f) Cover treated surface with one coat of primer C03-0007.

(g) Air dry part for 15 to 30 minutes.

(h) Bake part for 1 hour at 150 to 175°F (66 to 79°C), or 30 minutes at 275 to 300°F (135 to 149°C).

(i) Touch-up bare spots on painted surfaces. Refer to Method No. 409A or 409B, as specified in applicable manual.

B. Method No. 406B: Magnesium-Alloy Parts Heavy Damage Repair

Repair minor damage to magnesium-alloy parts as follows:

(1) Clean part. Refer to SECTION II – CLEANING.

(2) Strip paint from entire surface of part.

NOTE: Make sure paint is completely removed from part.

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(3) Put part fully into magnesium touch-up solution. Refer to Method No. 402G.

CAUTION: METHANOL (METHYL OR WOOD ALCOHOL) MUST NOT BE USED AS A CLEANING AGENT WHEN CLEANING MAGNESIUM PARTS. PROLONGED CONTACT WITH UNPROTECTED MAGNESIUM PARTS WILL DESTROY THE PARTS. USE OF METHANOL WITH MAGNESIUM PARTS IS AUTHORIZED ONLY AS SPECIFICALLY INSTRUCTED FOR REPAIR OF CORRODED SURFACES.

CAUTION: MAKE SURE TO OVEN DRY THE PART AT 250°F (121°C) FOR 2 HOURS, IMMEDIATELY AFTER CLEANING.

CAUTION: MAKE SURE TO OVEN DRY THE PART AT 250°F (121°C) FOR 2 HOURS, IMMEDIATELY AFTER CLEANING.

(4) Fully flush part in clean tap water, flush inserts, passages and ports.

(5) Immediately dry part in oven at 250°F (121°C) for 2 hours.

(6) Visually check part for remaining corrosion. No corrosion is permitted.

NOTE: Make sure paint is completely removed from part.

(7) If corrosion is present, remove it with abrasive cloth C08-0001.

(8) Repeat Steps (4) to (7).

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

(9) Put part fully into magnesium touch-up solution for 30 seconds to 1 minute. Refer to Method No. 402G.

(10) Flush part in clean tap water.

CAUTION: METHANOL (METHYL OR WOOD ALCOHOL) MUST NOT BE USED AS A CLEANING AGENT WHEN CLEANING MAGNESIUM PARTS. PROLONGED CONTACT WITH UNPROTECTED MAGNESIUM PARTS WILL DESTROY THE PARTS. USE OF METHANOL WITH MAGNESIUM PARTS IS AUTHORIZED ONLY AS SPECIFICALLY INSTRUCTED FOR REPAIR OF CORRODED SURFACES.

CAUTION: MAKE SURE TO OVEN DRY THE PART AT 250°F (121°C) FOR 2 HOURS, IMMEDIATELY AFTER CLEANING.

(11) Clean part. Refer to SECTION II – CLEANING.

(12) Cover all holes.

(13) Mask all areas not to be painted.

(14) Apply primer to part. Refer to Method No. 402J.

(15) Let part air dry to room temperature.

(16) Bake part for 1 hour at 175 to 225°F (79 to 107°C).

(17) Apply color coat to part. Refer to Method No. 403K. Refer to applicable manual for paint color.

(18) Let part air dry to room temperature.

(19) Bake part for 1 hour at 175 to 225°F (79 to 107°C).

C. Method No. 406C: Magnesium-Alloy Parts Gouge and Scoring Repair

Repair minor damage to magnesium-alloy parts as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMICAL SOLUTION CAN CAUSE SKIN EYE, AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

CAUTION: MAKE SURE TO OVEN DRY THE PART AT 250°F (121°C) FOR 2 HOURS, IMMEDIATELY AFTER CLEANING.

(1) Hand finish damaged areas to remove raised metal.

(2) Clean part. Refer to SECTION II – CLEANING.

(3) Mask all areas not to be repaired.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

WARNING: THIS IS IMPORTANT. HEAT BUILD UP DURING OR AFTER MIXING IS NORMAL. DO NOT MIX QUANTITIES GREATER THAN 450 GRAMS AS DANGEROUS HEAT BUILD UP CAN OCCUR CAUSING UNCONTROLLED DECOMPOSITION OF THE MIXED ADHESIVE. TOXIC FUMES CAN OCCUR, RESULTING IN PERSONAL INJURY. MIXING SMALLER QUANTITIES WILL MINIMIZE THE HEAT BUILD UP.

CAUTION: DO NOT EXCEED TEMPERATURE LIMITATIONS DURING CURE PERIOD.

(4) Prior to mixing, make sure that the temperature of the separate epoxy paste adhesive components C01-0002 (Parts A and B) are close to room temperature 77˚F (25˚C). Combine Parts A and B in correct ratio and mix thoroughly.

Mix Ratio	Part A	Part B
By Weight	100	20
Pot Life:	8 hours at 77˚F (25˚C)	

NOTE: Uncured Epoxy Paste Adhesive C01-0002 can be cleaned from work area and application equipment using denatured alcohol.

CAUTION: EXERCISE CARE IN APPLYING COMPOUND TO MINIMIZE THE TRAPPING OF AIR.

(5) Apply compound with sufficient thickness for finish machine. Use a spatula for compound application.

NOTE: Uncured adhesive can be cleaned from work area and application equipment using denatured alcohol.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) Cure compound in an oven for 1 hour at 200°F (93°C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) Machine part to finish dimensions. Refer to applicable manual for repaired limits.

(8) Check machined part as follows:

(a) Porosities or voids of 0.015 inch (0.38 mm) minimum must be considered as related. Porosities or voids less than 0.015 inch (0.38 mm) must not be considered during evaluation.

(b) Porosities or voids of 0.080 inch (2.03 mm) maximum diameter are permitted. Two 0.080 inch (2.03 mm) porosities or voids or any number of smaller porosities or voids with a combined area no greater than two 0.080 inch (2.03 mm) within a 0.50 X 0.50 inch (12.7 X 12.7 mm) area is permitted.

(c) No porosity, voids, or chipping to parent metal are permitted.

(9) Clean part. Refer to SECTION II – CLEANING.

CAUTION: EXERCISE CARE IN APPLYING COMPOUND TO MINIMIZE THE TRAPPING OF AIR.

(10) If necessary, apply compound to porosity and/or voids with sufficient thickness for finish machine.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(11) Cure compound in an oven for 1 hour at 200°F (93°C).

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(12) Machine part to finish dimensions. Refer to applicable manual for repaired limits.

(13) Touch-up bare metal with magnesium touch-up solution. Refer to Method No. 402G or 402H.

7. Replacing Inserts, Studs, Bushings, Pins and Nutplates

NOTE: Refer to Method No. 415A, and 415B for repairing damaged/oversized diameters with inserts.

A. Method No. 407A: Loose or Damaged Thread Inserts Replacement

Step (1) describes the repair of non-Keensert thread inserts, and Step (2) describes the repair of Keensert thread inserts.

(1) Remove and replace non-Keensert thread inserts as follows:

(a) Remove loose or damaged inserts. Use long-nosed pliers.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS OBSERVE FIRE PRECAUTIONS.

(b) Clean hole from which insert was removed. Use degreasing solvent C04-0025. Remove corrosion if present.

(c) Apply a thin even coat of primer C03-0007 to threaded area in which new insert is to be installed.

NOTE: Refer to applicable manual to verify type of primer required.

(d) Install new insert three-quarters to one and one-half turns below surface of countersink. Remove tang, if applicable. Use long-nosed pliers or blunt tool and hammer.

NOTE: To install new insert, use a modified screwdriver, or a rod, with the correct outside diameter to fit inside diameter of insert and slotted to fit over tang of insert.

(2) Remove and replace loose or damaged Keensert thread inserts as follows:

NOTE: Refer to Table 402 and Table 403 for Keensert dimensions and installation data.

CAUTION: DO NOT PERMIT THE DRILL TO TOUCH HOUSING OR DAMAGE CAN RESULT.

(a) Remove insert material between Kees. Use a standard drill. Refer to Figure 407.

(b) Bend Kees inward and break off. Refer to Figure 407.

(c) Remove insert with an "easyout" type tool. Refer to Figure 407.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

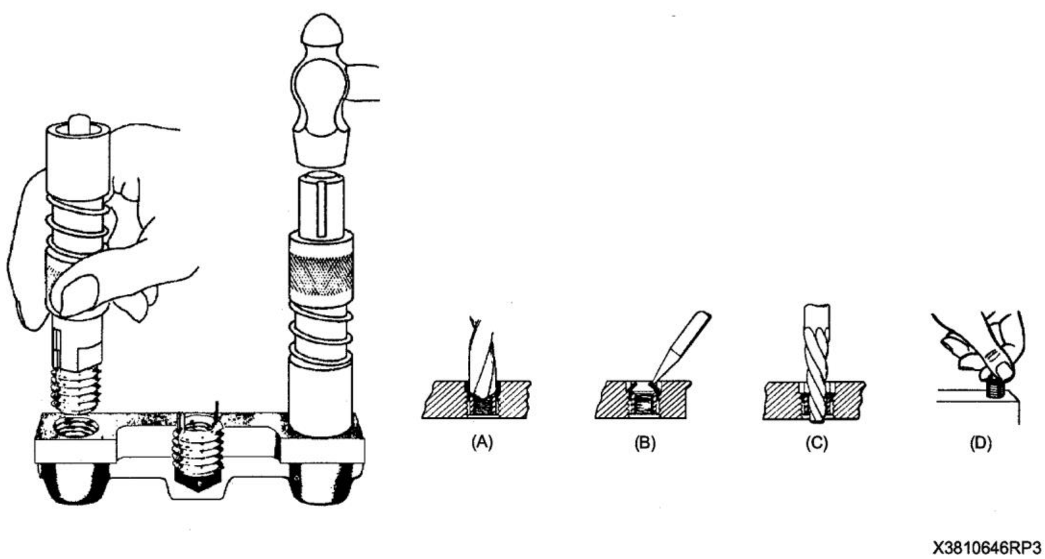
(d) Clean hole to remove unwanted material with compressed air at 20 PSIG (138 kPa) maximum.

(e) Apply a thin even coat of primer C03-0007 to threaded area in which new insert is to be installed.

NOTE: Refer to applicable manual to verify type of primer required.

(f) Install new insert with fingers or use an insert tool. Refer to Table 402 or Table 403 to identify the correct insert tool. Use insert tool to drive in the Kees. Refer to Figure 407.

(g) If the receiving holes should become damaged, use a larger outside diameter replacement insert while keeping original bolt size.



Keensert Thread Insert Repair Tool
Figure 407

Table 402. Dimension and Installation Data for Heavy Duty Keensert Thread Inserts

		DIMENSIONS					INSTALLATION DATA					REMOVAL DATA	
			External Thread						Thread Tap			Drill	
Non-Locking	Internal Thread Locking	Internal Thread Class 3B	Size Class 2A	Shear Engag.	L	A	Tap Drill Dia	C'Sink Dia +.010 -.000	Size UNC-2B	Min Depth	Installation Tool Part Number	Size	Depth
X		8-32	5/16-18	.1517			.272	.323	5/16-18		THD 0832L	7/32	
	X			.0945		.29							
X		10-32		.1901	.31					.37	THD 1032L		
	X		3/8-16	.1156		.31	.332	.385	3/8-16			9/32	1/8
X		10-24		.1901							THD1024L		
	X			.1156		.31							
X		1/4-28		.2842							THD 428L		
	X		7/16-14	.1970	.37	.33	.397	.447	7/16-14	.43		11/32	
X		1/4-20		.2842							THD 420L		
	X			.1970		.36							
X		5/16-24		.3588							THD 524L		
	X		1/2-13	.2608	.43	.34	.453	.510	1/2-13	.50		13/32	
X		5/16-18		.3588							THD 518L		
	X			.2608		.37							
X		3/8-24		.4975							THD 624L		
	X		9/19-12	.3843	.50	.37	.516	.572	9/16-12	.56		15/32	
X		3/8-16		.4975							THD 616L		
	X			.3843		.41							
X		7/16-20		.7172							THD 720L		
	X		5/8-11	.5831	.62	.42	.578	.635	5/8-11	.68		17/32	3/16
X		7/16-14		.7172							THD 714L		
	X			.5831		.46							
X		1/2/20		.8884							THD 820L		
	X		11/16-11	.7368	.68	.42	.641	.700	11/16-11	.75		19/32	
X		1/2-13	NS	.8884					NS		THD 813L		
	X			.7368		.47							
X		9/16-18		1.2493							THD 918L		
	X		13/16-16	1.0247	.81	.48	.766	.822	13/16-16	.94			
X		9/16-12		1.2493					UN		THD 912L	23/32	
	X			1.0247		.54							
X		5/8-18		1.4866							THD 1018L		
	X		7/8-14	1.2415	.87	.49	.828	.885	7/8-14	1.00		25/32	
X		5/8-11		1.4866					UNF		THD 1011L		
	X			1.2415		.57							

L = Length of external threads C= Bore depth A= Maximum distance to then of thread lock.
Inserts with internal thread size 5/16 and more are furnished with 4 locking Kees.
STANDARD MATERIALS: INSERT - 303 CRES (passivated)
Kees – 302 CRES

Table 402. Dimension and Installation Data for Heavy Duty Keensert Thread Inserts (Cont)

		DIMENSIONS					INSTALLATION DATA					REMOVAL DATA	
			External Thread						Thread Tap			Drill	
Non-Locking	Internal Thread Locking	Internal Thread Class 3B	Size Class 2A	Shear Engag.	*L	*A	Tap Drill Dia	C'Sink Dia +.010 -.000	Size UNC-2B	Min Depth	Installation Tool Part Number	Size	Depth
X		3/4-16		2.4901	1.12					1.31	THD 1216L		
	X		1-1/8-12	2.4478	1.25	.68	1.062	1.145	1-1/8-12	1.44		31/32	
X		3/4-10		2.4901	1.12				UNF	1.31	THD 1210L		
	X			2.4478	1.25	.75				1.44			
X		7/8-14		3.1370	1.25					1.44	THD 1414L		
	X		1-1/4-12	3.0775	1.37	.69	1.187	1.270	1-1/4-12	1.56		1-3/32	
X		7/8-9		3.1370	1.25				UNF	1.44	THD 1409L		5/16
	X			3.0775	1.37	.77				1.56			
X		1-12		3.8381	1.37					1.56	THD 1612L		
	X		1-3/8-12	3.7929	1.50	.78	1.312	1.395	1-3/8-12	1.68		1-7/32	
X		1-8		3.8381	1.37				UNF	1.56	THD 1608		
	X			3.7929	1.50	.86				1.68			

L = Length of external threads C= Bore depth A= Maximum distance to then of thread lock.
Inserts with internal thread size 5/16 and more are furnished with 4 locking Kees.
STANDARD MATERIALS: INSERT - 303 CRES (passivated)
Kees – 302 CRES

Table 403. Dimension and Installation Data for Lightweight-Keensert Thread Inserts

		DIMENSIONS					INSTALLATION DATA					REMOVAL DATA	
			External Thread						Thread Tap			Drill	
Non-Locking	Internal Thread Locking	Internal Thread Class 3B	Size Class 2A	Shear Engag.	*L	*A	Tap Drill Dia	C'Sink Dia +.010 -.000	Size Class 2B	Min Depth	Installation Tool Part Number	Size	Depth
X		10-32		.1517							TD 1032L		
	X		5/16-18	.0945	.31	.31	.272	.323	5/16-18	.37			
X		10-24		.1517							TD 1024L	7/32	5-32
	X			.0945		.31							
X		1/4-28		.2371							TD 428L		
	X		3/8-16	.1726	.37	.33	.332	.385	3/8-16	.43		9/32	
X		1/4-20		.2371							TD 420L		
	X			.1726		.36							
X		5/16-24		.3049							TD 524L		
	X		7/16-14	.2321	.43	.34	.397	.447	7/16-14	.50		11/32	
X		5/16-18		.3049							TD 518L		
	X			.2321		.37							
X		3/8-24		.4299							TD 624L		
	X		1/2-13	.3366	.50	.36	.453	.510	1/2-13	.56		13/32	
X		3/8-16		.4299							TD 616L		3/16
	X			.3366		.40							
X		7/16-20		.5665							TD 720L		
	X		9/16-12	.4606	.56	.41	.516	.572	9/16-12	.62		15/32	
X		7/16-14		.5665							TD 714L		
	X			.4606		.45							
X		1/2-20		.7175							TD 820L		
	X		5/8-11	.5906	.62	.42	.578	.635		.68		17/32	
X		1/2-13		.7175							TD 813L		
	X			.5906		.47							

L = Length of external threads A= Maximum distance to then of thread lock.
Inserts with internal thread size 5/16 and more are furnished with 4 locking Kees.
STANDARD MATERIALS: INSERT - 303 CRES (passivated)
Kees – 302 CRES

B. Method No. 407B: Loose or Damaged Thread Inserts (Aluminum or Magnesium Parts) Replacement

Replace loose or damaged thread inserts in aluminum or magnesium-alloy parts as follows:

(1) Remove loose or damaged inserts. Use long nosed pliers.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(2) Clean hole from which insert was removed. Use degreasing solvent C04-0025. Remove corrosion if present.

(3) Apply a thin, even coat of primer C03-0007 to threaded area in which new insert is to be installed.

NOTE: Refer to applicable manual to verify type of primer required.

(4) Install new insert, while primer is wet, three-quarters to one and one-half turns below surface of countersink.

NOTE: Use a modified screwdriver, or a rod, with the correct outside diameter to fit inside diameter of insert and slotted to fit over tang of insert, to install new insert.

(5) Remove tang. If applicable, use long-nosed pliers or blunt tool and hammer.

(6) Touch-up lead thread on component. Wipe with a thin coat of primer C03-0007 to seal surface scratches and adjacent area around the insert hole.

(7) Let primer to cure for 4 to 6 hours at room temperature or bake for 1 hour at 180 to 275°F (82 to 135°C).

C. Method No. 407C: Loose or Damaged Keensert Stud Repair

Loose or damaged Keensert studs are repaired using different procedures. Step (1) describes repair of a loose Keenert stud, and Step (2) describes repair of a damaged Keensert stud.

NOTE: Rotational movement of Keensert studs in component undergoing repair is not permitted. If rotational movement exists, replace stud be completing Step (2).

(1) Loose Keensert studs are repaired as follows:

(a) Fabricate a punch of suitable material with blade width and thickness slightly smaller than keyway for stud locking key.

(b) Drive lock keys of stud further into keyways of stud until stud is tight. Use punch.

NOTE: Depth of key must not exceed a quantity equal to half the length of stud material inserted in the assembly. If stud will not tighten, replace stud. Refer to Step (2).

(c) If threads of hole for the stud are damaged, tap new threads in the hole one size larger than existing threads. Use a new stud with matching threads.

NOTE: Threads on external portion of stud must be the same as on stud removed.

(d) Wipe a thin even coat of primer C03-0007 to the area around stud to seal the surfaces from the joint in all directions.

(e) Let primer to cure for 4 to 6 hours at 180 to 275°F (82 to 135°C) prior to assembly usage.

(2) Damaged Keensert studs are repaired as follows:

(a) Cut off stud just below mounting surface to expose pilot hole for removal drill.

NOTE: Studs less than three-eighths inch diameter do not have a pilot hole.

CAUTION: DO NOT LET DRILL TO TOUCH HOUSING OR DAMAGE MAY RESULT.

(b) Drill out stud until only a thin shell remains. Use pilot hole as a guide.

(c) Bend locking keys inward and break them off.

(d) Remove stud with an "easyout" tool.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(e) Clean hole from which stud was removed. Use degreasing solvent C04-0025.

(f) Apply a thin even coat of wet primer C03-0007 to the threaded hole to receive the replacement stud.

NOTE: Application of primer must be uniform and neat in appearance without bare spots or runs.

1 Coat blind holes to cover adjacent walls with primer. The bottom needs not be covered. Let primer dry two or three minutes before installing stud.

2 Coat through-holes in components to cover all internal surfaces through to adjacent painted surfaces. The end of stud needs not be covered.

(g) While the primer is still soft, turn stud into threaded hole until step is 0.010 to 0.030 inch (0.25 to 0.76 mm) below machined surface.

(h) Drive lock keys into keyways of stud until flush with step of stud. Use a punch tool.

(i) Wipe a thin, even wet coat of primer to surfaces adjacent to the locking device of the Keensert studs.

NOTE: A thin even coat of primer must be applied to the area around the stud to seal all surface from the joint in all directions.

(j) Let primer to cure for 4 to 6 hours at room temperature, or for 1 hour at 180 to 275°F (82 to 135°C) prior to assembly usage.

D. Method No. 407D: Replace of Loose, Worn, and/or Damaged Bushing (Steel Parts)

Replace loose, worn, and/or damaged bushing in steel parts as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART DURING MACHINING OPERATION.

(1) Machine bushing as required for easy removal.

(2) Remove bushing.

(3) Clean part. Refer to SECTION II – CLEANING.

(4) Press new bushing in position as specified in applicable manual.

NOTE: Cold soaking of bushing may be required prior to installation. Refer to applicable manual.

(5) If required, machine the inner diameter of bushing. Refer to applicable manual.

(6) Clean part. Refer to SECTION II – CLEANING.

E. Method No. 407E: Loose, Worn, or Damaged Bushings (Aluminum or Magnesium Parts) Replacement

Replace loose, worn, or damaged bushings in aluminum or magnesium-alloy parts as follows:

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART WHILE REMOVING BUSHING.

(1) Remove loose, worn or damaged bushing from the basic part.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(2) Clean hole from which bushing was removed. Use degreasing solvent C04-0025 (Type I). Let solvent to evaporate completely.

(3) Apply a thin coat of primer C03-0007 to sides of hole to receive new bushing.

NOTE: Refer to applicable manual to verify type of primer to be used.

(4) While primer is still wet, press new bushing into position specified in applicable manual.

(5) Remove unwanted primer.

(6) Let primer to cure for 4 to 6 hours at room temperature, or bake for 1 hour at 180 to 275°F (82 to 135°C).

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) If required, machine inside diameter of bushing. Refer to applicable manual.

(8) Clean machined area. Use degreasing solvent C04-0025 to remove machining debris.

F. Method No. 407F: Loose, Worn, or Damaged Pins (Steel Parts) Replacement

Replace loose, worn, or damaged pins in steel parts as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART DURING MACHINING OPERATION.

(1) Machine pin as required for easy removal.

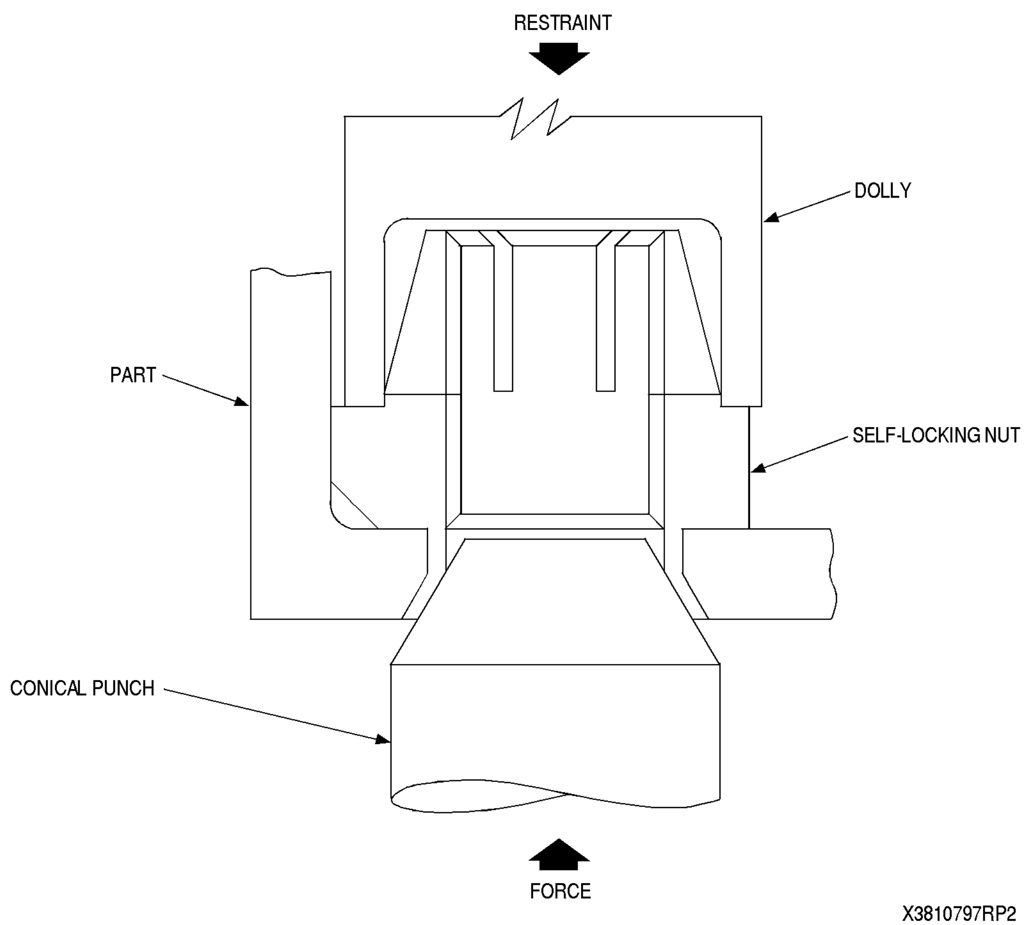
(2) Remove pin.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(3) Clean to remove machining residue from hole from which pin was removed. Use degreasing solvent C04-0025 (Type I).

SUBTASK Cold soaking of pin may be required prior to installation. Refer to applicable manual.

(4) Press new pin into position. Refer to applicable manual.



Replace Self-Locking Nut
Figure 408

G. Method No. 407G: Loose, Worn, or Damaged Pins (Aluminum or Magnesium Parts) Replacement

Replace loose, worn, or damaged pins in aluminum or magnesium-alloy parts as follows:

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART WHILE REMOVING PIN.

(1) Remove loose, worn, or damaged pin from basic part.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(2) Clean hole that pin was removed from. Use degreasing solvent C04-0025.

(3) Let solvent to evaporate completely.

NOTE: Refer to applicable manual to verify type of primer required.

(4) Apply thin primer coat C03-0007 to sides of hole to receive new pin.

(5) While primer is still wet, press new pin into position specified in applicable manual.

(6) Remove unwanted primer.

(7) Let primer to cure for 4 to 6 hours at room temperature, or bake for 1 hour at 180 to 275°F (82 to 135°C).

H. Method No. 407H: Loose, Worn, or Damaged Rosan Stud and Insert Replacement

Loose, worn, or damaged Rosan studs and inserts are repaired using different procedures. Step (1) describes how to replace a Rosan stud, and Step (2) describes how to replace a Rosan insert. Refer to Figure 408.

(1) Replace defective Rosan studs.

CAUTION: EXERCISE CARE NOT TO DAMAGE ASSEMBLY IN WHICH STUD IS INSTALLED.

(a) Cut stud off approximately flush with surface of parent material. Center punch over flat end of stud.

(b) Use a slightly oversize drill bit, large enough to cut inner serrations of lock ring. Remove enough of stud to remove serrations.

(c) Drill a small hole into stud to accommodate an appropriate “easyout” tool.

CAUTION: DO NOT ALLOW “EASYOUT” TO CATCH ON LOCK RING.

(d) Install “easyout” tool into stud and remove out of assembly.

NOTE: The remainder of lock ring must come out with the stud.

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(e) Remove unwanted material from hole. Use dry, clean compressed air.

(f) Install new stud into assembly. Refer to applicable manual.

(g) Drive or press lock ring into position.

(2) Replace defective Rosan Inserts.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: EXERCISE CARE NOT TO DAMAGE ASSEMBLY IN WHICH INSERT IS INSTALLED.

(a) Mill lock ring unit only a thin shell remains. Use a rotary mill of appropriate size.

(b) Remove remainder of lock ring with a scribe or other suitable tool.

(c) Install an appropriate size “easyout” tool into insert and remove of assembly.

WARNING: USE THE CORRECT PERSONAL PROTECTION. COMPRESSED AIR WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES. COMPRESSED AIRFLOW CAN CAUSE CUTS, DO NOT POINT IT AT YOUR SKIN.

(d) Remove unwanted material from hole. Use dry, clean compressed air.

(e) Install new insert into assembly. Refer to applicable manual.

(f) Drive or press lock ring into position.

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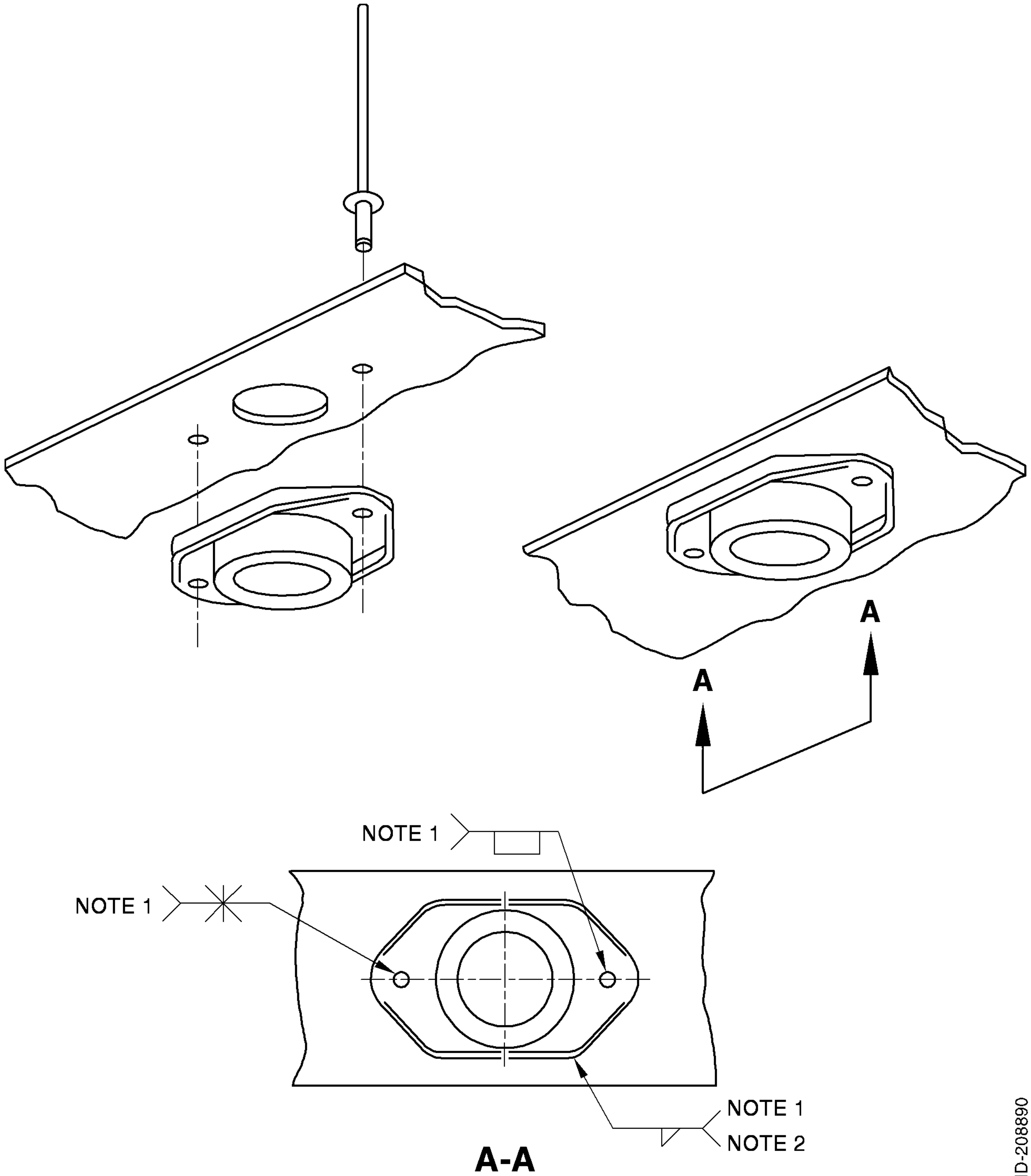


NOTE: 1. Weld nutplates with one of three alternative processes.

2. GTAW tack weld in 4 corners of nutplate.

Replace Loose, Worn, or Damaged Nutplate (Riveted and/or Welded)
Figure 409

I. Method No. 407I: Loose, Worn or Damaged Nutplate (Riveted) Replacement

Replace loose, worn, or damaged riveted nutplate as follows:

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART WHILE REMOVING RIVET.

(1) Remove worn or damaged nutplate from basic part. Refer to Method No. 410A.

(2) Remove and discard damaged nutplates.

(3) Procure new nutplates.

(4) Put nutplate in the correct location as specified in applicable manual. Refer to Figure 409 as reference.

NOTE: Make sure nutplate is well aligned to original dameter.

(5) Attach nutplates with rivets. Use an adequate punch tool as specified in applicable manual. Refer to Method No. 410A.

J. Method No. 407J: Loose, Worn or Damaged Nutplate (Welded) Replacement

Replace loose, worn, or damaged welded nutplate as follows:

(1) Replace nutplate with GTAW weld.

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART WHILE REMOVING RIVET.

(a) Remove damaged nutplates.

(b) Procure new nutplates.

(c) Put nutplate in correct location as specified in applicable manual. Refer to Figure 409 as reference.

(d) GTAW weld new nutplate. Refer to Method No. 411A, 411B, or 411C. Refer to Figure 409 as reference only.

CAUTION: AFTER WELDING, LET TEMPERATURE OF THE PART SLOWLY DECREASE TO ROOM TEMPERATURE.

1 GTAW weld nutplates with weld filler metal specified in applicable manual.

NOTE: Make sure nutplate is well aligned to original diameter.

2 Hand finish repaired surfaces.

(2) Replace nutplate with resistance weld.

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART WHILE REMOVING RIVET.

(a) Remove damaged nutplates.

(b) Procure nutplates.

(c) Put nutplate in the correct location. Refer to Figure 409 as reference.

(d) Resistance weld new nutplates. Refer to AWSD17.2-D17.2M, Class C.

CAUTION: AFTER WELDING, LET TEMPERATURE OF THE PART SLOWLY DECEASE TO ROOM TEMPERATURE.

1 Hand finish repaired surfaces.

NOTE: Make sure nutplate is well aligned to original diameter.

(3) Replace nutplate with GTAW tack weld.

CAUTION: EXERCISE CARE NOT TO DAMAGE BASIC PART WILE REMOVING RIVET.

(a) Remove damaged nutplates.

(b) Procure new nutplates.

(c) Put nutplate in the correct location. Refer to Figure 409 as reference.

(d) GTAW tack weld new nutplates. Refer to Method No. 411A, 411B, or 411C. Refer to Figure 409 as reference only.

CAUTION: AFTER WELDING, LET TEMPERATURE OF THE PART SLOWLY DECREASE TO ROOM TEMPERATURE.

1 GTAW tack weld nutplates in four corners of nutplate. Diameter tack and filler metal must be as specified in applicable manual.

NOTE: Make sure nutplate is well aligned to original diameter.

2 Hand finish repaired surfaces.

8. Repairing Gear Teeth

A. Method No. 408A: Minor Gear Teeth Involute Surface Damage Repair

Repair minor surface damage on gear teeth as follows:

NOTE: Surface damage of 0.003 inch (0.08 mm) maximum depth is permitted. Pits of 0.003 inch (0.08 mm) maximum depth are permitted. Damaged area or polishing repaired area is not necessary remove all damages.

NOTE: Blend repair may be performed on both sides of the teeth and on all of the gear teeth if necessary.

WARNING: WHEN YOU DO THIS PROCEDURE, BE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABRASIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIR PART.

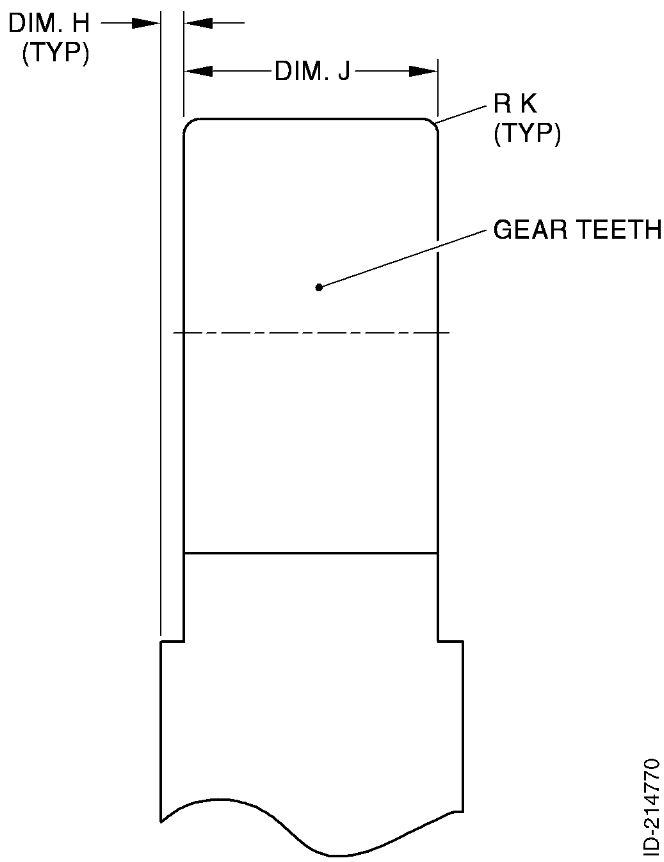
(1) Remove high stains from gear teeth surface. Use sharpening stone C08-0016.

(2) Deburr repaired surfaces.

(3) Blend edge of gear tooth. Keep Dimension J and Dimension H in Repaired limits. Refer to applicable manual. Use sharpening stone C08-0016. Refer to Figure 405 for example.

(4) Blend radius K of repaired edge. Refer to applicable manual for Repaired Limits. Use sharpening stone C08-0016. Refer to Figure 410.

(5) Perform magnetic particle inspection or a fluorescent penetrant inspection, as specified in applicable manual. Refer to SECTION III - INSPECTION.



NOTE: 1. Typical Repair Limits for gear teeth. Refer to applicable manual for values of limit.

Blend Repair Gear Teeth
Figure 410

9. Repainting Parts

A. Method No. 409A: Enamel Paint Repair of Parts

Repair painted surfaces of parts as follows:

(1) Prepare surfaces to be painted as follows:

NOTE: Normal service temperature can cause heat discoloration and looseness on the paint coating. Make sure to brush the part to remove all damaged paint.

(a) Clean the part to be painted. Refer to SECTION II – CLEANING.

(b) Blend and polish the part to remove raised metal and/or damage.

(c) Feather abraded paint and bare metal smoothly as required. Use Abrasive cloth C08-0001.

(d) Touch-up bare metal surfaces. Refer to Method No. 403L or 403M.

(2) Paint external and non-critical surfaces of parts as follows, unless specified differently in applicable manual.

(a) If required, plug all holes and mask all areas not to be painted.

(b) Clean the part to be painted. Refer to SECTION II – CLEANING.

(c) Apply a uniform layer of primer of 0.0006 to 0.0030 (0.015 to 0.076 mm) inch thick unless specified differently in applicable manual. Refer to Method No. 402J for mixing instructions.

(d) Apply a uniform layer of Enamel as specified in applicable manual to all surfaces to be repaired.

(e) Remove masking material and plugs.

(f) Visually check paint coating appearance. Appearance must be continuous, smooth, and free from bubbles.

B. Method No. 409B: Epoxy Paint Repair of Parts

Repair painted surfaces of parts as follows:

(1) Prepare surface to be painted as follows:

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(a) Remove existing paint. Put the part into Paint Remover C04-0033 or use Plastic Media Blasting (refer to Method No. 203W).

NOTE: Do this step only if complete stripping is desired.

(b) Brush part with Paint Remover C04-0035.

NOTE: Do this step only if complete stripping is not desired.

(c) Clean the part. Refer to SECTION II – CLEANING.

(d) Let the part dry to room air.

(e) Touch-up bare metal surfaces. Refer to Method No. 403L or 403M.

(2) Paint external and non-critical surfaces of parts as follows, unless specified differently in applicable manual.

(a) If required, plug all holes and mask all areas not to be painted.

(b) Apply a uniform layer of primer of 0.0006 to 0.0030 (0.015 to 0.076 mm) inch thick unless specified differently in applicable manual. Refer to Method No. 402J for mixing instructions.

(c) Let part dry to air temperature for 15 to 30 minutes.

(d) Put the part in oven to increase the temperature of the part to 175 to 225°F (79 to 107°C) for 1 hour.

(e) Apply a uniform layer of Epoxy paint as specified in applicable manual to all surfaces to be repaired. Refer to Method No. 402K. Use color as specified in applicable manual.

NOTE: If specified in applicable manual, an Epoxy Paint of a different color from those listed in this SPM can be used. Make sure not to coat machine interfaces and threads.

(f) Let part dry to air room for 15 to 30 minutes.

(g) Put the part in an oven to increase the temperature of the part to 175 to 225°F (79 to 107°C) for 1 hour.

(h) Remove masking material and plugs.

(i) Visually check paint coating appearance. Appearance must be continuous, smooth, and free from bubbles.

10. Repairing Riveted Parts

A. Method No. 410A: Damaged Rivet Replacement General Guidelines

(1) Replace damage rivets as follows:

NOTE: Refer to NASM47196 for preparation and installation of buck-type rivets.

(a) Rivets must be formed by the cold continuous squeeze method. In this method, riveting machines, rivet sets, and rivet set adapters, specified in applicable manual, are used to form the rivet head from a continuous squeezing operation.

(b) The proper replacement rivet for an assembly is listed in the illustrated parts list. Refer to applicable manual.

(c) Rivets are manufactured in various shapes and sizes. Refer to Figure 411.

(d) Manufactured head is the head produced at the time the rivet is manufactured and before the rivet is installed in an assembly.

(e) Protruding head" is a general term applied for one of the rivets where the head projects above the surface of the items being assembled.

(f) One-hundred-degree flush head rivets are installed in countersunk holes and the heads of rivets are flush with outside surface of items being assembled.

B. Method No. 410B: Damaged Rivet Replacement

(1) Replace damaged rivet as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

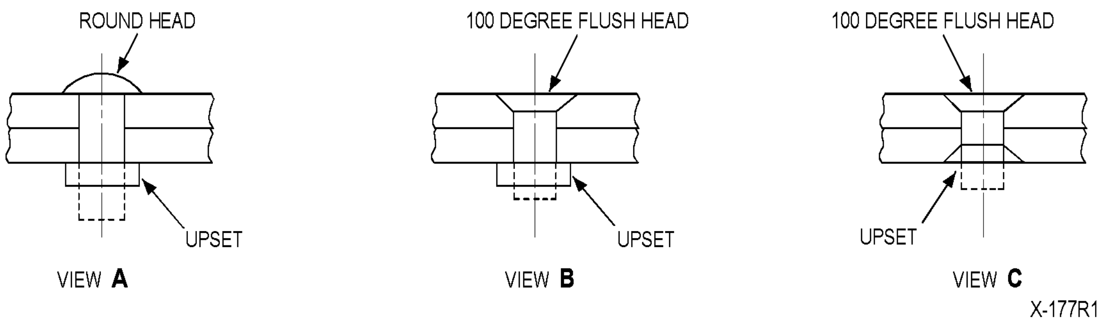
CAUTION: EXERCISE CARE WHEN DRILLING OUT OLD RIVET NOT TO DAMAGE BASIC ITEMS.

(a) Drill to remove head of installed rivet.

(b) Remove rivet remainder with a punch tool and hammer.

(c) Clean rivet hole of part. Refer to SECTION II – CLEANING.

(d) Install new rivet. Use tooling specified in applicable manual.



Riveting (Typical)
Figure 411

11. Repairing Welded Parts

NOTE: Refer to applicable manual for unit for specialized welding.

A. Method No. 411A: Fusion Weld Repair of Aluminum Alloy Parts

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine or hand abrade part to remove damage.

NOTE: For removal of cracks, prepare crack to “V” shape routing. For removal of cracks on sheet metal, stop drill cracks to prevent further progression of the damage.

(2) Hand abrade surface to be repaired, to prepare for welding.

(3) Clean surface to be repaired. Refer to SECTION II – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(4) If required, pre-heat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. WELDING / CUTTING / BRAZING / SOLDERING / OPERATIONS CAUSE HEAT, METAL FUMES, SLAG, RADIATION AND LOOSE PARTICLES.

CAUTION: REFER TO APPLICABLE MANUAL FOR REQUIRED COOLING PROCEDURES AFTER WELDING.

(5) GTAW weld the surface to be repaired. Refer to AWS D17.1. Use filler metal specified in applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) If required, heat treat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) Finish machine repaired surfaces.

NOTE: Finish machining is required if controlled surfaces were repaired only.

(8) Hand finish repaired surfaces.

NOTE: Hand finishing is required if non controlled surfaces were repaired only.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(9) If weld material extends into mounting holes or outside radius, machine to clean up. Refer to applicable manual for requirements.

(10) Clean welded surface. Refer to SECTION II – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. OIL USED DURING THIS INSPECTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE HOT BLACK LIGHT WILL CAUSE BURNS TO BODY AREAS WITH NO PROTECTION.

(11) Perform penetrant inspection. Refer to ASTM E1417, Type 1, Method A, C, or D Level 3 or 4. No cracks permitted. Acid etch only when required.

(12) Clean part. Refer to SECTION II – CLEANING.

(13) Touch-up bare metal. Refer to MIL-DTL-5541. Refer to Method No. 402E.

B. Method No. 411B: Fusion Weld Repair of Magnesium Alloy Parts

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine or hand abrade part to remove damage.

NOTE: For removal of cracks, prepare crack to “V” shape routing. For removal of cracks on sheet metal, stop drill cracks to prevent further progression of the damage.

(2) Hand abrade surface to be repaired, to prepare for welding.

(3) Clean surface to be repaired. Refer SECTION II – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(4) If required, pre-heat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. WELDING / CUTTING / BRAZING / SOLDERING / OPERATIONS CAUSE HEAT, METAL FUMES, SLAG, RADIATION, AND LOOSE PARTICLES.

CAUTION: REFER TO APPLICABLE MANUAL FOR REQUIRED COOLING PROCEDURES AFTER WELDING.

(5) GTAW weld the surface to be repaired, refer to AWS D17.1. Use filler metal specified in applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) If required, heat treat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) Finish machine repaired surfaces.

NOTE: Finish machining is required if controlled surfaces were repaired only.

(8) Hand finish repaired surfaces.

NOTE: Hand finishing is required if non controlled surfaces were repaired only.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(9) If weld material extends into mounting holes or outside radius, machine clean up. Refer to applicable manual for requirements.

(10) Clean welded surface. Refer to SECTION II – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. OIL USED DURING THIS INSPECTION CAN CAUSE SKIN, EYE, AND LUNG DAMAGE. THE HOT BLACK LIGHT WILL CAUSE BURNS TO BODY AREAS WITH NO PROTECTION.

(11) Perform penetrant inspection. Refer to ASTM E1417, Type 1, Method A, C or D Level 3 or 4. No cracks permitted. Acid etch only when required.

(12) Clean part. Refer to SECTION II – CLEANING.

(13) Touch-up bare metal with magnesium touch-up solution. Refer to Method No. 402H or 402J.

C. Method No. 411C: Fusion Weld Repair of Corrosion-Resistant Steels, Cobalt and Nickel-Base Alloy Parts

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Machine or hand abrade part to remove damage.

NOTE: For removal of cracks, prepare crack to “V” shape routing. For removal of cracks on sheet metal, stop drill cracks to prevent further progression of the damage.

.

(2) Hand abrade surface to be repaired, to prepare for welding.

(3) Clean surface to be repaired. Refer to SECTION II – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(4) If required, pre-heat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. WELDING / CUTTING / BRAZING / SOLDERING / OPERATIONS CAUSE HEAT, METAL FUMES, SLAG, RADIATION, AND LOOSE PARTICLES.

CAUTION: REFER TO APPLICABLE MANUAL FOR REQUIRED COOLING PROCEDURES AFTER WELDING.

(5) GTAW weld the surface to be repaired. Refer to AWS D17.1. Use filler metal specified in applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) If required, heat treat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(7) Finish machine repaired surfaces.

NOTE: Finish machining is required if controlled surfaces were repaired only.

(8) Hand finish repaired surfaces.

NOTE: Hand finishing is required if non controlled surfaces were repaired only.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(9) If weld material extends into mounting holes or outside radius, machine clean up. Refer to applicable manual for requirements.

(10) Clean welded surface. Refer to SECTION – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. OIL USED DURING THIS INSPECTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE HOT BLACK LIGHT WILL CAUSE BURNS TO BODY AREAS WITH NO PROTECTION.

(11) Perform penetrant inspection. Refer to ASTM E1417, Type 1, Method A, C or D Level 3 or 4. No cracks permitted. Acid etch only when required.

(12) Clean part. Refer to SECTION II – CLEANING.

D. Method No. 411D: Resistance Welding Repair

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(1) Hand abrade part to remove damage.

NOTE: Drill or mill resistance weld to get the separation of the sheet metals.

(2) Hand abrade surfaces to be repaired, to prepare for welding.

CAUTION: DO NOT USE ALUMINUM OXIDE OR STEEL GRIT OR SHOT TO CLEAN THE PART. SURFACES TO BE WELDED COULD BE DAMAGED.

(3) Clean surface to be repaired. Refer to SECTION II – CLEANING.

NOTE: Chemical cleaning processes used must not result in intergranular attack or oxidation, or alloy depletion in the parent metal of 0.001 inch (0.03 mm) maximum depth to prevent weld failure.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(4) If required, pre-heat the part. Refer to applicable manual.

WARNING: USE THE CORRECT PERSONAL PROTECTION. WELDING / CUTTING / BRAZING / SOLDERING / OPERATIONS CAUSE HEAT, METAL FUMES, SLAG, RADIATION, AND LOOSE PARTICLES.

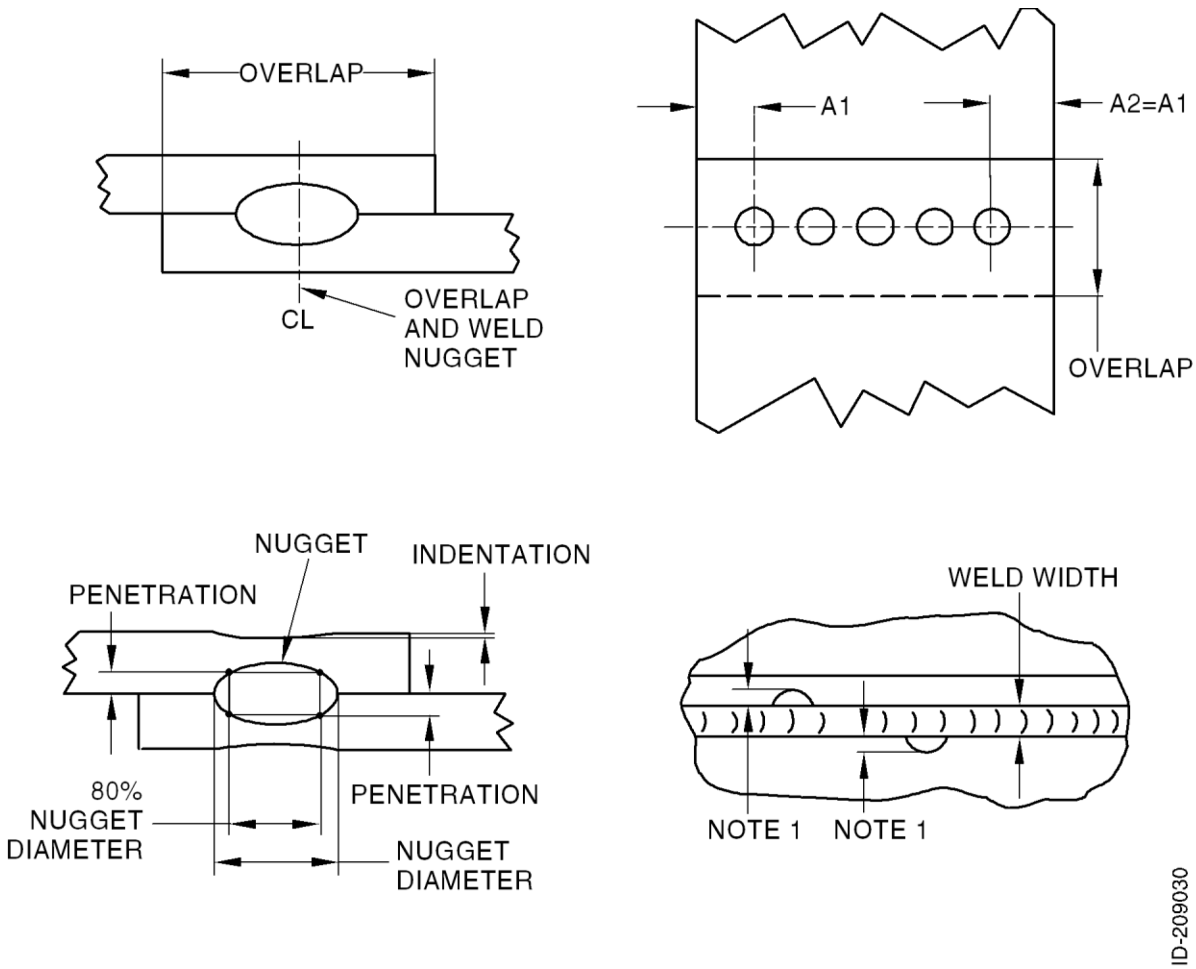
CAUTION: REFER TO APPLICABLE MANUAL FOR REQUIRED COOLING PROCEDURES AFTER WELDING.

(5) Resistance weld the surfaces to be repaired. Refer to AWS D17.2. Use parameters specified in applicable manual. Refer to Table 404.

(a) The centerline for spot or seam welds must be the centerline of the contacting overlap. Refer to Figure 412.

NOTE: Displacement with respect to the centerline must not be more than one-half of the spot diameter, seam width or 0.10 inches (2.5 mm), whichever is greater.

(b) Minimum weld penetration into all sheets must not be less than 20 percent of the measured original thickness of the thinner outer sheet, over an area whose major axis is 80 percent of the weld diameter or width at the interface. Refer to Figure 412.



NOTE: 1. Indentations must not exceed 10 percent of the measured original sheet thickness or 0.005 inch (0.13 mm), whichever is greater.

Spot and Seam Weld Geometry
Figure 412

(c) Maximum penetration into outer sheet must not be greater than 80 percent of its reduced thickness for aluminum and magnesium alloys, and 90 percent of its reduced thickness for all other alloys. Refer to Figure 412.

WARNING: USE THE CORRECT PERSONAL PROTECTION. HEATED PARTS WILL CAUSE BURNS.

(6) If required, heat treat the part. Refer to applicable manual.

(7) Hand finish repaired surfaces.

NOTE: Hand finishing is required if non controlled surfaces were repaired only.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(8) If weld material extends into mounting holes or outside radius, machine clean up. Refer to applicable manual for requirements.

(9) Clean welded surface. Refer to SECTION II – CLEANING.

WARNING: USE THE CORRECT PERSONAL PROTECTION. OIL USED DURING THIS INSPECTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE HOT BLACK LIGHT WILL CAUSE BURNS TO BODY AREAS WITH NO PROTECTION.

(10) Perform penetrant inspection. Refer to ASTM E1417, Type 1, Method A, C or D Level 3 or 4. No cracks permitted. Acid etch only when required.

(11) Clean part. Refer to SECTION II – CLEANING.

Table 404. Weld Diameters, Widths and Overlaps for Resistance Spot and Seam Welds

STD. SHEET			MINIMUM SEAM WIDTH OR SPOT DIAMETER		MINIMUM OVERLAP					
MIN	NOM.	MAX.			NICKEL AND COBALT		IRON AND TITANIUM		ALUMINIUM AND MAGNESIUM	
0.008 (0.20)	0.010 (0.25)	0.012 (0.30)	0.08	(2.03)	0.22	(5.59)	0.22	(5.59)	0.30	(7.62)
0.010 (0.25)	0.012 (0.30)	0.014 (0.36)	0.09	(2.29)	0.25	(6.35)	0.24	(6.10)	0.32	(8.13)
0.012 (0.30)	0.014 (0.36)	0.016 (0.41)	0.09	(2.29)	0.25	(6.35)	0.25	(6.35)	0.34	(8.64)
0.014 (0.36)	0.016 (0.41)	0.018 (0.46)	0.10	(2.54)	0.31	(7.87)	0.26	(6.60)	0.36	(9.14)
0.016 (0.41)	0.018 (0.46)	0.020 (0.51)	0.11	(2.79)	0.31	(7.87)	0.27	(6.86)	0.38	(9.65)
0.018 (0.46)	0.020 (0.51)	0.022 (0.56)	0.11	(2.79)	0.38	(9.65)	0.28	(7.11)	0.40	(10.16)
0.020 (0.51)	0.022 (0.56)	0.024 (0.61)	0.12	(3.05)	0.38	(9.65)	0.30	(7.62)	0.42	(10.67)
0.023 (0.58)	0.025 (0.64)	0.027 (0.69)	0.13	(3.30)	0.40	(10.16)	0.32	(8.13)	0.44	(11.18)
0.025 (0.64)	0.028 (0.71)	0.031 (0.79)	0.14	(3.56)	0.40	(10.16)	0.35	(8.89)	0.47	(11.94)
0.029 (0.74)	0.032 (0.81)	0.035 (0.89)	0.14	(3.56)	0.40	(10.16)	0.38	(9.65)	0.50	(12.70)
0.032 (0.81)	0.036 (0.91)	0.040 (1.02)	0.15	(3.81)	0.40	(10.16)	0.40	(10.16)	0.52	(13.21)
0.036 (0.91)	0.040 (1.02)	0.044 (1.12)	0.16	(4.06)	0.45	(11.43)	0.42	(10.67)	0.54	(13.72)
0.040 (1.02)	0.045 (1.14)	0.050 (1.27)	0.17	(4.32)	0.50	(12.70)	0.44	(11.18)	0.56	(14.22)
0.045 (1.14)	0.050 (1.27)	0.055 (1.40)	0.18	(4.57)	0.50	(12.70)	0.46	(11.68)	0.58	(14.73)
0.052 (1.32)	0.056 (1.42)	0.060 (1.52)	0.19	(4.83)	0.55	(13.97)	0.48	(12.19)	0.61	(15.49)
0.058 (1.47)	0.063 (1.60)	0.068 (1.73)	0.20	(5.08)	0.55	(13.97)	0.50	(12.70)	0.64	(16.26)
0.065 (1.65)	0.071 (1.80)	0.077 (1.96)	0.21	(5.33)	0.62	(15.75)	0.54	(13.72)	0.69	(17.53)
0.073 (1.85)	0.080 (2.03)	0.087 (2.21)	0.23	(5.84)	0.62	(15.75)	0.58	(14.73)	0.74	(18.80)
0.083 (2.11)	0.090 (2.29)	0.097 (2.46)	0.24	(6.10)	0.62	(15.75)	0.62	(15.75)	0.80	(20.32)
0.093 (2.36)	0.100 (2.54)	0.107 (2.72)	0.25	(6.35)	0.75	(19.05)	0.65	(16.51)	0.84	(21.34)

NOTE: 1. For materials other than sheet, use the closest nominal thickness to select above limits.

2. All dimensions are in inches (mm).

Table 404. Weld Diameters, Widths and Overlaps for Resistance Spot and Seam Welds (Cont)

STD. SHEET			MINIMUM SEAM WIDTH OR SPOTDIAMETER		MINIMUM OVERLAP					
MIN	NOM.	MAX.			NICKEL AND COBALT		IRON AND TITANIUM		ALUMINIUM AND MAGNESIUM	
0.104 (2.64)	0.112 (2.84)	0.120 (3.05)	0.27	(6.86)	0.75	(19.05)	0.68	(17.27)	0.89	(22.61)
0.117 (2.97)	0.125 (3.18)	0.133 (3.38)	0.28	(7.11)	0.88	(22.35)	0.72	(18.29)	0.94	(23.88)
0.132 (3.35)	0.140 (3.56)	0.148 (3.76)	0.30	(7.62)	0.88	(22.35)	0.78	(19.81)	0.98	(24.89)
0.151 (3.84)	0.160 (4.06)	0.169 (4.29)	0.32	(8.13)	1.00	(25.40)	0.84	(21.34)	1.04	(26.42)
0.170 (4.32)	0.180 (4.57)	0.190 (4.83)	0.34	(8.64)	1.00	(25.40)	0.91	(23.11)	1.10	(27.94)
0.189 (4.80)	0.200 (5.08)	0.211 (5.36)	0.36	(9.14)	1.12	(28.45)	0.97	(24.64)	1.17	(29.72)
0.212 (5.38)	0.244 (5.69)	0.236 (5.99)	0.38	(9.65)	1.12	(28.45)	1.00	(25.40)	1.24	(31.50)

NOTE: 1. For two members of different thickness, use the weld size and overlap specified for the thinner member.

2. If three members are welded, use the weld size and overlap specified for the outside member.

3. All dimensions are in inches (mm).

12. Balancing Procedures and Guidelines

A. Method No. 412A: Turbine Wheel Assembly Balance Check and Re-balance

Rebalance the turbine wheel assembly as follows:

(1) Install turbine wheel assembly in adapter specified in applicable manual.

(2) Place adapter and turbine wheel assembly in a balancing machine.

(3) Determine class of balancing to be performed. Refer to Method No. 412C.

(4) Mark consecutive numbers opposite each vane or inner flat surface of turbine wheel with Flexographic ink C05-0001. Adjust strobe lamp to illuminate numbers.

NOTE: Do not vary RPM of wheel when checking for imbalance. Speed selected must be used for each check.

(5) Rotate turbine wheel assembly at approximately 600 to 1800 RPM. Use jet or belt drive as specified in applicable manual. Balance must be as specified in applicable manual.

(6) If turbine wheel assembly is not in the balance requirements, stop turbine wheel and place clay in opposite numbered areas indicating excessive weight and imbalance. Adjust clay to obtain balance in specified limits.

(7) Remove turbine wheel assembly from balancing machine.

(8) Cover shaft of turbine wheel assembly to protect from metal particles.

(9) Remove metal from surfaces specified in applicable manual, as required, to bring turbine wheel assembly into balances. Unless specified differently in manual, finish affected rework surfaces to 32 microinches (0.8 micrometers) or better with corner radii no sharper than 0.090 inch (2.29 mm).

(10) Remove clay.

(11) Reinstall turbine wheel assembly in balancing machine and recheck balance at same RPM used in Step (5). Repeat procedure until turbine wheel assembly is in balance limits.

(12) Remove turbine wheel assembly from balancing machine.

(13) Spot treat material removal area with appropriate touch-up solution as specified in applicable manual.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

(14) Remove industrial marking ink numbers. Use degreasing solvent C04-0025 (Type1).

(15) Remove turbine wheel assembly from adapter.

(16) Tag turbine wheel assembly as a balanced part and place in a protected area until required for re-assembly.

B. Method No. 412B: Rotor Assembly Balance

Balance rotor assemblies as follows:

(1) Place rotor assembly in an insert specified in applicable manual.

(2) Install rotor in a standard balancing machine.

(3) Turn rotor assembly at approximately 600 to 1800 RPM and locate imbalance. Use jet or belt drive as specified in applicable manual.

(4) Remove rotor assembly from balancing machine.

(5) Remove material from surface indicated in applicable manual as required to bring rotor assembly into balance in limits specified.

(6) Reinstall rotor assembly in balancing machine and recheck balance. Continue balancing procedure until rotor assembly is balanced in limits specified in applicable manual.

(7) Remove rotor assembly from balancing machine.

(8) Spot treat material removal area with appropriate touch-up solution as specified in applicable manual.

C. Method No. 412C: General Balancing

(1) Force Balance or Static Force Balance is a single plane balance procedure by which a mass distribution of a rigid rotor is adjusted in order to make sure that the residual static unbalance is within specified limits which needs correction in only one plane.

Material is removed or added in equal quantities from the two sides to bring the plane into balance.

(2) Dual-Plane Balance is a procedure by which the mass distribution of a rigid rotor is adjusted in order to make sure that the residual unbalance in two arbitrary planes limits are as specified of those planes.

Material is removed or added as necessary to bring each plane into balance.

The general balancing procedure includes the following:

- Reviewing balance procedure terms. Refer to Step (3)
- Determining specifications of the balancing machine that will be used. Refer to Step (4)
- Determining the Class of balancing to be performed. Refer to Step (5)
- Performing the actual balancing procedure. Refer to Step (6)

(3) Refer to Table 405 to familiarize yourself with balancing procedure terms.

(4) Refer to Table 406 to identify the specifications of recommended balancing machines.

(5) Determine the Class of balancing to be performed.

(a) Class A is balancing of parts supported on their own journals or surfaces during the balancing procedure. Correction is accomplished utilizing dial angel and quantity readings after single spin(s) in each plane.

(b) Class B is balancing of parts supported on an arbor designed to provide journals or surfaces for the balancing procedure. Preliminary gimmick (balance) of tooling is not required. Correction must be accomplished use Vector Calculation or equivalent, assuring part compliance over tooling.

(6) Perform the balancing procedure.

(a) Thoroughly clean part to be balanced (Refer to SECTION II). Lubricate locating surfaces of part use Lubricant Oil C02-0008.

(b) If part journal is not used, install required adapter or tool as specified in applicable manual for unit in work.

(c) Set up balancing machine in accordance with manufacturer instructions.

(d) Record setup data as required use instructions of balancing machine manufacturer. Conversion number (ounce/inches) must be corrected if required. Use the following equation.

$$\text{ounce / inches per unit} = \frac{\text{weight} \times \text{radius} \times 16}{\text{units} \times 454}$$

(e) Install part to be balanced in balancing machine in accordance with manufacturer instructions.

NOTE: The following steps must be accomplished when using Vector Calculation (Polar graph plotting or theory of 180 degrees turn).

(f) Spin part and record angle and quantity of reading.

(g) Stop rotation of part, rotate arbor on part 180 degrees.

(h) Spin part and record angle and quantity reading for second position.

(i) Record limits of balance as specified in applicable manual for unit in work.

(j) Select suitable scale quantity and identify radical lines on polar graph paper. The scale selected must be as large as possible and in the quantity of readings recorded. Figure 413 reflects a typical Vector Calculation for Plane L or Plane M. Calculate for one plane at a time.

Table 405. Balancing Terms and Explanations

Term	Explanation
Amplitude Measuring	Measurement of the maximum or peak value of the sine wave of voltage produced by the pickups. This maximum value represents the quantity of unbalance in the work-piece.
Balancing Tolerance	The maximum quantity of unbalance usually expressed in ounce/inches that can remain in a part without affecting its performance in operation.
Clay-In	The process of balancing where no material is removed and balance is achieved by adding modeling clay to the part or arbor.
Couple Unbalance	Unbalance caused by two equal unbalances, opposite in direction and located in two separate traverse planes perpendicular to journal centerline, which cause the principle inertia axis to want to be at an angle to the journal centerline. Units are Weight X Radius X Distance (ounce inch 2). Produces motion of gyration.
Cradle	A rigid, usually lightweight, support member used to join work supports to allow balancing of parts whose mass, weight distribution, geometry, or bearings interferes with the self aligning feature of the work support.
Critical Speed	The speed at which a rotating body vibrates excessively. Usually the critical speed is the same as the natural frequency of the rotating assembly.
Cross Effect	The change of unbalance in one plane brought about by alternating the unbalance state of the other plane.
Damping	A viscous or frictional-resistance hysteresis force used to reduce the amplitude of vibration.
Equation	A shortcut way of expressing a scientific law of relationship by using letters to represent the words.
Force Unbalance	Unbalance that can be detected when the part is placed on level knife edges, and will cause the journal centerline to be displaced a distance from, but parallel to, the principle inertia axis. Units are Weight X Radius (ounce X inches).
Gimmick	Electrically or mechanically applied corrections to an arbor or piece of tooling such that the unbalance affects caused by the tooling are reduced.
Hard Support	Balancing machine with stiff work supports. Parts rotate about its journal centerline and the centrifugal force caused by the unbalance, deflect the supports. Natural frequency of the supports is approximately ten times that of the machine operating speed. Setup accomplished by dialing in part dimensions. Calibration is fixed.
Hold Meter	Angle or quantity meter that retains its reading after each read cycle.
Incremental Balancing	The balancing of an assumed non-rigid rotor by re-balancing the assembly after each stage of the assembly is added and making the correction in the last assembled stage.

Table 405. Balancing Terms and Explanations (Cont)

Term	Explanation
Journal Centerline (Rotational Axis)	The rotational centerline of a rotor as determined by its bearing.
Linear	A relationship between two variables such that the output is directly proportional to the input.
Mass Centering	A balancing process where the principle inertia axis of a part is located and marked.
Natural Frequency	The frequency at which a body will vibrate upon excitation from an outside force.
Off Angle Correction	A correction made for an unbalance condition at an angle other than the angle of unbalance.
Linear	A relationship between two variables such that the output is directly proportional to the input.
Mass Centering	A balancing process where the principle inertia axis of a part is located and marked.
Natural Frequency	The frequency at which a body will vibrate upon excitation from an outside force.
Off Angle Correction	A correction made for an unbalance condition at an angle other than the angle of unbalance.
Peak	The maximum on scale reading of the quantity meter that can be obtained when tuning the filters of a tuned amplifier measuring system. ("S" measuring)
Sensitivity	The smallest quantity of displacement the balancing machine can detect and display accurately on the quantity meter.
Set Up	A sequence of adjustments and operations
(Programming)	On a balancing machine in order to accurately read the angle of unbalance and quantity of correction necessary in units usable to the operator.
Single Pass Correction	The ability of the balance measuring system to read the unbalance and the correction system to apply the proper sized correction on angle and in plane such to reduce the quantity of unbalance with a single correction effort.
Soft Support	Balancing machine with flexible work supports. Part rotates about its principle inertia axis (as it would in free space) and the journal movement deflects the work supports. Natural frequency of the supports is one-fifth of the lowest operating speed of the machine.
Theory of 180 degree	A method of calculating the unbalance turn caused by rotating the tooling of a balanced assembly radially 180 degrees relative to the work-piece. The resulting quantity is equal to exactly twice the unbalanced caused by tooling.

Table 405. Balancing Terms and Explanations (Cont)

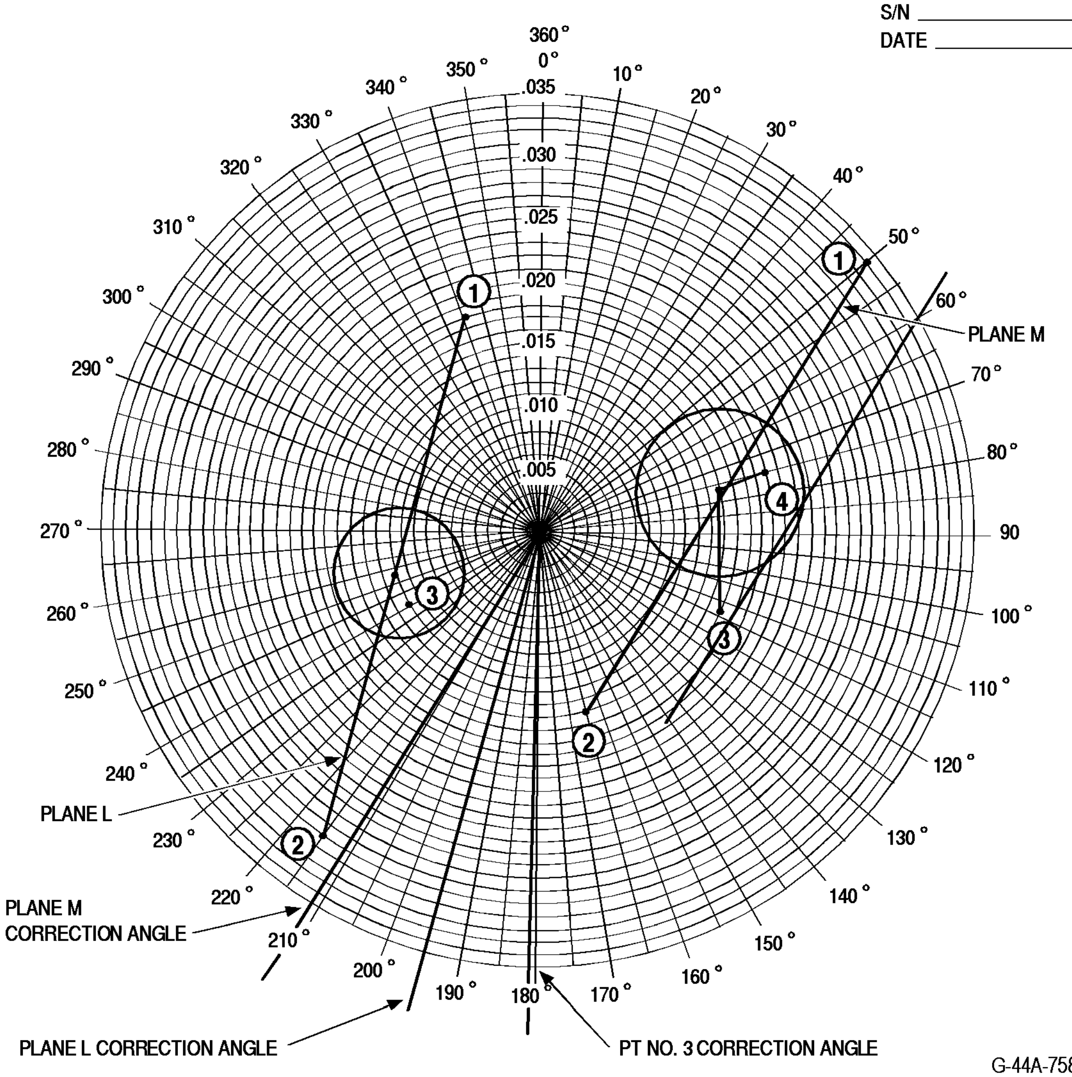
Term	Explanation
Tooling	The additional apparatus that is used to attach and support the work-piece in the balance work supports or to the spindle. Tooling is what stays on the balance.
Translation	Motion in which at any instant every point on the journal centerline is moving in the same direction and at the same velocity as every other point.
Unbalance	The condition that exists in a part when its principle inertia axis and journal centerline are not coincident. Usually measured in ounce/inches.
Vector	A line with an arrowhead used to represent magnitude and angle of an unbalance or force.
Whip or Whirl	Bending or bowing of the journal centerline of a non-rigid rotating body initiated by the centrifugal force generated by unbalance.

Table 406. Specifications of Recommended Machines

Machine Model	Weight, Min	Pounds Max.	Swing Diameter Inch Max.	Length Inch Max.	Speed (RPM)	Sensitivity Inch Min
American Hofmann HD-12.1	1 oz (28.34 g)	35 (15 kg)	16 (406 mm)	18 (457 mm)	60 to 3600	0.000010 (0.254 Um)
American Hofmann HD-13.15	.4 oz (11.33 g)	150 (68 kg)	25 (635 mm)	32 (812 mm)	60 to 3600	0.000010 (0.254 Um)
American Hofmann HD-11.1	1 oz (28.34 g)	15 (15 kg)	10 (254 mm)	18 (457 mm)	60 to 3600	0.000010 (0.254 Um)
American Hofmann Vertical HDV-30-2J	2 oz (56.69 g)	150 (68 kg)	36 (914 mm)	-	400 to 1500	0.000020 (0.508 Um)
American Hofmann HD-16.1J	8 oz (226.8 g)	250 (113 kg)	31 (787 mm)	45 (1143 mm)	60 to 3600	0.000010 (0.254 Um)

	PLANE L		PLANE M		FORCE	
	LIMIT 0.005		LIMIT 0.007		LIMIT	
	AMT	ANGLE	AMT	ANGLE	AMT	ANGLE
PT1 0°	0.018	340°	0.034	50°		
PT2 180°	0.030	215°	0.015	165°		
PT3		235°	0.016	122°		
PT4			0.019	75°		

P/N ____________________
S/N ____________________
DATE ____________________



Vector Calculation (Polar Graph Plotting) (Typical)
Figure 413

(k) Make a plot of the first reading (quantity and angle) and identify it as point No. 1. Refer to Figure 413).

(l) Make a plot the second reading (quantity and angle) and identify as Point No. 2.

(m) Make a line between Point No. 1 and 2. Divide the line into two equal lengths and identify center of line as Point X.

(n) Measure distance between Point No. 2 and Point X. Convert to scale selected. Quantity measured is the total unbalance of part.

NOTE: Lead tape or clay may be used to gimmick (balance) arbor or tool. Add lead tape or clay 180 degrees from angle of Point X.

(o) Measure distance between zero quantity (center of polar chart) and Point X. Convert to scale selected. Quantity measured is the total unbalance in the arbor or tool.

(p) Use a compass, make a tolerance circle with its center at Point X. The radius of this circle must be the scale-equal of the balance limit specified in applicable manual for unit in work.

(q) Make a line from center of polar chart, parallel to the line of Point No. 1 to Point No. 2, and in the direction of Point No. 2. Note angle of this line. Stock removal must be accomplished at this angle. If addition of stock is required add 180 degrees to angle.

(r) Locate correction angle accurately on part. Remove part from balancing machine.

CAUTION: REMOVE STOCK ONLY FROM AREAS OF PART AS SPECIFIED IN APPLICABLE MANUAL FOR PART IN WORK.

(s) Cover arbor or tool attached to part to protect from metal particles, and remove or add stock at Plane L correction angle (Figure 413). Minimize stock removal or addition by concentrating at correction angle.

(t) Thoroughly remove metal particles and reinstall part in balancing machine.

(u) Spin part and record corrected angle and quantity. Make a plot of corrected reading (quantity and angle) and identify as Point No. 3.

(v) If Point No. 3 falls within tolerance circle, the part is balanced in limits. The distance between Point X and Point No. 3 is the remaining unbalance in the part.

(w) If Point No. 3 falls outside of tolerance circle draw a line from center of polar chart parallel to the line of Point X to Point No. 3 and in the direction of Point No. 3. Second balancing attempt must be made at this correction angel.

(x) Repeat Steps (q) through (u) as required until part is balanced. Remove part from balancing machine.

(y) Plane M can be plotted on same chart as depicted in Figure 413.

13. Repairing Electrical Components

NOTE: The following methods are typical only. Refer to applicable manual for unit in work for specific instructions.

A. Method No. 413A: Switch Assembly Repair

Repair switch assembly as follows:

NOTE: After completion of repair. Switch must be in range of Dimension F. Refer to applicable manual and Figure 407. If sleeving requires replacement, remove Potting Compound C03-0008 from the two parts of assembly.

(1) Remove Potting Compound C03-0008 from part to be replaced. Melt solder from connecting points on part and disconnect wiring from part.

(2) If required, remove sleeving from wiring.

(3) Cut new sleeving length as required. Refer to applicable manual.

(4) Slide new sleeving above wiring.

(5) Connect wiring. Refer to Figure 414.

NOTE: Make sure of receptacles correct align before wiring installation.

(6) Solder wiring. Refer to ASTM B 32. Use flux C06-0002, C06-0003, C06-0004, C06-0005 or C06-0006.

(7) Connect continuity meter between receptacle Pins A and B. There must be continuity indicated.

(8) Put switch to open condition. Continuity must be broken.

(9) Put switch to close condition. There must be continuity indicated.

(10) Connect continuity meter between Pin A and case of receptacle. There must not be continuity indicated.

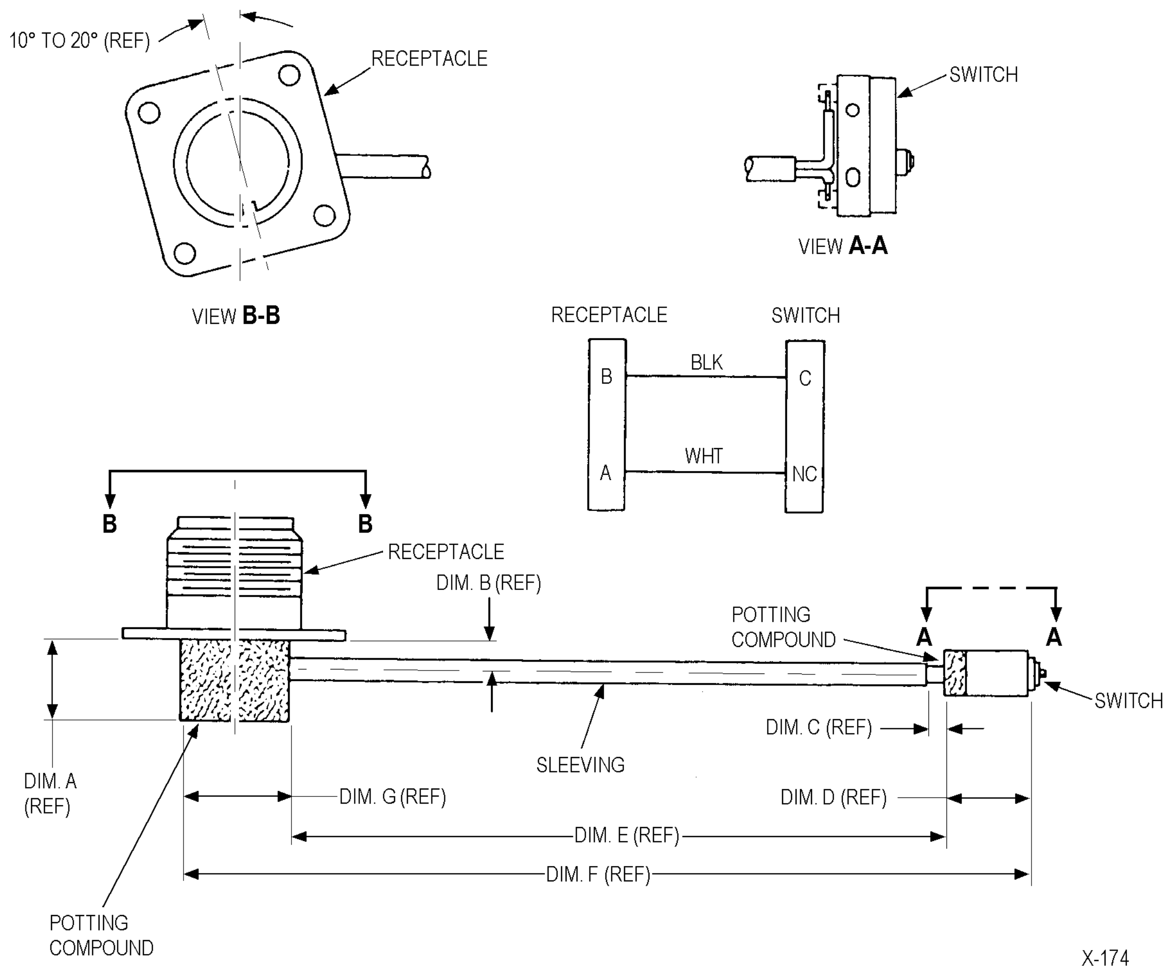
(11) Connect continuity meter between terminal C and switch condition. There must not be continuity.

(12) Mix potting compound. Use Potting compound C03-0008, 8 parts A to one part B by weight.

NOTE: Make sure of correct Potting Compound C03-0008. Refer to applicable manual.

(13) Apply Potting Compound C03-0008. Refer to Figure 414 for repaired limits.

(14) Cure Potting Compound C03-0008 for 4 hours at 250°F (121°C).



Repair Switch Assembly (Typical)
Figure 414

B. Method No. 413B: Solenoid Assembly Repair (Receptacle Replacement)

Replace receptacle on solenoid assembly as follows:

CAUTION: MAKE SURE THAT WIRING IS NOT DAMAGED OR CUT TOO SHORT WHILE REMOVING RECEPTACLE. IF WIRING IS DAMAGED, REPLACE SOLENOID ASSEMBLY.

(1) Remove applicable screws and washers, or rivets, and terminal.

(2) Carefully disconnect receptacle from solenoid assembly sufficiently far to put a screwdriver or blunt tool to remove Potting Compound C03-0008 around terminals or receptacle.

(3) Disconnect wiring from receptacle as near behind of receptacle as possible.

(4) If required, remove spacer that attach between receptacle and solenoid assembly.

(5) Remove sufficient Potting Compound C03-0008 from receptacle hole in solenoid assembly to aid for a good bond on reassembly.

WARNING: METHYL-ETHYL-KETONE (MEK) IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR CONTACT WITH SKIN. OBSERVE ALL FIRE PRECAUTIONS.

(6) Clean mating surfaces of solenoid assembly and new receptacle. Use methyl-ethyl-ketone C04-0003.

(7) If applicable, install spacer.

(8) Attach wiring from solenoid assembly to applicable pins of new receptacle. Refer to applicable manual for wiring diagram and keyway location

NOTE: Silver solder mechanical joints in accordance with ASTM B32 using silver brazing wire in accordance with AMS 4774.

(9) Flush bonded joints with a diluted solution of Sodium Bicarbonate C04-0039 (one ounce for each gallon of water) at room temperature.

NOTE: Clean bonded joint using a stiff bristle brush.

(10) Trim ends of wiring to remove sharp protrusions through silver solder.

(11) Apply primer to the mating surfaces, receptacle and space in solenoid assembly, if applicable on spacer. Refer to applicable manual.

(12) Let primer to cure for 1 hour at room temperature.

(13) Apply a layer of Potting Compound C03-0008 to the mating surfaces of solenoid assembly, receptacle and if applicable on spacer.

NOTE: Do not abovefill the space of solenoid assembly.

(14) Fill space of solenoid assembly with specified Potting Compound C03-0008.

(15) Attach receptacle to solenoid assembly with screws and washers, or rivets, and applicable terminal lug. Upset rivets to attach.

(16) Cure Potting Compound C03-0008 at 300 to 350°F (149 to 177°C) for 1 hour.

NOTE: Set solenoid assembly with receptacle down while curing.

C. Method No. 413C: Electrical Connector Repair (Pin Replacement)

Repair bent or damage pins in electrical connectors as follows:

NOTE: Pution and removal tools (MIL-I-81969-17 and MIL-I-81969-19) (SECTION VII) can be used with the following connectors and contacts: MIL-C-23216, MIL-C-26482, MIL-C-26500, MIL-C-26518, MIL-C-26636, MIL-C-38300, MIL-C-39029, and MS3190.

(1) Replace bent or damaged pin in electrical connectors as specified in applicable Military Standard for part requiring repair.

Example: Military Standard for Connectors, PN MS24264XXX calls for using Tool (PN MS24256R) to remove contacts, and Tool (PN MS24256A) to install contacts.

D. Method No. 413D: Wiring Harness Assembly Repair

Repair cable for small damage as follows:

NOTE: Tape C08-0017 or C08-0030 can be used in place of heat shrink or sleeving, where called out, in cases where the wire below repair is not required to be removed from the harness assembly.

NOTE: Splices are not to be used for thermocouple wires.

NOTE: Check harness assembly to applicable manual prior to repair to determine extent of work necessary.

NOTE: Apply Humiseal (Type 1B15) or equivalent to repaired or replaced harness lacing.

(1) Repair damage to outer insulation. Refer to Figure 415, Figure 415A, Figure 413B, Figure 413C and Figure 413D.

(a) If damage is to outer insulation, or if damage to shielding is abrasion, or deformation only no broken strands, repair as follows. Refer to Figure 415.

1 Clean part. Use Alcohol Isopropyl C04-0004.

2 Let port dry.

3 Reshape damage strands to usual shape.

4 Wind the damaged area with Tape C08-0017 and C08-0030 or equivalent for less than one and one half times, and no more than two times. The tape must extend more than either side of the edge of the damage by a minimum of 0.5 inch (13 mm).

NOTE: Steps (1)(a)5 and 6 maybe be deleted if using Tape C08-0030.

5 Apply heat to the tape with a heat gun until tape is attach to the cable.

6 Use cable lacing or cable attaches at both ends of the repaired area to attach the repair. This can be done on the single repaired cable or to attach it to the adjacent cables. Refer to Figure 415C and Figure 415D.

(b) If damage to shielding includes broken strands, the damage cannot exceed more than one cord. A cord represents a grouping of individual strands that are braided together to form the shield. Broken strands must not penetrate the insulator around the inner conductor wire.

1 Clean part to remove contaminates (fuel, oils, dirt, etc) and let to dry. Use Alcohol Isopropyl C04-0004.

2 Fold the broken strands in a manner that cannot impinge on the insulation around the inner conductor.

3 Wind the damaged area with Tape C08-0017 and C08-0030 or equivalent no less than one and one half times, and no more than two times. The tape must extend more than either side of the edge of the damage by a minimum of 0.5 inch.

NOTE: Steps (1)(b)4 and 5 maybe be deleted if using Tape C08-0030.

4 Apply heat to the tape with a heat gun until tape is attached to the cable.

5 Use cable lacing or attach cable at both ends of the repaired area to attach the repair. This can be done to one repaired cable or to attach it to adjacent cables.

(c) Damage that extends through or more than the inner insulation, around the conductor is not permitted. Refer to Figure 415A.

Repairable. Shield is Still Intact and Only has Minor Deformation
Figure 415

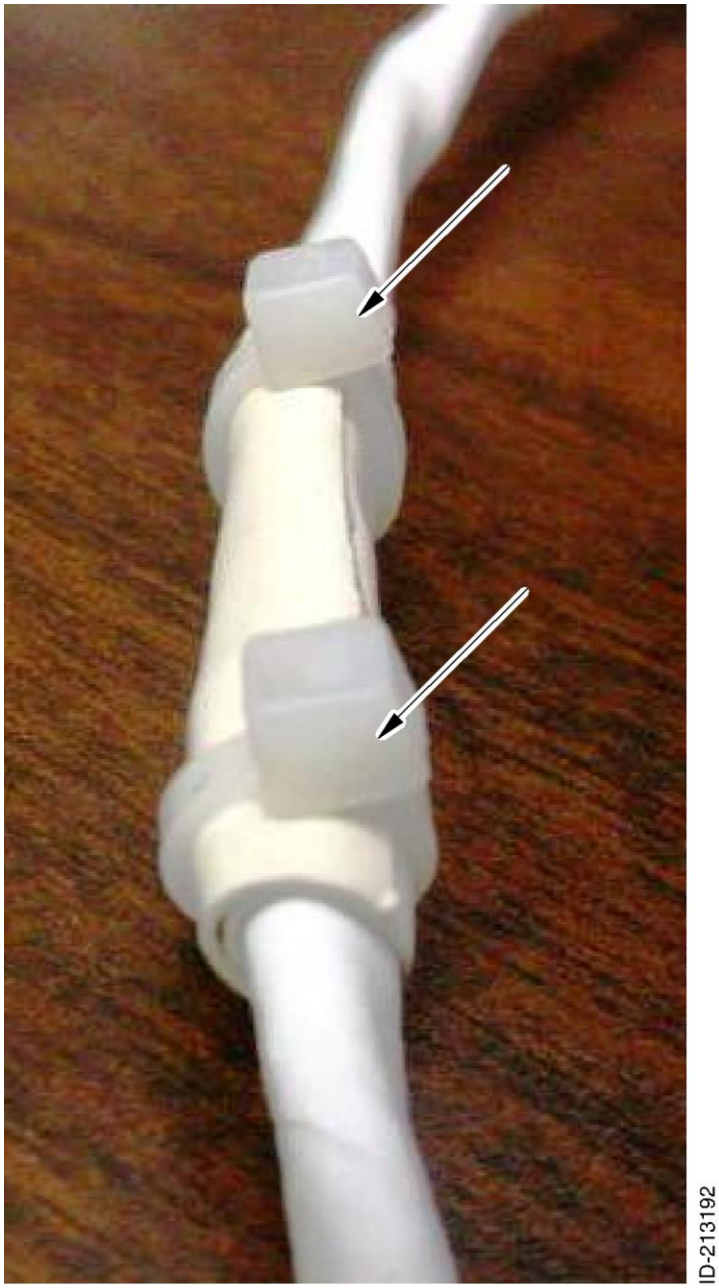
NOTE: 1. Too much damage to shielding and in the inner conductor (on top strand is not permitted).

Excessive Damage to Shielding and into the Inner
Conductor on Top Strand. Cable must be Replaced
Figure 415A

NOTE: 1. Correct configuration to wind a tape 1 and ½ times minimum around a single cable.

2. Correct configuration of repaired and attached cable.

Shows the Acceptable Wrap of Tape to a
Minimum of 1 and 1/2 Times Around a Single Cable
Figure 415B



NOTE: 1. Correct attach with cable ties at the end of a repair tape.

2. Correct configuration of repaired and attached cable.

Shows the Use of Cable Ties to Secure
the Ends of a Tape Repair
Figure 415C

ID-213193

NOTE: 1. It is not necessary to attach a single cable that will be bundled, unless it will not be attached by a tie to secure the bundle.

2. Cable lacing attach configuration of a repaired cable in a bundle cable.

3. Correct configuration of repaired and attached cable.

Shows the Use of Cable Lacing to Secure a Repaired Cable to a Cable Bundle
Figure 415D

Repair wiring harness assembly (Typical) as follows:

NOTE: Disassemble wiring harness only to extent necessary to replace faulty component. If wires require cutting for removal, it can not be possible to re-use wires.

(2) Disassemble wiring harness assembly. Refer to Figure 416 (Sheet 1).

(a) Remove nuts (3), washers (4), and screw (5).

(b) Remove tie (19) from leads.

(c) Cut wire leads to connector (6) as close as possible to retain maximum length of leads.

(d) Remove connector (6) and bracket assembly (7).

(e) Remove screws from adapter (9), then using a rod of correct diameter, push pins of connector (8) through the front of connector.

(f) Remove connector (8), adapter (9), and grommet (10).

(g) Remove screws from connector (11) and support (11A). Remove support (11A), then using a rod of suitable diameter, push pins of connector (11) through the front face of connector.

(h) Remove connector (11) and grommet (12).

(i) Remove nuts (13), washers (14), and screw (15).

(j) Remove adhesive compound.

(k) Cut wire leads to connector (16) as close as possible to retain maximum length of leads.

(l) Separate connector (16), gasket (17), and bracket (18).

(m) If wiring was cut too short during disassembly, replace each cut wire with a new wire cut to initial length.

NOTE: Install new sleeving on wires.

(3) Re-assemble wiring harness.

(a) Cut new wiring to length of initial wiring.

(b) Cut new sleeving to length of initial sleeving.

(c) Apply primer, to both ends of sleeving for a length of 1 inch (25.4 mm). Refer to applicable manual.

(d) Solder wire leads to connector (6), refer to ASTM B32. Use flux C06-0002, C06-0003, C06-0004, C06-0005, C06-0006, refer to ANSI/IPC J-STD.

(e) Install sleeving. Refer to applicable manual.

NOTE: Make sure sleeving and wiring that connects to connector (8) is centered and wires are straight to pins.

(f) Using a heat gun, shrink ends of sleeving installed in Sub-step (e).

(g) Install bracket (7) on the connector (6).

(h) Put wiring and sleeving through gasket (17) and bracket (18).

(i) Solder wire leads to connector (6), refer to ASTM B32. Use flux C06-0002, C06-0003, C06-0004, C06-0005, refer to ANSI/IPC J-STD.

(j) Put wiring and sleeving through grommet (10) and adapter (9).

(k) Put wiring and sleeving through grommet (12) and support (11A).

(l) Crimp wire leads to connectors (8, 11) pins using appropriate crimping tools (SECTION VII). Put into connectors.

(m) Install support (11A) to connector (11).

(n) Tighten support (11A) to 10 to 15 in-lbs (1.13 to 1.69 Nm) torque.

(o) Attach adapter (9) to connector (8).

(p) Install sleeving, above wiring harness and grommet (12). Tighten screws in adapter (9). Refer to applicable manual.

(q) Install sleeving, above wiring harness and grommet (12). Tighten screws in adapter (11A). Refer to applicable manual.

(r) Install connector (16) and gasket (17) onto bracket (18). Align key of connector (16) with side of bracket (18) and with bracket (18) mounting holes.

(s) Install screws (15), washers (14), and nuts (13).

(t) Install tie wrap (19) above wiring harness in 0.140 inch (3.56 mm) from bottom of connector (6).

(u) Install plate (2) on one screw (5). Install bracket assembly (7) on connector (6). Attach using screws (5), washers (4), and nuts (3).

(v) Perform continuity check of wiring harness.

(4) Apply potting to connector Refer to Figure 416 (Sheet 2, Item 6).

(a) Set wiring to get Dimension A with a 5 to 15 degree bend, and sleeving above wiring inserted to Dimension F in connector (6) space.

(b) Apply Potting Compound C03-0008 for each applicable manual, at rear of connector (6) to fully seal wiring end of connector (6).

(c) Potting Compound C03-0008 must extend to Dimension C, from rear of connector (6) where wiring bends, to Dimension B where wiring extends from connector (6).

(d) Make sure Potting Compound C03-0008 is in Dimension B and Dimension D to fully cover sleeving. The external dimension of adhesive compound must not be more than Dimension E.

(e) Cure Potting Compound C03-0008. Refer to applicable manual.

(5) Apply potting to connector as follows. Refer to Figure 416 (Sheet 2, Item 16).

(a) Set writing to obtain Dimension H with a 45 to 60 degree bend, and sleeving above wiring put on Dimension K in connector (16).

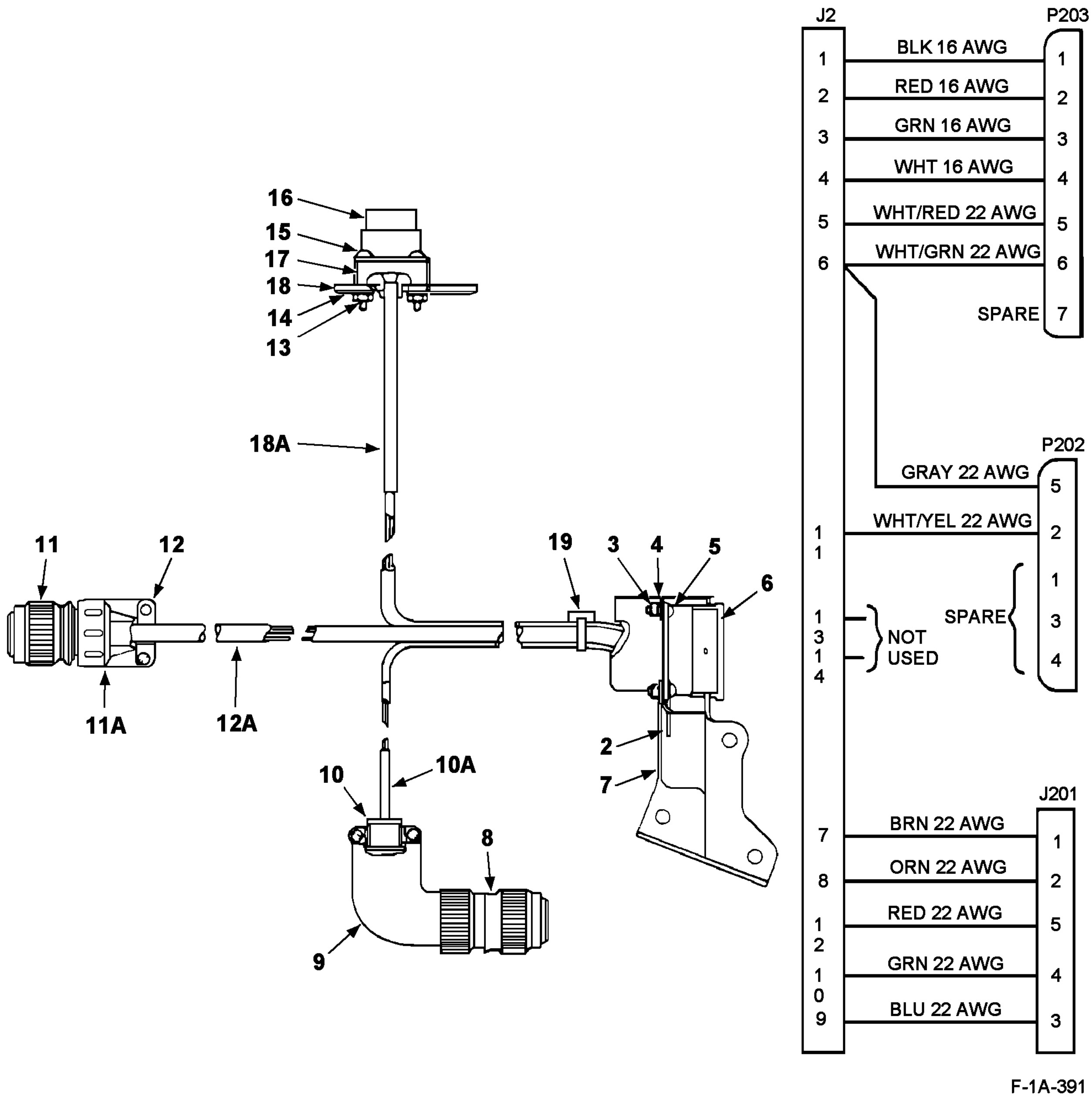
(b) Apply Potting Compound C03-0008, for each applicable manual, behind of connector (16).

(c) Fill the space connector (16) around wiring harness until adhesive compound is protruding from behind of connector (16) to the thickness of Dimension J.

(d) Cure Potting Compound C03-0008. Refer to applicable manual.

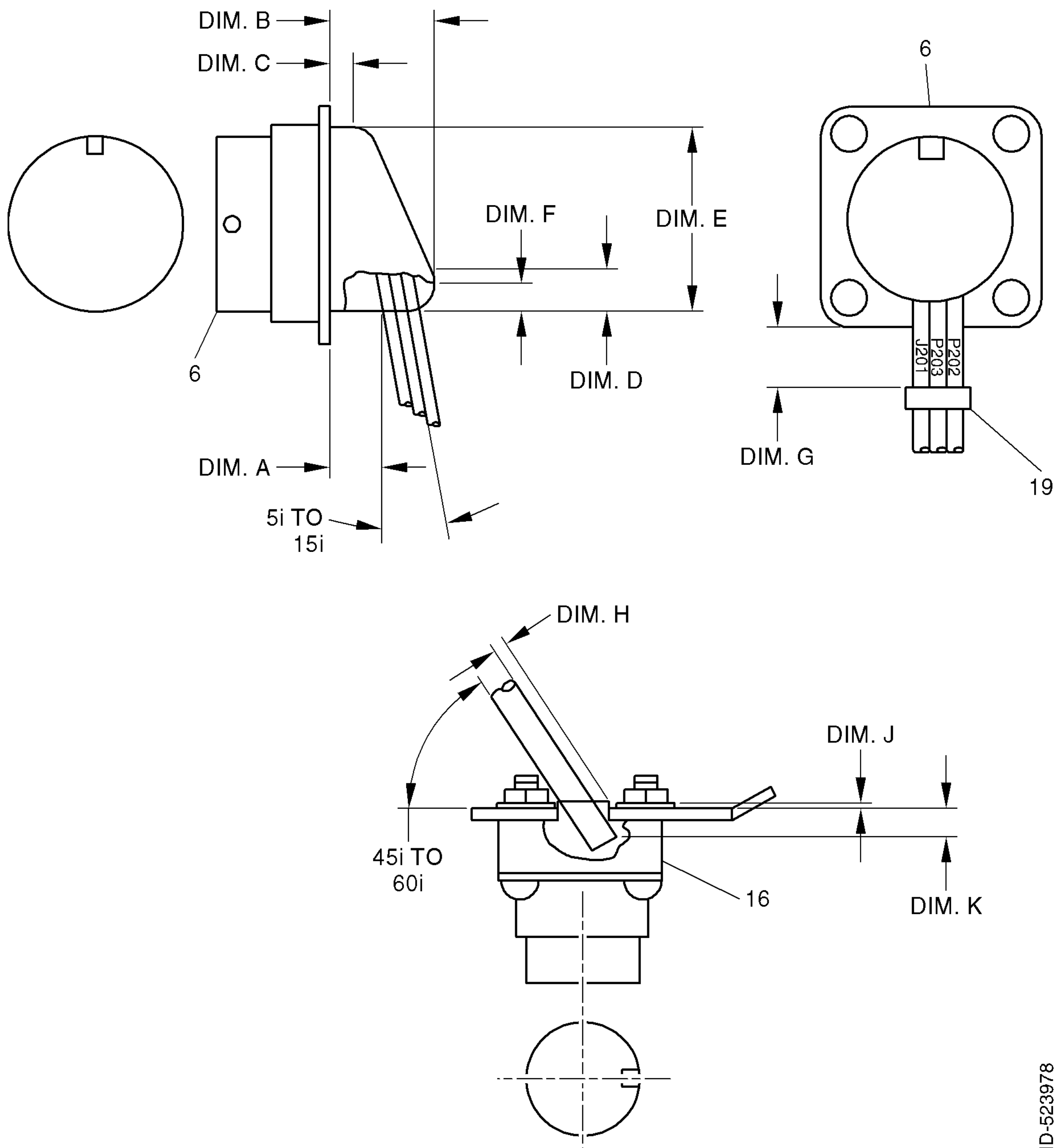
(e) Install tie wind (19) to get Dimension G.

(6) Do insulation resistance check and dielectric strength check. Refer to applicable manual.



2.	PLATE	10.	GROMMET	14.	WASHER
3.	NUT	10A.	SLEEVING	15.	SCREW
4.	WASHER	11.	CONNECTOR (P203)	16.	CONNECTOR (J201)
5.	SCREW	11A.	SUPPORT	17.	GASKET
6.	CONNECTOR (J2)	12.	GROMMET	18.	BRACKET
7.	BRACKET ASSY	12A.	SLEEVING	18A.	SLEEVING
8.	CONNECTOR (P202)	13.	NUT	19.	TIE
9.	ADAPTER				

Repair Wiring Harness Assembly (Typical)
Figure 416 (Sheet 1 of 2)



A	B	C	D	E
0.300 IN. (7.62 MM) MIN	0.60 IN. (15.2 MM) MAX.	0.10 TO 0.12 IN. (2.5 TO 3.05 MM)	0.25 TO 0.27 IN. (6.3 TO 6.8 MM)	1.10 IN. (27.9 MM) MAX.

F	G	H	J	K
0.10 IN. (2.5 MM) MIN	0.000 TO 0.140 IN. (0.00 TO 3.56 MM)	0.04 TO 0.08 IN. (1.0 TO 2.0 MM)	0.10 TO 0.20 IN. (2.5 TO 5.1 MM)	0.08 IN. (2.0 MM) MIN

Repair Wiring Harness Assembly (Typical)
Figure 416A (Sheet 2)

14. Remarking Parts

Before to start cleaning, locate the marks that can be removed by the cleaning and repainting process. Those marks must be identified and recorded. Cleaned and repainted part must be remarked in the same locations using the original method of marking of the part.

A. Method No. 414A: Part Marking Guidelines and Methods

NOTE: Manufacturing marking methods are selected based on the physical properties of the part, degree of performance required, accessibility of the marking location, economics and readability. The intent is to give marking that will stay readable for the service life of the part.

NOTE: When identification marks are lost through rework, repair or normal wear, they must be identified again using the same criteria as originally used. Refer to MIL-STD-130 or AS478.

Mark or remark part as follows:

CAUTION: THE USE OF ELECTROCHEMICAL ETCH MARKING ON THE FOLLOWING TYPES OR CRITICAL ENGINE HARDAREWARE MUST BE PERFORMED WITH EXTREME CARE: LIFE LIMITED PARTS (SUCH AS DISKS, BLISKS, SPOOLS, AND SHAFTS), COUPLING NUTS, CASTINGS, COMPRESSOR REAR FRAMES, COMBUSTION/DIFFUSER CASINGS. PROPER CONTROL OF MARKING DEPTH, ELECTROLYTE SELECTION, NEUTRALIZATION, AND INSPECTION FOR ANY STRAY ELECTRICAL ARCING TO THE PART IS CRITICAL TO THE PROCESS.

CAUTION: DO NOT USE ELECTROCHEMICAL ETCH MARKING ON ANODIZED SURFACES. THE CHEMICAL REACTION CAN CAUSE CORROSION.

(1) Electrochemical etch.

NOTE: Electrochemical etch is adaptable for all metallic parts, cast or forged surfaces, plated, painted or anodized surfaces and tube assemblies. Do not use this method in small thin or delicate parts.

NOTE: The surface to be marked must be electrically conductive. Surfaces covered with paints, lacquers, or enamels cannot be electrochemically etched.

WARNING: ELECTROCHEMICAL ETCH MATERIALS ARE TOXIC. USE PERSONAL PROTECTION EQUIPMENT.

(a) Select the proper stencil for the application.

1 Brown stencils are adequate for 1 - 2 markings. (These stencils are not longer recommended.)

2 Blue stencils are available for some hundred markings.

(b) Cut the stencil to a size so that the wick pad of the marker does not extend more than the edges of the stencil.

(c) Position the stencil in the typewriter/ printer with the white backing paper against the roller. If possible, use an electric typewriter.

1 Set the typewriter/ printer for stencil cutting, or remove the ribbon.

2 Type the marking information in the center of the stencil with typewriter/ printer set on medium pressure. If a manual typewriter is used, apply the same pressure for all characters.

3 Remove the stencil from the typewriter/printer, remove the backing paper from the stencil, and hold the stencil up to a light. The typed information must show fully through the stencil openings.

CAUTION: TO PREVENT INFERIOR MARKINGS WHEN USING A NEW STENCIL MARK ON SAMPLE OR SCRAP PARTS FIRST.

(d) Make sure the part is clean and free from all grease, oil, or film before start marking. Lightly burnish the area to be marked, use abrasive cloth C08-0003.

CAUTION: EXCESS ELECTROLYTE ON THE WICK PAD CAN CAUSE THE MARKING TO BLUR. INSUFFICIENT ELECTROLYTE CAN CAUSE A VERY LIGHT MARK, OR NO MARK ON THE PART.

(e) Apply a sufficient amount of the correct electrolyte to the wick pad of the marker.

NOTE: Different base metal and marking systems require different electrolytes for correct electro etch marking.

(f) Position the stencil on the surface to be marked. The marking location for the part is indicated in applicable manual.

CAUTION: USE THE SMALLEST AMOUNT OF CURRENT AND THE SHORTEST DWELL TIME THAT WILL GIVE A SATISFACTORY MARK. LARGE AMOUNTS OF CURRENT AND LOND DWELL TIMES WILL DECREASE THE STENCIL LIFE.

(g) Set up and adjust the power unit for the necessary shade, type, and depth of mark.

(h) Put the marker over the stencil as follows:

1 Make sure that the typed marking information is covered.

2 Make sure that the wick pad does not extend off of the stencil edges.

3 Apply firm, but not excessive, pressure on the marker for the required dwell time.

(i) Remove the marker and stencil from the part. If the mark is too light, turn the power setting higher or increase the dwell time.

(j) Clean part. Refer to SECTION II – CLEANING.

(k) Clean the equipment after use as follows:

1 Rise the marker wick pad in water to remove the fully electrolyte.

2 Rinse the stencils in water and dab-dry them with a clean, dry cloth.

(2) Electric arc scribe, vibrating tool or pencil grinder-Adaptable.

NOTE: Use electric arc scribe, vibrating tool or pencil grinder-Adaptable for identification of castings, forging and anodized items before anodizing.

CAUTION: DO NOT USE ELECTRIC ARC SCRIBE, VIBRATING TOOL OR PENCIL GRINDER TO MARK ROTATING PARTS.

(a) Clean part. Refer to SECTION II – CLEANING. Make sure that surface to be marked is not clogged.

(b) Start marking tool and adjust stroke if necessary.

(c) Guide tool by hand to write marking information.

1 Markings from 0.001 to 0.006 inch (0.03 to 0.15 mm) maximum depth are acceptable.

WARNING: USE THE CORRECT PERSONAL PROTECTION. MARKING PROCEDURES WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

(d) Carefully remove all projections produced on the surface by the displaced metal.

(e) Clean part. Refer to SECTION II – CLEANING.

(3) Mechanical stamp, mustow or deep-Adaptable for nonfunctional surfaces.

NOTE: Metal stamp marking uses the procedure of forcing the metal stamp into the surface of the part to be marked; as a result of this procedure the parent material is displaced.

NOTE: Perform these steps before all surface treatments.

(a) Thickness of 0.032 inch (0.81 mm) minimum for aluminum sheet and thickness of 0.025 inch (0.64 mm) minimum for steel sheet are required.

(b) Do not use for marking 2014, 2024, 7075 aluminum or magnesium sheet, plastic, tubing, sheet metal parts of pressure systems, metal harder than 34 HRC, nitrided or case hardened parts.

(c) Clean part. Refer to SECTION II – CLEANING. Make sure that surface to be marked is free from debris.

(d) Give back support at the location where marking will be made to prevent all distortion of part.

CAUTION: WHEN YOU DO THIS PROCEDURE, MAKE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABUSIVE FORCING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE MARKED PART.

(e) Put metal stamp on the necessary area to be marked and apply force.

(f) Make sure that correct size-to depth ratio is maintained.

1 Characters of 0.03 to 0.08 inch (0.8 to 2.0 mm) length require an impression of 0.002 to 0.006 inch (0.05 to 0.15 mm) depth.

2 Characters of 0.10 to 0.16 inch (2.5 to 4.0 mm) length require an impression of 0.006 to 0.01 inch (0.15 to 0.3 mm) depth.

(g) Carefully remove all surface defects caused by the displaced metal.

(h) Clean part. Refer to SECTION II – CLEANING.

15. Deleted

A. Method No. 415A: Deleted.
B. Method No. 415B: Deleted.
C. Method No. 415C: Deleted.

16. Repairing Damaged/Oversize Threads

NOTE: Refer to Method No. 407A, 407B, and 407C for repair of loose or damaged inserts.

Prepare for and install standard Helicoil®, or (in case of Helicoil® thread rework) by using a Helicoil;® twin-sert to meet resultant required thread.

Damaged or oversize threads in aluminum or magnesium (where wall thicknesses are 0.050 inch or greater at thinnest point) may be processed to original manual thread requirements using suitable Keensert® installation.

A. Method No. 416A: Damaged or Oversize Threads Corrected by Helicoil Inserts and Helicoil Twin-Serts.

Repair damaged or oversize threads as follows:

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: DO NOT INSTALL ANY STEEL INSERTS INTO ALUMINUM OR MAGNESIUM ALLOYS UNTIL AFTER THE PART HAS BEEN PROTECTIVE COATED (ANODIZE OR ANODIC COATING).

(1) Machine to remove damaged threads with minimum removal of parent material. Refer to applicable manual for Repaired Limits.

(2) Deburr repaired surfaces.

(3) Touch-up bare metal surfaces.

(a) Chemical film touch-up bare aluminum surfaces. Refer to Method No. 403N.

(b) Chemical film touch-up bare magnesium surfaces. Refer to Method No. 4030.

(4) Clean repaired surface. Refer to SECTION II – CLEANING.

(5) Install Helicoil Insert or Twin-Sert.

NOTE: Use Helicoil Insert class “C” (stainless steel), unless otherwise specified.

NOTE: Install Helicoil Insert with epoxy primer. Refer to manufacturer’s instructions.

NOTE: Twin-sert are machined for and installed at the same operation, refer to manufacturer’s instructions.

NOTE: Twin-sert must be used when a “no go” gage can be inserted in a tapped hole for helical insert.

NOTE: Tangless inserts and tanged inserts are interchangeable.

CAUTION: SUFFICIENT WALL THICKNESS MUST BE PRESET TO AVOID PART WILL NOT CRACK, BREAK OR CHIP WHEN THE INSERT, BOLT OR SCREW IS TORQUED.

CAUTION: BOSSES MEETING DOD SPEC AND10050, DESIGNED TO ACCEPT STANDARD “AN” TUBE FITTINGS, REQUIRE A SPECIAL TYPE OF SEALED INSERT AS EXPLAINED IN THE APPLICABLE MANUAL. DO NOT ATTEMPT TO REPAIR THREADS IN THIS TYPE BOSS WITH A HELICAL INSERT.

(a) Machine hole oversize to the required size.

NOTE: Depth of the newly machined hole must not exceed depth of the original thread hole.

NOTE: Size of the newly machined hole must be of the size required for the insert or twin-sert.

(b) Tap hole to sufficient depth to the insert or twin-sert. Refer to manufacturer’s instructions.

CAUTION: HELICOIL® TWIN-SERTS MUST BE INSTALLED AS A SET, TWIN-SERT HELICOIL® ARE NOT INTERCHANGEABLE WITH STANDARD HELICOILS®.

(c) Install insert or twin-sert. Refer to manufacturer’s instructions.

NOTE: Insert or twin-sert selected must be of a length which permitted the insert to be installed flush 1 turn below the surface of the part to allow maximum length of thread engagement compatible with the depth of the thread hole.

NOTE: When installing a twin-sert, use only the matching inner and outer inserts. Do not use a standard helical insert as an inner member of a twin-sert application. Be sure both tangs match up when the inner insert is installed into the outer one.

(d) Make sure the two tangs match up when the inner insert is installed into the outer one. Refer to Figure 417.

(e) Installation torque of a stud into a high torque insert must be more than the torque callout for the same stud installed in magnesium.

NOTE: Use a standard size stud when installing into a high torque insert.

NOTE: Lubricate stud threads with Aircraft Lubricant Grease C02-0010 before installation.

Table 407. Twin-sert Kits

NOMINAL THREAD SIZE	1 - 1/2 DIAMETER NOMINAL LENGTH		2 DIAMETER NOMINAL LENGTH		QUANTITY OF TWIN-SERT ASSEMBLIES IN EACH KIT
	INSERT BEING REPLACED	TWIN-SERT REPAIR KIT	INSERT BEING REPLACED	TWIN-SERT REPAIR KIT	
8-32	MS21209C0815	3177-2	MS21209C0820	3176-2	25
10-24	MS21209C1-15	3177-3	MS21209C1-20	3176-3	25
1/4-20	MS21209C4-15	3177-4	MS21209C4-20	3176-4	25
5/16-18	MS21209C5-15	3177-5	MS21209C5-20	3176-5	20
3/8-16	MS21209C6-15	3177-6	MS21209C6-20	3176-6	15
10-32	MS21209F1-15	3179-3	MS21209F1-20	3178-3	25
1/4-28	MS21209F4-15	3179-4	MS21209F4-20	3178-4	25
5/16-24	MS21209F5-15	3179-5	MS21209F5-20	3178-5	20
3/8-24	MS21209F6-15	3179-6	MS21209F6-20	3178-6	10

NOTE

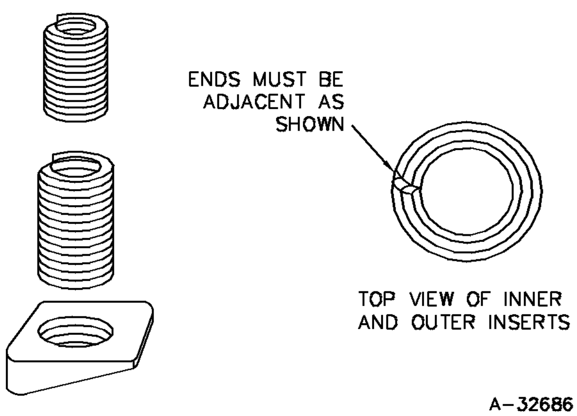
Twin-sert kits include: inner and outer twin-sert members (quantity listed), a bottoming tap, an outer insert installation tool, and an outer insert tang breakoff tool. Use standard helical insert installation and tang breakoff tools for the inner member.

The inner and outer twin-sert members can be purchased individually from the manufacturer or the manufacturer’s designated distributor.

NOMINAL THREAD SIZE	NOMINAL LENGTH				SUGGESTED DRILL SIZE	
	1-1/2 DIAMETER		2 DIAMETER		ALUMINUM OR MAGNESIUM	STEEL
	OUTER	INNER	OUTER	INNER		
8-32	0.246	0.215	0.328	0.297	3	7/32
10-24	0.285	0.243	0.380	0.338	"F"	“G"
1/4-20	0.375	0.325	0.500	0.450	21/64	“Q”
5/16-18	0.469	0.413	0.625	0.569	“X"	“Y"
3/8-16	0.562	0.500	0.750	0.688	15/32	15/32
10-32	0.285	0.254	0.380	0.349	“C”	“D”
1/4-28	0.375	0.339	0.500	0.464	5/16	5/16
5/16-24	0.469	0.427	0.625	0.583	"V”	“V"
3/8-24	0.562	0.521	0.750	0.700	7/16	7/16

Table 408. Twin-sert Drill Sizes

NOMINAL THREAD SIZE	SUGGESTED DRILL SIZE		SELF-LOCKING HELICAL INSERT PART NUMBER *
	ALUMINUM OR MAGNESIUM	STEEL	
	UNIFIED COARSE THREADS		
8-32	#17	#16	MS21209C08**
10-24	13/64	#5	MS21209C1-**
1/4-20	“H”	“H”	MS21209C4-**
5/16-18	“Q”	“Q”	MS21209C5-**
3/8-16	“X”	“X”	MS21209C6-**
	UNIFIED FINE THREADS		
10-32	#7	13/64	MS21209F1-**
1/4-28	"G”		MS21209F4-**
5/16-24	21/64	21/64	MS21209F5-**
3/8-24	25/64	25/64	MS21209F6-**
* - OTHER DIAMETER INSERTS ARE AVAILABLE ** - INSERT DASH NUMBER FOR LENGTH REQUIRED: 10 - 1 DIAMETER NOMINAL LENGTH 15 - 1-1/2 DIAMETER NOMINAL LENGTH 20 - 2 DIAMETER NOMINAL LENGTH 25 - 2-1/2 DIAMETER NOMINAL LENGTH 30 - 3 DIAMETER NOMINAL LENGTH			

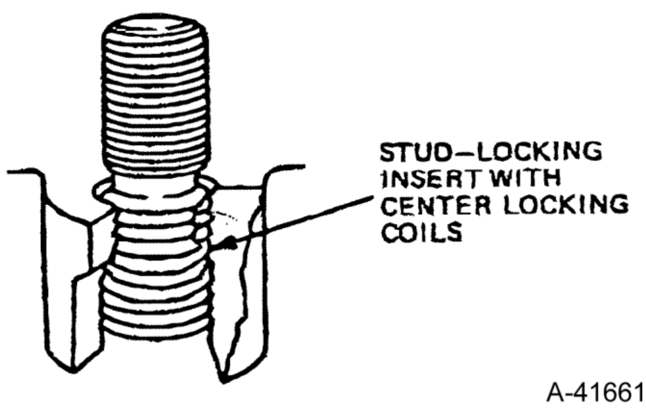


NOTE: 1. End must be adjacent as shown.

Twin-sert Installation
Figure 417

Table 409. Twin-sert Drill Data

PACK PART NO.	STUD THREAD SIZE	INSERTS: INSERT PART NUMBER AND LENGTH		DRILLING: ALUMINUM: DRILL SIZE	ALUMINUM: DRILLED HOLE LIMITS MIN	ALUMINUM: DRILLED HOLE LIMITS MAX.	MAGNESIUM & STEEL: DRILL SIZE	MAGNESIUM & STEEL: DRILLED HOSE LIMITS MIN	MAGNESIUM & STEEL: DRILLED HOSE LIMITS MAX.	HOLE DEPTH MIN	TAPPING: TAP PART NO.	TAPPING: MIN FULL THD. DEPTH	INSERT TOOL PART NO.	TANG BREAK-OFF TOOL PART NO.
NATIONAL COARSE SERIES														
3990-3	10-24	3758-3CN	0.285	13/64	.199	.205	#5	.203	.209	.431	3 CBB	.330	5551-3	3580-3
		3578-3CN	0.380							.526		.420		
3990-4	1/4-20	3758-4CN	0.375	17/64	.261	.267	17/64	.265	.271	.550	4 CBB	.430	5551-4	3580-4
		3758-4CN	0.500							.675		.550		
3990-5	5/16-18	3758-5CN	0.469	Q	.328	.334	Q	.331	.337	.662	5 CBB	.530	5551-5	3580-5
		3758-5CN	0.625							.819		.680		
3990-6	3/8-16	3758-6CN	0.562	X	.390	.398	X	.396	.402	.781	6 CBB	.630	5551-6	3580-6
		3758-6CN	0.750							.968		.810		
3990-7	7/16-14	3758-7CN	0.656	29/64	.453	.463	15/32	.461	.471	.906	7 CBB	.730	5551-7	3580-7
		3758-7CN	0.875							1.124		.950		
3990-8	1/2-13	3758-8CN	0.750	33/64	.515	.525	17/32	.523	.533	1.020	8 CBB	.830	5551-8	1196-7
		3758-8CN	1.000							1.270		1.080		



High Torque Stud-Locking Thread Repair Kit
Figure 418

Table 410. Oversize Data (Unified Coarse 1 Diameter)

Nominal Thread Size	Heli-Coil P/N	Effect. Correc. to Oversize Hole
4-40	3885-04CN 112	.0034
6-32	3885-06CN 138	.0040
8-32	3885-2CN 164	.0040
10-24	3885-3GN 190	.0050
1/4-20	3885-4CN 250	.0060
5/16-18	3885-5CN 312	.0060
3/8-16	3885-6CN 375	.0066
7/16-14	3885-7CN 437	.0074
1/2-13	3885-8CN 500	.0056
UNIFIED FINE 1 DIAMETER		
4-48	3891-04CN 112	.0030
6-40	3891-06CN 138	.0034
10-32	3891-3CN 190	.0040
1/4-28	3891-4CN 250	.0042
5/16-18	3891-5CN 312	.0050
3/8-24	3891-6CN 375	.0050
7/16-20	3891-7CN 437	.0060
1/2-20	3891-8CN 500	.0060

Table 411. Oversize Data (Unified Coarse 1-1/2 Diameter)

Nominal Thread Size	Heli-Coil P/N	Effect. Correc. to Oversize Hole
4-40	3885-04CN 168	.0034
6-32	3885-06CN 207	.0040
8-32	3885-2CN 246	.0040
10-24	3885-3CN 285	.0050
1/4-20	3885-4CN 375	.0060
5/16-18	3885-5CN 469	.0060
3/8-16	3885-6CN 562	.0066
7/16-14	3885-7CN 656	.0074
1/2-13	3885-8CN 750	.0056
UNIFIED FINE 1-1/2 DIAMETER		
4-48	3891-04CN 168	.0030
6-40	3891-06CN 207	.0034
10-32	3891-3CN 285	.0040
1/4-28	3891-4CN 375	.0042
5/16-24	3891-5CN 469	.0050
3/8-24	3891-6CN 562	.0050
7/16-14	3891-7CN 656	.0060
1/2-20	3891-8CN 750	.0060

Table 412. Oversize Data (Unified Coarse 2 Diameter)

Nominal Thread Size	Heli-Coil P/N	Effect. Correc. to Oversize Hole
4-40	3885-04CN 224	.0034
6-32	3885-06CN 276	.0040
8-32	3885-2CN 328	.0040
10-24	3885-3CN 380	.0050
1/4-20	3885-4CN 500	.0060
5/16-18	3885-5CN 625	.0060
3/8-16	3885-6CN 750	.0066
7/16-14	3885-7CN 875	.0074
1/2-13	3885-8CN 1000	.0056
UNIFIED FINE 2 DIAMETER		
4-48	3891-04CN 224	.0030
6-40	3891-06CB 276	.0034
10-32	3891-3CN 380	.0040
1/4-28	3891-4CN 500	.0042
5/16-24	3891-5CN 625	.0050
3/8-24	3891-6CN 750	.0050
7/16-20	3891-7CN 875	.0060
1/2-20	3891-8CN 1000	.0060

Table 413. Oversize Data (Unified Coarse 2-1/2 Diameter)

Nominal Thread Size	Heli-Coil P/N	Effect. Correc. to Oversize Hole
4-40	3885-04CN 280	.0034
6-32	3885-06CN 345	.0040
8-32	3885-2CN 410	.0040
10-24	3885-3CN 475	.0050
1/4-20	3885-4CN 625	.0060
5/16-18	3885-5CN 781	.0060
3/8-16	3885-6CN 938	.0066
7/16-14	3885-7CN 1094	.0074
1/2-13	3885-8CN 1250	.0056
UNIFIED FINE 2-1/2 DIAMETER		
6-40	3891-06CN 345	.0034
10-32	3891-3CN 475	.0040
1/4-28	3891-4CN 625	.0042
5/16-24	3891-5CN 781	.0050
3/8-24	3891-6CN 938	.0050
7/16-20	3891-7CN 1094	.0060
1/2-20	3891-8CN 1250	.0060

B. Method No. 416B: Damaged Threads Corrected by Keensert®.

NOTE: Damaged or oversize threads in aluminum or magnesium (where wall thicknesses are 0.050 inch (1.27 mm) or more than at thinnest point) must be processed to resultant drawing thread requirements using correct Keensert® installation.

WARNING: USE THE CORRECT PERSONAL PROTECTION. PROCEDURES THAT NEED GRIND/MACHINE WORK WILL CAUSE LOOSE PARTICLES THAT CAN GET IN YOUR EYES.

CAUTION: DO NOT INSTALL ANY STEEL INSERTS INTO ALUMINUM OR MAGNESIUM ALLOYS UNTIL AFTER THE PART HAS BEEN PROTECTIVE COATED (ANODIZE OR ANODIC COATING).

(1) Machine to remove damaged threads with minimum parent material removal. Refer to applicable manual for Repaired Limits.

(2) Deburr repaired surfaces.

(3) Touch-up bare metal surfaces.

(a) Chemical film touch-up bare aluminum surfaces. Refer to Method No. 403N.

(b) Chemical film touch-up bare magnesium surface. Refer to Method No. 403O.

(4) Clean repaired surface. Refer to SECTION II – CLEANING.

(5) Install Keensert®. Refer to manufacturer's instructions.

(6) Perform visual check. Refer to applicable manual for Repaired Limits.

C. Method No. 416C: Deleted

17. Deleted

    A. Method No. 417A: Deleted.

18. Repairing Tubing and Flexible Hoses

    A. Method No. 418A: Repair Silicone Rubber Insulation on Flexible Hose Assemblies

    This procedure repairs damage to the molded insulation covering a flexible steel braided hose. Damage to the steel braid resulting in broken or separated wires, evidence of punctures, leakage, or permanent deformation are not permitted and require replacement of the hose section. There is no limit to the number of repairs per hose provided the hose contour and thickness is maintained.

    WARNING: USE THE CORRECT PERSONAL PROTECTION. THIS CHEMCIAL SOLUTION CAN CAUSE SKIN, EYE AND LUNG DAMAGE. THE DANGER AND PRECAUTIONS FOR EACH CHEMICAL IS DIFFERENT.

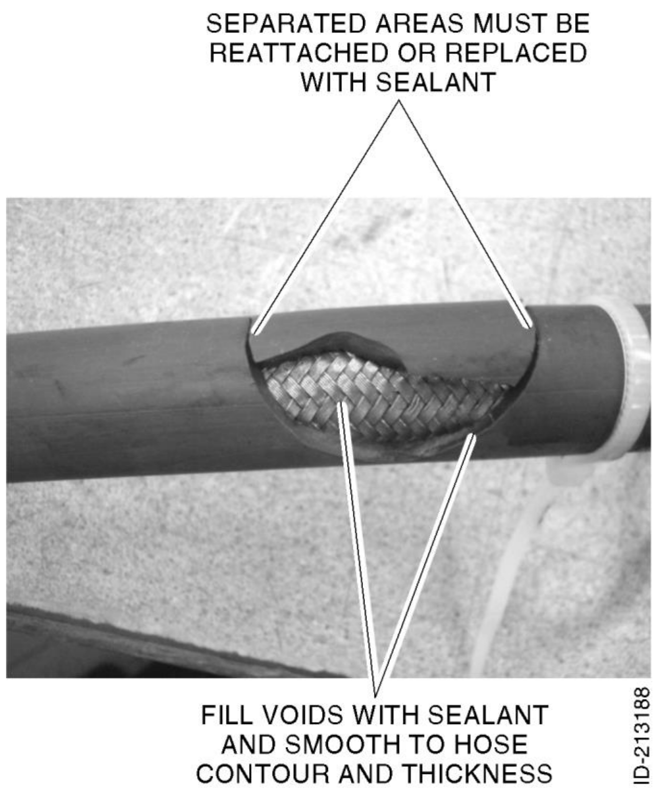
    (1) Clean the area to be repaired. Refer to Method No. 203V or 203Q.

    (2) Remove loose or separated insulation, except where sufficient adhesive can be applied to reattach the material and fully seal the area. Refer to Figure 419.

    (3) Apply Adhesive Sealant C01-0006 to area of damaged or missing insulation. Keep conformity and thickness of adjacent surfaces.

    NOTE: If the conformity and thickness of the repaired area cannot be maintained with adjacent surfaces, the hose section should be replaced.

    (4) Cure the adhesive sealant. Refer to the manufacturer's recommendations.



NOTE: 1. Separated areas must be reattached or replaced with sealant.

2. Fill voids with sealant and smooth to hose contour and thickness.

Tubing or Flexible Hose Assembly Repair
Figure 419

19. Repairing Seals (Silicone Rubber)

A. Method No. 419A: Repair of Disbonded Seals (Silicone Rubber)

(1) Remove damaged seal as follows:

CAUTION: MAKE SURE NOT TO DAMAGE THE SEAL DURING THIS OPERATION.

(a) Remove damaged seal with a knife blade.

(b) Clean the surface of the part. Refer to SECTION II – CLEANING. Use scotch brite C08-0003 to abrade the surface.

NOTE: The part will be considered clean when a dry, lint-free wipe can be swiped over the surface and show no indications of dirt or contaminants.

(c) Air dry the seal contact area for 30 minutes minimum or dry in an air circulating oven at 120 to 130°F (49 to 54°C) for 5 minutes minimum.

(d) Apply primer C03-0010 to the surfaces to be bonded and air dry for 30 to 60 minutes.

(e) Apply adhesive sealant C01-0006 to surfaces to be bonded. Refer to manufacturer instructions.

NOTE: Install during the 5 minutes after application of the adhesive sealant to guarantee the correct bonding surfaces.

(f) If necessary, procure new gasket. Refer to applicable manual.

(g) Set the seal using hand pressure to guarantee good contact between surfaces.

NOTE: Remove from the edge of the gasket the unwanted adhesive. If necessary, it is permitted to use clamps to keep surfaces contact.

(h) Let the adhesive cure for 24 hours minimum at room temperature.

NOTE: Remove clamps if they were used.

CAUTION: MAKE SURE NOT TO DAMAGE THE SEAL DURING THIS OPERATION.

(i) Use a knife blade to remove the unwanted adhesive.

B. Method No. 419B: Repair of Cuts and Gouges in Seals (Silicone Rubber)

(1) Clean the surface of the part. Refer to SECTION II – CLEANING.

NOTE: The part will be considered clean when a dry, lint-free wipe can be swiped over the surface and show no indications of dirt or contaminants.

(2) Apply adhesive sealant C01-0006 to cut, missing, loose or separate silicone rubber gasket. Refer to manufacturer instructions.

(3) Attach the surfaces to be bond with a clamp if necessary.

(4) Let the adhesive cure for 24 hours minimum at room temperature.

NOTE: Remove clamps if they were used.

CAUTION: MAKE SURE NOT TO DAMAGE THE SEAL DURING THIS OPERATION.

(5) Use a knife blade to remove the unwanted adhesive.

20. Repairing Thermal Insulation Blankets

NOTE: Tears, cuts and/or punctures of 1.5 inches (38.1 mm) maximum length are repairable. If parts is out of repairable limits, replace the thermal insulation blanket.

A. Method No. 420A. Repair of tears, cuts and punctures with silicone sealant.

(1) Repair damage as follows:

(a) Hand abrade the surface to be repaired with 120 grit sandpaper and/or Scotch Brite pad. Remove any loose material. Wipe clean with isopropyl alcohol.

(b) Apply MIL-A-46106, 736 RTV adhesive sealant to the damaged surface. Refer to manufacturer’s specifications. Apply enough sealant to seal the damage.

B. Method No. 420B. Repair of tears, cuts and punctures with high temperature tape.

(1) Repair damage as follows:

(a) Hand abrade the surface to be repaired with 120 grit sandpaper and/or Scotch Brite pad. Remove any loose material. Wipe clean with isopropyl alcohol.

(b) Apply 3M brand, 363 foil/glass high temperature tape to the damaged surface. Refer to the manufacturer’s specifications.

SECTION V – ASSEMBLY

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SECTION V – ASSEMBLY

1. General Assembly Practices

A. Protecting Unit During Assembly

Maintain fits and clearances as specified in applicable manual for unit in work. Exercise extreme care to prevent dirt, dust, or foreign particles from entering the unit. If any foreign particles are dropped into the unit during assembly, stop assembly and find the particle before continuing even though considerable disassembly is involved. For added protection, cover large openings with tape and cardboard and small openings with tape or clean cloth. Plug fuel or lubrication system tubing using plastic caps or plugs, cap or tape all other tube ends. If the unit is to be left for even a short period of time in a partially assembled state, cover all openings.

B. Corrosion Prevention Compound Removal

If any parts were coated with corrosion-preventive compound, remove all traces of this compound and any accumulated foreign matter. (Refer to SECTION II.)

C. Verifying Cleanliness of Parts

Check that all parts are cleaned before assembly. Wipe all surfaces with a clean, lint-free cloth.

D. Lubricating Splines and Gear Teeth

When splines or gear teeth are to be mated, lubricate the surfaces as specified in applicable manual.

E. Assembly Inspection, Guidelines, and Precautions

Never use extreme force in the assembly of a unit. If difficulty is encountered, disassemble the unit and inspect for burrs or other interference.

F. Lockwiring Techniques and Requirements

Lockwire unit as specified in applicable manual and Paragraph E. Lockwiring is the most positive and satisfactory method of securing in place the various attaching parts of a unit, which cannot be otherwise locked satisfactorily.

G. Bearing and Gear Preparation, Handling, and Assembly Guidelines

Refer to applicable manual for installation and/or assembly procedures for bearings that are components of that equipment. If required, lightly coat all bearings and gear assemblies with lubricant specified in applicable manual, prior to installation.

H. Preparing Shafts for Seal and Packing Installation

Lightly coat all surfaces of shafts that mate with seals and packings, with lubricant as specified in applicable manual.

I. Tagging (Recording) and Shimming Measured Components

When special measurements for shimming or fitting are made on parts or on assembled parts prior to their installation in the next higher assembly, these parts must be tagged as measured components of the higher assembly and kept with that assembly. If damage or other reason caused replacement of a measured component, all measurements which include that part must be repeated using the new part.

2. Packing and Seals

A. Lubricating and Installing Packings

Refer to Table 501 when selecting the type of packing lubricant and Figure 501 for a graphic representation of how to install typical packings.

WARNING: THE LUBRICANTS LISTED HAVE BEEN RATED AS NON-IRRITATING AND NON-TOXIC; HOWEVER, PRECAUTIONS SHOULD BE TAKEN TO PREVENT INADVERTENT CONTAMINATION OF EYES AND NASAL PASSAGES. IF SKIN IRRITATION SHOULD OCCUR, WASH THE AFFECTED AREA THOROUGHLY IN CLEAN WATER.

Table 501. Recommended Lubricants

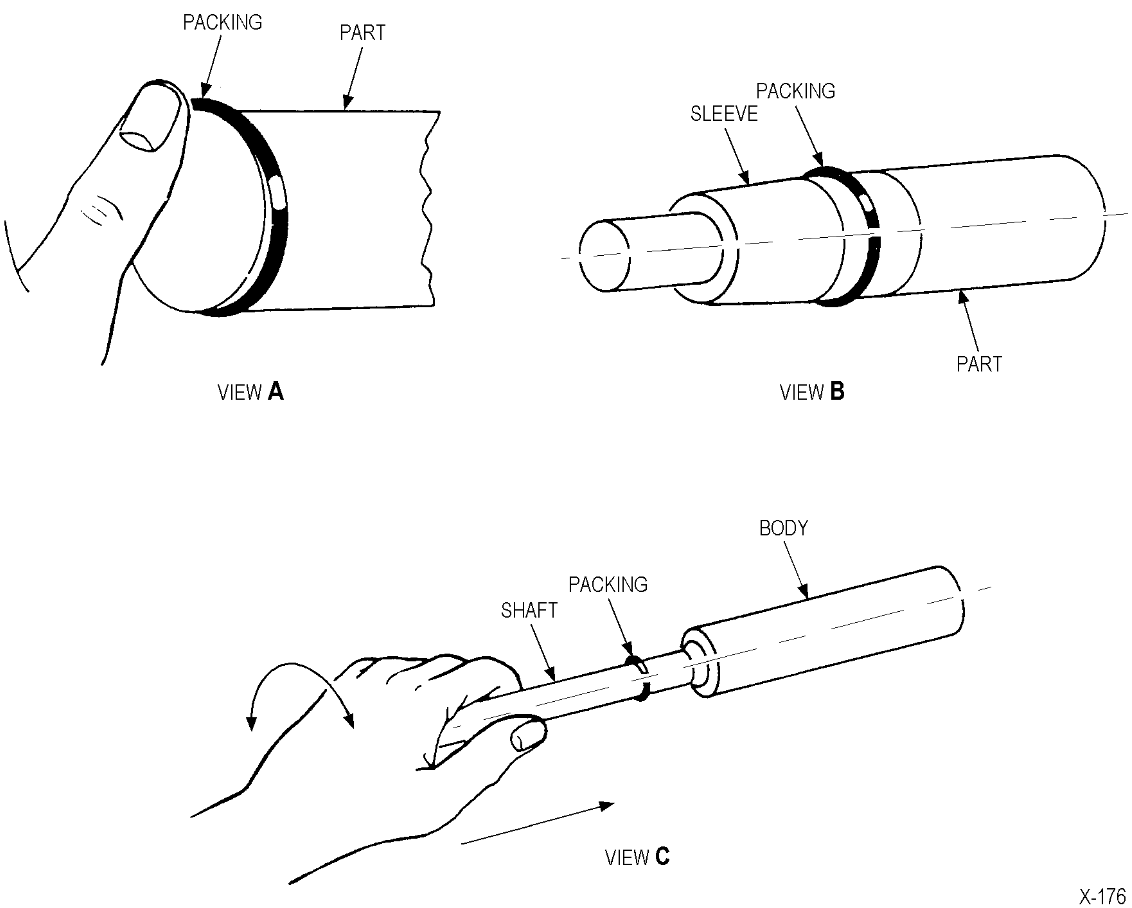
	Recommended Lubricant	
System Usage	First Choice	Second Choice
Air	None	OS-124 or Santovac 5
Air/Fuel	None	OS-124 or Santovac 5
Fuel	JP-4 or JP-5 Fuel per MIL-T-5624G	OS-124 or Santovac 5
Lubrication	Lubricating Oil Per MIL-L-23699	OS-124 or Santovac 5

(1) Carefully roll lubricated packing over end of part as shown in View A. Roll or slide packing along part, carefully rolling it over any chamfered shoulder, etc., until it drops in groove. After packing installation in groove, remove any twists in packing caused by rolling.

NOTE: The use of lubricant on packings is helpful in preventing twisting, tearing, and cutting of the elastomer during installation. The lubricant must be applied as a thin, even coat. Recommended lubricants are listed in Table 501, however, packings should be lubricated with lubricant specified in applicable manual.

(2) If part is threaded, or has sharp edges, keyways, or splines, it may be necessary to install packing on a sleeve. Insert threaded or sharp portions of part into a suitable sleeve and roll packing off sleeve and into the packing groove of part as shown in View B.

(3) As shown in View C, slowly and carefully slide shaft into bore of body, using a twisting motion, back and forth, so packing will slide past any grooves or cross holes without shearing or clipping.



Typical Installation of Packings
Figure 501

B. Heat-set Seal Installation

Determine the application or Class of the heat set seals prior to attempting installation:

NOTE: Elastomer seals, such as packings, used in sliding applications subject to critical leakage or low hysteresis requirements can be heat set to improve fit and function. Seals to be heat set are classified as follows: Class I, PN S8990-X and Class II, PN 663700-X.

Class II seals may be heat set in the functional unit but Class I seals must be heat set in a fixture prior to installation unless specifically authorized otherwise. The fixture used must duplicate the dimensions of the using hardware. Heat set seals normally incorporate the use of bridge seals. The bridge seal must be installed over the elastomer seal prior to heat-setting operation.

CAUTION: WHEN A FIXTURE IS USED, CARE MUST BE EXERCISED IN REMOVING THE HEAT SET SEAL TO PREVENT ROLLING OR OTHERWISE DEFORMING THE SET SHAPE OF THE ELASTOMER. CARE MUST BE EXERCISED IN INSTALLING HEAT SET SEALS IN THE FUNCTIONAL HARDWARE, IN THE PROPER ATTITUDE.

(1) Install seals to be heat set into functional hardware or in a fixture specified in applicable manual for unit in work.

(2) Heat set Class I seal at 515 to 535°F (268 to 279°C) and Class II seals at 340 to 360°F (171 to 182°C) for 2 hours.

(3) Allow alloy assembly to cool at room temperature prior to removing seals.

C. Forming Lip Seals

If lip seal is not formed, install the seal on pilot specified in applicable manual to form the seal lip in the correct direction.

3. Conical Seal

NOTE: Conical seals are used at specific locations during engine production to preclude leakage. However, conical seals may be used at any flared tubing fitting of appropriate size in fuel and oil systems as a repair to correct leakage at the option of the user.

A. Conical Seal Selection and Lubrication

CAUTION: INPROPER INSTALLATION OF CONICAL SEALS DESCRIBED IN THE FOLLOWING STEPS IS ESSENTIAL TO AVOID FLOW RESTRICTION OR SUBSEQUENT LEAKAGE. CONICAL SEALS ARE TO BE USED ONLY ONCE AND MUST BE REPLACED AT EACH DISASSEMBLY OF PLUMBING. MAKE SURE THAT PREVIOUSLY INSTALLED CONICAL SEAL IS REMOVED FROM PLUMBING FITTING BEFORE INSTALLING NEW CONICAL SEAL.

Unless otherwise specified, flared tubing fittings when used with conical seals must be tightened to torque values specified in Table 502. When conical seals are used, install conical seals and tighten fittings as described in the following steps.

(1) Select proper conical seal part number for tube assembly being installed. (Refer to Table 502.)

(2) Lubricate conical seal and threads of plumbing fitting with clean engine oil.

B. Conical Seal Installation

CAUTION: DO NOT INSTALL CONICAL SEAL INTO TUBE NUTS. SEAL MUST BE INSTALLED ON MALE FITTING ONLY.

(1) Install conical seal onto male flare portion of plumbing fitting. Flats on conical seal are designed to provide proper positioning of seal onto plumbing fitting to prevent cocking of seal that could cause flow restriction.

(2) Thread tube nut onto plumbing fitting several turns with fingers until joint is snug. If tube nut cannot be tightened snugly with fingers, disassemble and correct problem to prevent assembly damage to conical seal.

CAUTION: DO NOT INSTALL CONICAL SEAL INTO TUBE NUTS. INSTALL SEAL ON MALE FITTING ONLY.

(3) Tighten tube nuts as follows:

NOTE: Conical seals are subject to cold creep; therefore, a double tightening procedures is required.

(a) Tighten tube nuts to torque value specified in Table 502. Torque values are higher than torque values for tube nuts without conical seals installed.

(b) Allow 5 minutes elapsed time for cold creep to occur.

(c) Recheck torque on tube nut and, if required, further tighten to torque value specified in Table 502.

Table 502. Standard Torque Values for Flared Tubing Fittings Used with Conical Seals

Tube Dash No.	Conical Seal Part Number	Torque (in-lb), All Steel Parts	Torque (Nm) All Steel Parts
2	*VSF1015N2B **651-525-9002	60 to 75	6.78 to 8.47
3	*VSF1015N3B **651-525-9003	110 to 125	12.43 to 14.12
4	*VSF1015N4B **651-525-9004	165 to 190	18.64 to 21.47
5	*VSF1015N5B **651-525-9005	225 to 250	25.42 to 28.25
6	*VSF1015N6B **651-525-9006	335 to 375	37.85 to 42.37
8	*VSF1015N8B **651-525-9008	575 to 625	64.97 to 70.61

*Voi-Shan Division of VSI Corp, 8663 Higuera St, Culver City, CA 90230

**Responsible Honeywell Inc.

4. Pressing Interference Fit Parts

CAUTION: DURING ASSEMBLY OF SOME UNITS, CLOSE TOLERANCE FITS REQUIRE THAT A PART WILL EITHER HAVE TO BE COLD SOAKED OR HEATED IN ORDER TO PERMIT ASSEMBLY WITHOUT DAMAGE TO PARTS.

A. Cold Soaking Loose Tolerance Fit Parts

(1) Cold soak part in liquid nitrogen (Federal Specification BB-N-411) (SECTION VII) immediately prior to installation.

(2) Install part as specified in applicable manual.

(3) Allow joined parts to warm to room temperature before continuing with assembly procedures.

B. Heating Close Tolerance Fit Parts

(1) Heat part as specified in applicable manual prior to installation.

(2) Install part as specified in applicable manual.

(3) Allow joined parts to cool to room temperature before continuing with assembly procedures.

C. Press Fitting Assembly Parts Using an Arbor Press

CAUTION: REFER TO APPLICABLE MANUAL FOR PROPER TOOLING TO BE USED TO PREVENT DAMAGE TO PARTS.

(1) Position parts to be joined, along with proper tooling, onto base of arbor press.

(2) Align parts and carefully apply pressure to tooling to start mating process. When alignment is assured, press part to positional requirements specified in applicable manual.

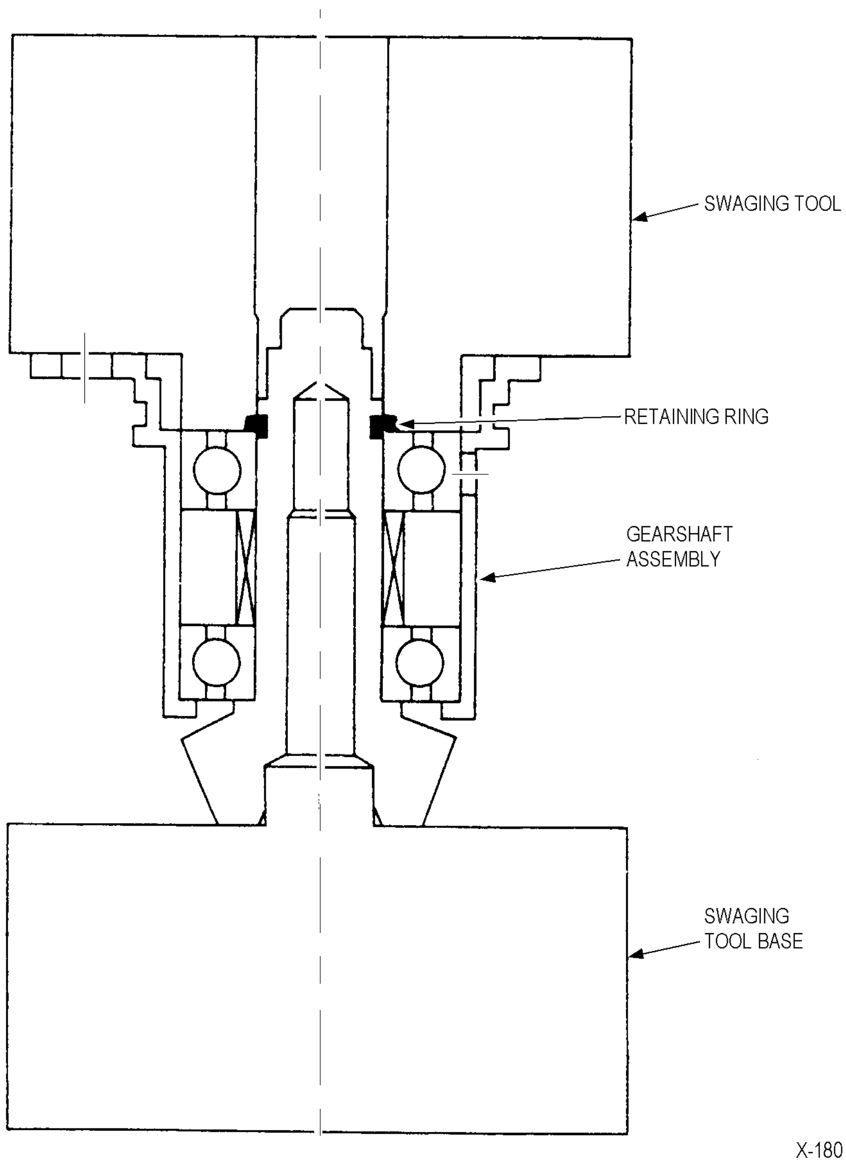
D. Force Forming Gearshaft Assembly Retainer Rings

(1) Assemble gearshaft assembly (typical) in accordance with applicable manual for unit in work.

(2) Position gearshaft assembly on suitable swaging tool base.

(3) Install suitable swaging tool over shaft of gearshaft assembly against retainer ring.

(4) Using an arbor press, apply pressure to swaging tool as specified in applicable manual, to form retainer ring.



Retainer Ring Installation (Typical)
Figure 502

5. Torque Requirements

Torque requirements for air, oil and fuel system components depend on the type of parts being fastened or tightened.

NOTE: The terms torquing and tightening are interchangeable in this task.

A. General Torque Requirements

This general practice applies to torquing bolts and screws when flanges are metal-to-metal.

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: WHEN FLANGES INCLUDE GASKET MATERIAL, INITIAL TORQUING OR TIGHTENING MUST BE AT 60 PERCENT OF SPECIFIED TORQUE OR AS LISTED IN TABLES.

(1) Clean threads using solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) and remove corrosion if present.

(2) Free threads of nicks and burrs.

(3) Apply a light coat of anti-seize lubricant to fittings prior to assembly.

NOTE: Table 503 identifies Honeywell approved anti-seize lubricants for threaded fasteners and fittings, depending on the service temperature and the fluid contacted. Only anti-seize lubricants shown in Table 503 must be used unless otherwise approved by Honeywell.

Table 503. Approved Anti-seize Lubricants

Air, Oil and Fuel Systems Fittings, Lines and Fasteners	Fasteners: Bolts, Nuts, Studs, etc.		
	Up to 600°F (Up to 315°C)	600 to 1200°F (315 to 649°C)	1200 to 1800°F (649 to 982°C)
Lubricating Compound (Liqui-Moly, Thread NV) Oil (MIL-L-7808 or MIL-L-23699) Lubricant (Santovac 5)	Lubricating Compound (Liqui-Moly, Thread) NV Lubricant (Fluoro-Glide) High Temperature Compound (Henkel Loctite C5-A Copper Based)*	High Temperature Compound (Henkel Loctite C5-A Copper Based)* *Never-Seez NS-165* Anti-seize Compound (Milk of Magnesia)	*Ease-Off 990* Never-Seez NS-165 Anti-seize Compound (Milk of Magnesia)
*Henkel Loctite C5-A Copper Based must not be used in oil-wetted areas.			

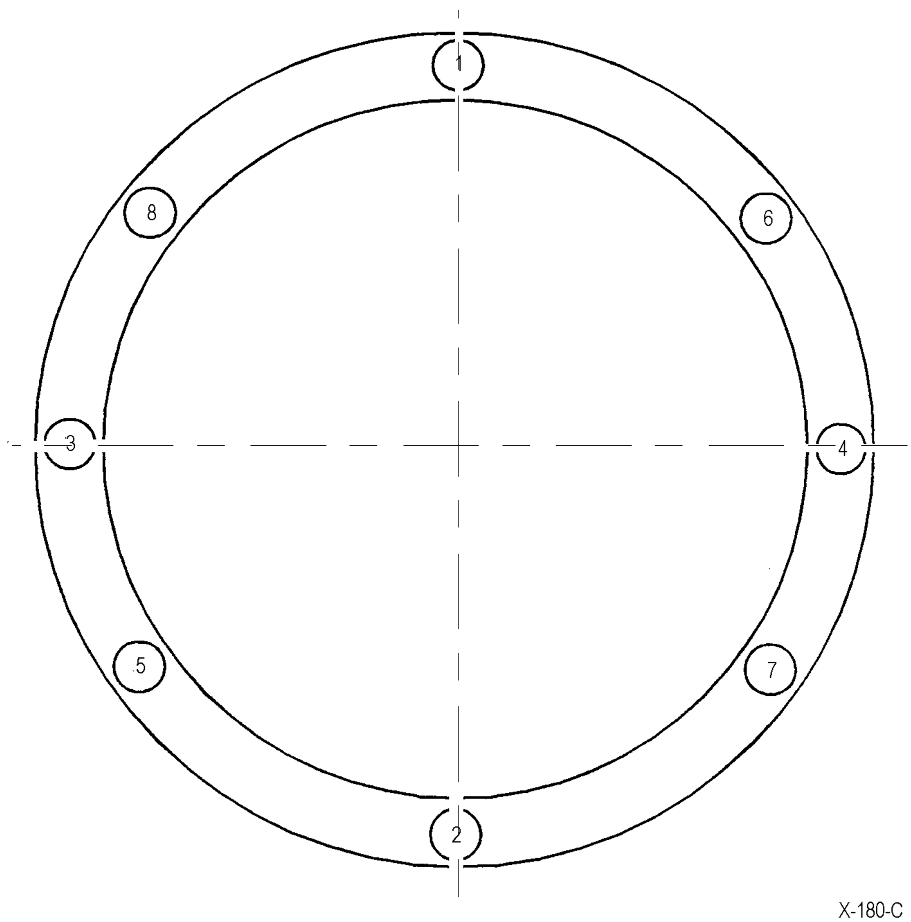
(4) Position mating flanges in specified assembly position. Preposition bolts or studs before beginning the torquing sequence.

CAUTION: REFER TO APPLICABLE ASSEMBLY MANUAL, OR TO FIGURE 503 AS NEEDED, FOR PROPER, SPECIFIED TORQUING SEQUENCES.

(5) For first sequence, apply approximately 25 to 50 percent of the maximum torque level uniformly for each bolt.

NOTE: For additional intermediate sequences apply torque levels proportionally between 25 to 50 percent of the maximum specified.

(6) For final sequence, apply maximum allowed for the specific bolts being used.



* Screws and bolts when flanges are metal-to-metal.

* Flange with gasket material, initial torque at 60 percent of specified, or as in listed in tables.

Torquing Sequence
Figure 503

(7) Acceptable torque wrench types include the following and must be certified, identified, and calibrated periodically.

- Dial indicator type.
- Micrometer adjustable click type.
- Preset click type.

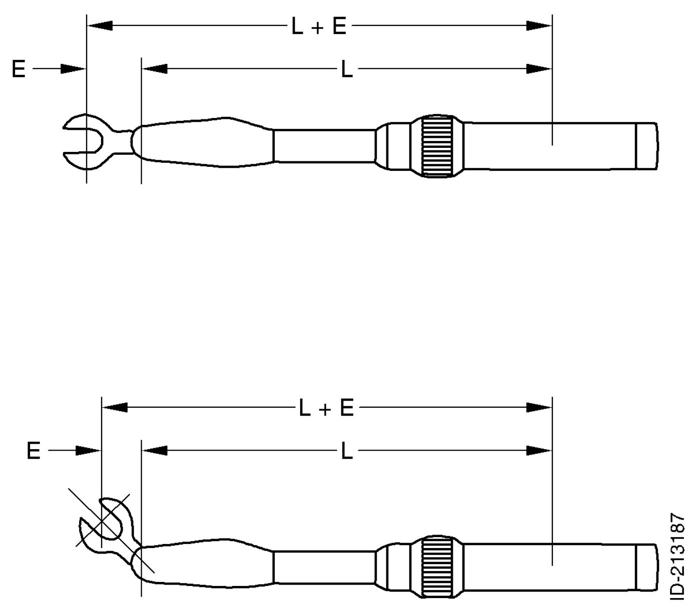
(a) These may be used in conjunction with a crow's foot or box socket. When an extension is used with the wrench, the readings must be decreased by a factor. If the crow's foot or extension is at 90°, no calculation is required (E = 0). The following formula provides the correct scale reading:

R = (TL) ÷ (L + E)

Where: R = Reading on torque wrench scale
T = Applied torque or actual torque
L = Effective length of wrench lever arm (see below)
E = Effective length of extension (see below)

(b) A proper wrench for desired torque ranges must be used. Recommended torque wrench sizes are as follows:

Torque Range	Torque Wrench Size
0 to 25 in-lbs (0 to 2.82 Nm)	30 in-lbs
25 to 140 in-lbs (2.82 to 15.82 Nm)	150 in-lbs
140 to 550 in-lbs (15.82 to 62.14 Nm)	600 in-lbs
30 to 140 ft-lbs (40.67 to 189.81 Nm)	150 ft-lbs
140 to 240 ft-lbs (189.81 to 325.40 Nm)	250 ft-lbs
240 to 1000 ft-lbs (325.40 to 1355.82 Nm)	1000 ft-lbs
1000 to 1500 ft-lbs (1355.82 to 2033.73 Nm)	2000 ft-lbs



Torque Wrench Formula
Figure 503A

B. Procedure - Preparing and Installing Fasteners (Standard Shop Practice)

WARNING: SOLVENT VAPORS ARE TOXIC AND FLAMMABLE. DO NOT INHALE VAPORS. OBSERVE FIRE PRECAUTIONS.

CAUTION: WHEN FLANGES INCLUDE GASKET MATERIAL, INITIAL TORQUE OR TIGHTENING MUST BE AT 60 PERCENT OF SPECIFIED OR AS LISTED IN TABLES.

(1) Clean threads using solvent (Federal Specification P-D-680, Type I/II/III) (SECTION VII) and remove corrosion if present.

(2) Free threads of nicks and burrs.

(3) Apply a light coating of anti-seize lubricant to fittings prior to assembly.

NOTE: Table 503 identifies Honeywell approved anti-seize lubricants for threaded fasteners and fittings, depending on the service temperature and the fluid contacted. Only anti-seize lubricants shown in Table 503 must be used unless otherwise approved by Honeywell.

(4) Tighten fasteners installed through inelastic boundaries as follows:

(a) Tighten each fastener until there is no visible clearance between parts.

NOTE: During the initial tightening run-down resistance must be noted on the last rotation before establishing tensile preload in the fastener.

(b) Apply additional tightening evenly to produce the final torque value specified in Table 504.

(5) Tighten nuts and bolts installed through faying surface joints or sealed with a diaphragm, o-ring, or similar elastomeric gasket as follows:

(a) Torque nuts and bolts to equal values to obtain pressure-tight seal.

(6) Tighten nuts and bolts installed through flanges with gasket material as follows:

(a) Apply initial torque at 60 percent of the final torque value specified, or listed in Table 504.

(b) Apply torque at 100 percent of final torque value.

(7) Retighten tubing connections as follows:

NOTE: All tubing connections must be torqued during the assembly and prior to functional testing of a unit.

If for any reason, personnel loosen or disconnect tubing, the connection must be retorqued to the required value with a calibrated torque wrench.

(a) Using a calibrated torque wrench, tighten connections to conform to the specified torque values.

Table 504. Bolts and Nuts with Metal-to-Metal Faying Surfaces

METAL-TO-METAL FAYING SURFACES - NUTS AND BOLTS												
	MAXIMUM TORQUE IN-LB AND NEWTON-METER BY BOLT MATERIAL											
THREAD SIZE	ALUMINUM 2024-T6				STEEL BOLT CAD. PLATED				18-8 STAINLESS STEEL			
BOLT SIZE	NUT TORQUE		BOLT TORQUE		NUT TORQUE		BOLT TORQUE		NUT TORQUE		BOLT TORQUE	
THREAD / INCH	In-lb	Nm	In-lb	Nm	In-lb	Nm	In-lb	Nm	In-lb	Nm	In-lb	Nm
2 ---- 56	1.1	0.1242833	1.4	0.1581787	1.7	0.1920742	2.2	0.2485666	2.0	0.2259696	2.5	0.2824620
2 ---- 64	1.4	0.1581787	1.7	0.1920742	2.2	0.2485666	2.7	0.3050590	2.4	0.2711635	3.0	0.3389544
3 ---- 48	1.7	0.1920742	2.1	0.2372681	2.8	0.3163574	3.5	0.3954468	3.1	0.3502529	3.9	0.4406407
3 ---- 56	1.9	0.2146711	2.4	0.2711635	3.2	0.3615514	4.0	0.4519392	3.5	0.3954468	4.4	0.4971331
4 ---- 40	2.4	0.2711635	2.9	0.3276559	3.8	0.4293422	4.7	0.5310286	4.3	0.4858346	5.2	0.5875210
4 ---- 48	3.0	0.3389544	3.6	0.4067453	4.8	0.5423270	5.9	0.6666103	5.4	0.6101179	6.6	0.7456997
5 ---- 40	3.4	0.3841483	4.2	0.4745362	5.6	0.6327149	6.9	0.7795951	6.3	0.7118042	7.7	0.8699830
5 ---- 44	4.2	0.4745362	5.1	0.5762225	7.0	0.7908936	8.5	0.9603708	7.7	0.8699830	9.4	1.0620571
6 ---- 32	4.6	0.5197301	5.5	0.6214164	7.1	0.8021921	8.7	0.9829678	8.0	0.9038784	9.6	1.0846541
6 ---- 40	5.5	0.6214164	6.5	0.7344012	9.1	1.0281617	10.9	1.2315343	10.0	1.1298480	12.0	1.3558176
8 ---- 32	7.6	0.8586845	9.0	1.0168632	14.3	1.6156826	17.0	1.9207416	16.0	1.8077568	19.0	2.1467112
8 ---- 36	9.2	1.0394602	11.0	1.2428328	16.0	1.8077568	19.0	2.1467112	17.6	1.9885325	21.0	2.3726808
10 ---- 24	10.3	1.1637434	12.0	1.3558176	17.2	1.9433386	20.0	2.2596960	19.0	2.1467112	22.0	2.4856656
10 ---- 32	15.5	1.7512644	18.0	2.0337264	25.0	2.8246200	29.0	3.2765592	26.0	2.9376048	30.0	3.3895440
1/4 ---- 20	37.0	4.1804376	43.0	4.8583464	56.0	6.3271488	65.0	7.3440120	66.0	7.4569968	77.0	8.6998296
1/4 ---- 28	45.6	5.1521069	53.0	5.9881944	78.0	8.8128144	90.0	10.168632	76.0	8.5868448	80.0	9.0387840
5/16 ---- 18	68.6	7.7507573	78.0	8.8128144	112.0	12.6542976	127.0	14.349069	114.0	12.880267	130.0	14.688024
5/16 ---- 24	73.0	8.2478904	83.0	9.3777384	122.0	13.7841456	139.0	15.704887	124.0	14.010115	141.0	15.930856
3/8 ---- 16	121.0	13.671160	138.0	15.591902	186.0	21.0151728	212.0	23.952777	211.0	23.839792	240.0	27.116352
3/8 ---- 24	129.0	14.575039	147.0	16.608765	204.0	23.0488992	232.0	26.212473	226.0	25.534564	257.0	29.037093
7/16 ---- 14	186.5	21.071665	212.0	23.952777	278.0	31.4097744	316.0	35.703196	310.0	35.025288	353.0	39.883634
7/16 ---- 20	199.5	22.540467	227.0	25.647549	298.0	33.6694704	339.0	38.301847	330.0	37.284984	376.0	42.482284
1/2 ---- 20	269.0	30.392911	306.0	34.573348	403.0	45.5328744	458.0	51.747038	447.0	50.504205	508.0	57.396278
9/16 ---- 12	346.0	39.092740	393.5	44.459518	507.0	57.2832936	576.0	65.079244	564.0	63.723427	641.0	72.423256
9/16 ---- 16	377.0	42.595269	428.5	48.413986	551.0	62.2546248	626.0	70.728484	622.0	70.276545	707.0	79.880253
5/8 ---- 18	658.0	74.343998	748.0	84.512630	943.0	106.544666	1072.	121.11970	1030.	116.37434	1170.	132.19221
3/4 ---- 10	810.0	91.517688	921.0	104.05900	1041.	117.617176	1183.	133.66101	1265.	142.92577	1438.	162.47214
3/4 ---- 16	795.0	89.822916	900.0	101.68632	1017.	114.905541	1156.	130.61042	1232.	139.19727	1400.	158.17872
7/8 ---- 8	1236.	139.64921	1405.	158.74364	1587.	179.306877	1804.	203.82457	1923.	217.26977	2186.	246.98477
7/8 ---- 14	1232.	139.19727	1400.	158.23521	1580.	178.515984	1796.	202.92070	1917.	216.59186	2179.	246.19387
1 ---- 8	1823.	206.02778	2072.	234.16099	2342.	264.610401	2662.	300.76553	2845.	321.44175	3233.	365.27985
1 ---- 14	1650.	186.42492	1875.	211.84650	2119.	239.414791	2408.	272.06739	2572.	290.59690	2923.	330.25457
1 1/8 ---- 7	219.0	24.743671	249.0	28.133215	266.0	30.0539568	320.0	36.155136	341.0	38.527816	388.0	43.838102
1 1/18 ----	207.5	23.444346	236.0	26.664412	266.0	30.0539568	303.0	34.234394	322.0	36.381105	366.0	41.352436
1 1/4 ---- 7	277.5	31.353282	315.5	35.646704	357.0	40.3355736	406.0	45.871828	431.0	48.696448	490.0	55.362552
1 1/4 ---- 12	253.0	28.585154	287.0	32.426637	327.0	36.9460296	372.0	42.030345	396.0	44.741980	450.0	50.843160
1 1/2 ---- 6	471.0	53.215840	535.5	60.503360	605.0	68.3558040	688.0	77.733542	732.0	82.704873	832.0	94.003353
1 1/2 ---- 12	372.0	42.030345	426.5	48.188017	478.0	54.0067344	544.0	61.463731	580.0	65.531184	660.0	74.569968

Table 505. Minimum Torque in In-lb

	MINIMUM TORQUE IN-LB * FOR BOLTS AND SCREWS THROUGH METAL FLANGES WITH DIAPHRAGM OR GASKET SEALS							
Thread Size	SEALING MATERIAL IN FAYING SURFACE							
Bolt Size	Flange w/Diaphragm Seals Using CRES (18-8) Bolt And Nuts				Flange w/Gasket Seals Using CRES (18-8) Bolt And Nuts			
Threads / Inch	Nut in-lb	Nut Nm	Bolt in-lb	Bolt Nm	Nut in-lb	Nut Nm	Bolt in-lb	Bolt Nm
2 -- 56	1.2	0.1355818	1.4	0.1581787	1.6	0.1807757	2.0	0.2259696
2 -- 64	1.4	0.1581787	1.8	0.2033726	1.9	0.2146711	2.4	0.2711635
3 -- 48	1.8	0.2033726	2.3	0.2598650	2.5	0.2824620	3.1	0.3502529
3 -- 56	2.1	0.2372681	2.6	0.2937605	2.8	0.3163574	3.5	0.3954468
4 -- 40	2.5	0.2824620	3.1	0.3502529	3.4	0.3841483	4.2	0.4745362
4 -- 48	3.2	0.3615514	3.9	0.4406407	4.3	0.4858346	5.3	0.5988194
5 -- 40	3.8	0.4293422	4.6	0.5197301	5.0	0.5649240	6.2	0.7005058
5 -- 44	4.7	0.5310286	5.7	0.6440134	6.1	0.6892073	7.5	0.8473860
6 -- 32	5.0	0.5649240	6.0	0.6779088	6.5	0.7344012	7.7	0.8699830
6 -- 40	6.0	0.6779088	7.2	0.8134906	8.1	0.9151769	9.7	1.0959526
8 -- 32	9.9	1.1185495	11.9	1.3445191	13.3	1.5026978	15.8	1.7851598
8 -- 36	11.1	1.2541313	13.2	1.4913994	14.8	1.6721750	17.6	1.9885325
10 -- 24	11.8	1.3332206	13.7	1.5478918	15.7	1.7738614	18.2	2.0563234
10 -- 32	16.4	1.8529507	19.0	2.1467112	21.3	2.4065762	24.8	2.8020230
1/4 -- 20	38.8	4.3838102	45.1	5.0956145	51.7	5.8413142	60.1	6.7903865
1/4 -- 28	48.5	5.4797628	56.4	6.3723427	64.7	7.3101166	75.2	8.4964570
5/16 -- 18	69.7	7.8750406	79.4	8.9709931	92.9	10.4962879	105.6	11.9311949
5/16 -- 24	75.0	8.4738600	85.2	9.6263050	100.0	11.2984800	113.6	12.8350733
3/8 -- 16	124.6	14.0779061	141.6	15.9986477	166.0	18.7554768	188.0	21.2411424
3/8 -- 24	136.7	15.4450222	155.4	17.5578379	182.0	20.5632336	207.0	23.3878536

* Minimum torque values for bolt and nuts used for sealing joints with diaphragms or gaskets. If, however, sealing is not complete, retorquing is allowed to a higher value in accordance with Paragraph 5 C. However, torques used must not exceed the value of steel or CRES bolts and nuts, whichever is applicable as shown in Table 504.

C. Guideline - Assembly Torque Values (Nuts, Bolts, Screws, Studs, and Inserts)

NOTE: Table 506, Table 507, and Table 508 list assembly torque values based on service requirements for A286 heat-resisting alloy steel or equivalent fastener material with lubricated threads.

Torque values specified are in addition to frictional torques developed by self-locking devices.

Table 509 lists the assembly torque values for drain, fill, and sight glass plugs.

Unless specified otherwise in tables, use tolerance values as follows:

- Zero to 1200 in-lb, ±2½% (0 - 135.6 Nm)
- Over 1200 in-lb, ±3% (Over 135.6 Nm)

When a torque wrench calibrated with SI units will be used to torque a bolt, nut, screw or other component, select a torque wrench where the required torque value is within the range of the torque wrench. Set the torque wrench value nearest to the required value based on the torque wrench scale.

For example:

- Torque requirement in manual: 50 in-lb (5.7 Nm)
- Torque wrench specification:

  Range: 4 to 12 Nm

  Scale: 0.2 Nm

- Torque wrench setting: 5.6 or 5.8 Nm

NOTE: Where two torque values are included, use the smaller one when the nut is torqued and the bolt is held stationary. Use the larger value when the bolt is torqued and the nut is held stationary.

Studs which have a different thread size on opposite ends must be torqued to the smaller size regardless of which end is fitted into the installation.

When the use of Hylomar is specified, multi-bolted flanges must be retorqued to original values after a 10-minute waiting period.

Application examples for Table 506, Table 507, Table 508, and Table 509 torque values follow:

- Table 506-Highly loaded connections; generally in specialized regions of the turbine such as steel-to-steel environment or joints directly exposed to rotor bearing dynamic forces. Specific applications include.
  - Turbine plenum-diffuser flanges
  - Turbine plenum-bearing flanges
  - Turbine stator flanges
  - Turbine bearing carrier-bearing capsule flanges
- Table 507-Moderately loaded connections; generally aluminum joints, magnesium joints, aluminum or magnesium-to-steel joints in the compressor, gearbox, or accessory region of gas turbines. Some specific applications are.
  - Diffuser-gearbox flanges
  - Accessory cases-gearbox flanges
  - Mounting flanges for accessories gearing
  - Compressor, diffuser, and shroud flanges
- Table 508-Lightly loaded connections; generally for clips and brackets. Torques may be used for nuts and a bolt installed on key- or ring-locked studs or inserts in magnesium for lightly loaded joints.
- Table 509-The minimum torque value must be used to seat the O-ring seal into the internal port. Do not exceed the maximum torque value or damage to the plug or threads can occur. For aluminum parts the safety factor is almost 1.5 times the maximum torque. The same maximum torque is recommended for stainless steel, however the safety factor will be higher.
- Special thin wall plugs require special torque specifications. Refer to the applicable manual for the unit in work.

Table 506. Examples - 77,500 PSI Thread Root Stress

NOMINAL TORQUES FOR NUTS, BOLTS, SCREWS, AND FOR NUTS AND BOLTS INSTALLED ON KEY- OR RING- LOCKED STUDS OR INSERTS IN ALUMINUM OR STEEL 77,500 PSI thread root stress						
SIZE	LOAD (LBS)	LOAD (N)	NUT TORQUE		BOLT TORQUE	
			(IN-LB)	(Nm)	(IN-LB)	(Nm)
2 - 56	---	---	---	---	---	---
4 - 40	---	---	---	---	---	---
6 - 32	---	---	---	---	---	---
8 - 32	960	4270.272	30	3.3895440	37	4.1804376
10 - 32	1400	6227.480	50	5.6492400	60	6.7790880
1/4 - 28	2590	11520.838	125	14.1231000	145	16.3827960
5/16 - 24	4160	18504.512	245	27.6812760	275	31.0708200
3/8 - 24	6385	28401.757	455	51.4080840	500	56.4924000
7/16 - 20	8615	38321.243	715	80.7841320	775	87.5632200
1/2 - 20	11715	52110.663	1115	125.9780520	1190	134.4519120

Table 507. Examples - 62,000 PSI Thread Root Stress

NOMINAL TORQUES FOR NUTS, BOLTS, SCREWS, AND FOR NUTS AND BOLTS INSTALLED ON KEY- OR RING- LOCKED STUDS OR INSERTS IN ALUMINUM OR STEEL 62,000 PSI Thread Root Stress						
SIZE	LOAD (LBS)	LOAD (N)	NUT TORQUE		BOLT TORQUE	
			(IN-LB)	(Nm)	(IN-LB)	(Nm)
2 - 56	---	---	---	---	---	---
4 - 40	---	---	---	---	---	---
6 - 32	---	---	---	---	---	---
8 - 32	770	3425.114	24	2.7116352	30	3.3895440
10 - 32	1125	5004.225	40	4.5193920	50	5.6492400
1/4 - 28	2135	9496.907	100	11.2984800	120	13.5581760
5/16 - 24	3330	14812.506	200	22.5969600	225	25.4215800
3/8 - 24	5110	22730.302	365	41.2394520	405	45.7588440
7/16 - 20	6895	30670.339	575	64.9662600	630	71.1804240
1/2 - 20	9376	41706.323	890	100.5564720	970	109.5952560

Table 508. Examples - 41,875 PSI Thread Root Stress

NOMINAL TORQUES FOR NUTS, BOLTS, SCREWS, AND FOR NUTS AND BOLTS INSTALLED ON KEY- OR RING- LOCKED STUDS OR INSERTS IN ALUMINUM OR STEEL

41,875 PSI Thread Root Stress

SIZE	LOAD (LBS)	LOAD (N)	NUT TORQUE (IN-LB)	NUT TORQUE (Nm)	BOLT TORQUE (IN-LB)	BOLT TORQUE (Nm)
2 - 56	142	631.644	2.5	0.2824620	4	0.4519392
4 - 40	210	934.122	5.0	0.5649240	7	0.7908936
6 - 32	325	1445.665	9.0	1.0168632	12	1.3558176
8 - 32	520	2313.064	16.0	1.8077568	22	2.4856656
10 - 32	760	3380.632	27.0	3.0505896	35	3.9544680
1/4 - 28	1400	6227.480	66.0	7.4569968	80	9.0387840
5/16 - 24	---	---	---	---	---	---
3/8 - 24	---	---	---	---	---	---
7/16 - 20	---	---	---	---	---	---
1/2 - 20	---	---	---	---	---	---

CAUTION: DO NOT USE THESE TORQUE VALUES FOR SET SCREWS OR DAMAGE CAN OCCUR.

Table 509. Drain, Fill, and Sight Glass Plug Installation Torque
Nm (Newton Meter) = In-lb x .1129848

THREAD SIZES	MINIMUM TORQUE IN-LB (Nm)	MAXIMUM TORQUE (IN-LB) (Nm)
1/4 - 28	5 in-lb (0.56 Nm)	30 in-lb (3.39 Nm)
5/16 - 24	5 in-lb (0.56 Nm)	30 in-lb (3.39 Nm)
3/8 - 24	8 in-lb (0.90 Nm)	40 in-lb (4.52 Nm)
7/16 - 20	8 in-lb (0.90 Nm)	40 in-lb (4.52 Nm)
1/2 - 20	8 in-lb (0.90 Nm)	40 in-lb (4.52 Nm)
9/16 - 18	16 in-lb (1.81 Nm)	60 in-lb (6.78 Nm)
5/8 - 18	20 in-lb (2.26 Nm)	60 in-lb (6.78 Nm)
3/4 - 16	30 in-lb (3.39 Nm)	108 in-lb (12.20 Nm)
13/16 - 16	32 in-lb (3.62 Nm)	108 in-lb (12.20 Nm)
7/8 - 14	32 in-lb (3.62 Nm)	108 in-lb (12.20 Nm)
15/16 - 20	32 in-lb (3.62 Nm)	120 in-lb (13.56 Nm)
1 - 12	33 in-lb (3.73 Nm)	120 in-lb (13.56 Nm)
1-1/16 - 12	35 in-lb (3.95 Nm)	144 in-lb (16.27 Nm)
1-3/16 - 12	38 in-lb (4.29 Nm)	150 in-lb (16.95 Nm)
1-1/4 - 12	40 in-lb (4.52 Nm)	160 in-lb (18.08 Nm)
1-5/16 - 12	48 in-lb (5.42 Nm)	160 in-lb (18.08 Nm)
1-1/2 - 12	60 in-lb (6.78 Nm)	180 in-lb (20.34 Nm)
1-1/2 - 16	60 in-lb (6.78 Nm)	180 in-lb (20.34 Nm)

D. Procedure - Preparing and Installing Fluid and Gasketed Fittings, and Special Metal and Conical Seals for Tubing and Hose Fittings

(1) Align tubing with fitting.

NOTE: Adjustments, which change the integrity of the tubing assembly, are not permitted. The sealing surface of a tube must never be drawn to a fitting with the tubing nut.

(2) Lubricate male threads and back sides of tubing nuts with oil (MIL-L-7808) or (MIL-L-23699) lubricant.

NOTE: Apply lubricants to male fitting only. Avoid line or sealing surface contamination with lubricant.

(3) Engage threads with fingers before tightening.

NOTE: If requirement cannot be met, parts must remain rejected until reworked or replaced.

(4) Uniformly increase torque until the required torque is obtained.

CAUTION: DO NOT OVER-TORQUE TUBING OR CONNECTIONS AS A MEANS TO CORRECT LEAKS OR MISALIGNMENT.

(a) On tubing and connection fittings run the nut down to the required torque.

(b) On flared-type fittings, back off one-quarter turn, then retighten to the required torque.

(c) Where gaskets set slowly, briefly hold fitting at torque until the gasket has set.

CAUTION: DO NOT OVER-TORQUE TUBING OR CONNECTIONS AS A MEANS TO CORRECT LEAKS OR MISALIGNMENT.

(5) Apply final tightening of nuts to the required values using the following guideline. Values for aluminum alloy tubing must apply in the following situations:

NOTE: Defective fittings are normally disassembled, checked, and replaced.

- Aluminum alloy tubing is used with steel fittings.
- Aluminum alloy threaded parts are mated with steel threaded parts.
- Steel tubing is used with aluminum alloy fittings.

(6) For flared tube fittings 1.5 inches (38.1 mm) or larger eliminate sleeve bind-up on the tube during tightening.

(a) After tightening, back off nut and check sleeve for rotation.

(b) If the sleeve rotates, it is not defective. Final tighten the nut.

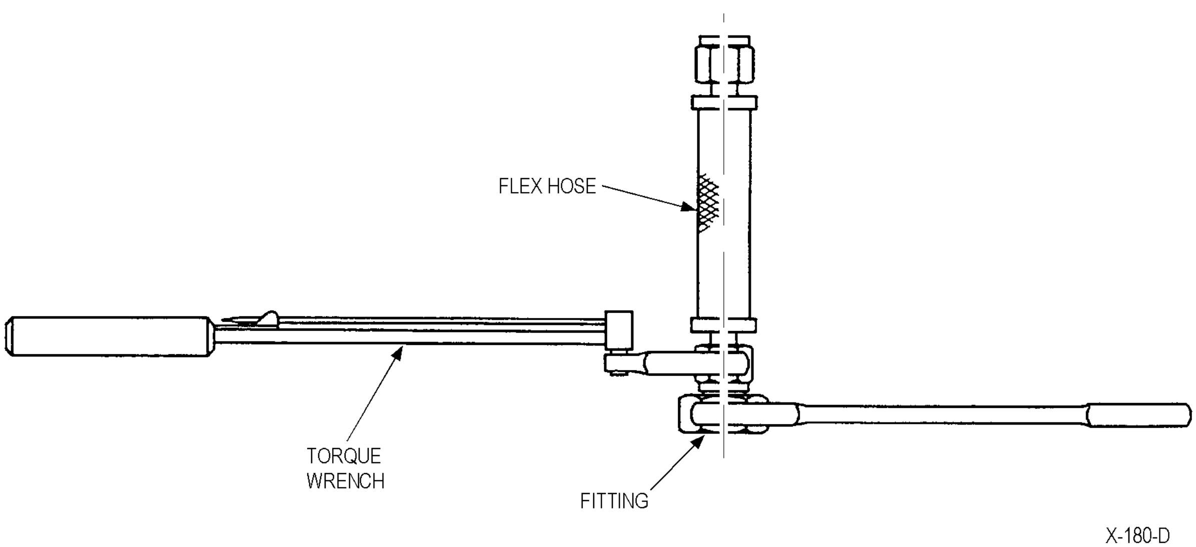
(7) Assemble flared tubing and hose fitting connection. Refer to Figure 504.

(a) Identify the required torque value.

- For flared tubing or hose fitting connections (except conical seals) refer to Table 510.
- For fluid fittings used with ring seals or gaskets made of aluminum, asbestos, leather, or other similar types of material refer to Table 511 and Table 512.
- For special metal seals tighten as specified. Refer to assembly manuals.

WARNING: DO NOT OVER-TORQUE ADJOINING FITTINGS OR DAMAGE MAY OCCUR.

(b) Hold fittings and hose assembly nuts securely while applying specified torque. Refer to Figure 504.



Flared Tubing and Hose Fitting Connections
Figure 504

(8) Assemble flareless tubing assembly.

(a) Align assemblies so that tube ends are square with adjoining fittings.

(b) Lightly lubricate male threads of adjoining fittings with oil (MIL-L-7808) or (MIL-L-23699) lubricant.

NOTE: Allow the brackets that secure the tube assembly to the basic unit to remain loose until the tubing fittings are torqued.

(c) Install nut by hand until it engages the threads of male fitting and contacts sleeve.

(d) Tighten the nut on the coupling to the specified torque value.

- Tighten the nut on dynamic beam seal couplings in accordance with Table 513.
- Tighten the nut on flareless tube couplings in accordance with Table 514.

Table 510. Flared Tubing and Hose Fittings Tightening Specifications

Assemble with Lubricants According to Table 503.			ALL STEEL PARTS	
TUBE OD (INCH)	TUBE DASH NO.	THREAD SIZE	(IN-LB)	(Nm)
0.1250	2	0.3125 - 24	60 - 75	6.7790880 - 8.4738600
0.1875	3	0.3750 - 24	95 - 130	10.7335560 - 14.6880240
0.2500	4	0.4375 - 20	135 - 190	15.2529480 - 21.4671120
0.3125	5	0.5000 20	170 - 240	19.2074160 - 27.1163520
0.3750	6	0.5624 - 18	215 - 280	24.2917320 - 31.6357440
0.5000	8	0.7500 - 18	470 - 550	53.1028560 - 62.1416400
0.6250	10	0.8750 - 14	620 - 745	70.0505760 - 84.1736760
0.7500	12	1.0625 - 12	855 -1055	96.6020040 - 119.1989640
1.0000	16	1.3125 - 12	1140 -1370	128.8026720- 154.7891760
1.2500	20	1.6250 - 12	1520 -1825	171.7368960- 206.1972600
1.5000	24	1.8750 - 12	1900 -2280	214.6711200- 257.6053440
2.0000	32	2.5000 - 12	2660 -2940	300.5395680- 332.1753120

Table 511. Gasketed Fittings in Low Temperature Alloys - EZ33A-T5

TUBE OD (INCH)	TUBE DASH NO.	THREAD SIZE	Low temperature magnesium alloys Gasketed Fittings in EZ33A-T5 PLUG AN814 or MS 24391 (IN-LB)	(Nm)	UNION AN815 or MS 24392 & DYNAMIC BEAM SEAL FITTINGS (IN-LB)	(Nm)
0.1250	2	0.3125 -- 24	25 -- 30	2.8246200 -- 3.3895440	20 -- 25	2.2597 -- 2.82462
0.1875	3	0.3750 -- 24	40 -- 45	4.5193920 -- 5.0843160	35 -- 40	3.9545 -- 4.51939
0.2500	4	0.4375 -- 20	65 -- 70	7.3440120 -- 7.9089360	60 -- 65	6.7791 -- 7.34401
0.3125	5	0.5000 -- 20	85 -- 90	9.6037080 -- 10.1686320	75 -- 80	8.4739 -- 9.03878
0.3750	6	0.5624 -- 18	120 -- 130	13.5581760 -- 14.6880240	90 -- 95	10.1686 -- 10.73356
0.5000	8	0.7500 -- 16	220 -- 240	24.8566560 -- 27.1163520	170 -- 180	19.2074 -- 20.33726
0.6250	10	0.8750 -- 14	355 -- 375	40.1096040 -- 42.3693000	295 -- 315	33.3305 -- 35.59021
0.7500	12	1.0625 -- 12	570 -- 620	64.4013360 -- 70.0505760	465 -- 505	52.5379 -- 57.05732
			(FT-LB)	(Nm)	(FT-LB)	(Nm)
1.0000	16	1.3125 -- 12	70 -- 75	94.9072600 -- 101.6863500	65 -- 70	88.1282 -- 94.90726
1.2500	20	1.6250 -- 12	100 -- 110	135.5818000 -- 149.1399800	95 -- 105	128.8027 -- 142.36089
1.5000	24	1.8750 -- 12	135 -- 145	183.0354300 -- 196.5936100	135 -- 145	183.0354 -- 196.59361

TUBE OD (INCH)	TUBE DASH NO.	THREAD SIZE	Gasketed Fittings in EZ33A-T5 NUT AN924 (IN-LB)	(Nm)
0.1250	2	0.3125 -- 24	20 -- 25	2.2597 -- 2.82462
0.1875	3	0.3750 -- 24	30 -- 35	3.3895 -- 3.95447
0.2500	4	0.4375 -- 20	50 -- 55	5.6492 -- 6.21416
0.3125	5	0.5000 -- 20	65 -- 70	7.3440 -- 7.90894
0.3750	6	0.5624 -- 18	90 -- 95	10.1686 -- 10.73356
0.5000	8	0.7500 -- 16	175 -- 185	19.7723 -- 20.90219
0.6250	10	0.8750 -- 14	260 -- 380	29.3760 -- 42.93422
0.7500	12	1.0625 -- 12	455 -- 495	51.4081 -- 55.92748
			(FT-LB)	(Nm)
1.0000	16	1.3125 -- 12	55 -- 60	74.5700 -- 81.34908
1.2500	20	1.6250 -- 12	85 -- 90	115.2445 -- 122.02362
1.5000	24	1.8750 -- 12	110 -- 120	149.1400 -- 162.69816

Table 512. Gasketed Fittings in Low Temperature Alloys - AZ91G-T6

Torque Values for Gasketed Fittings Installed in AZ91G-T6 Magnesium or any of the Family of Low Temperature Magnesium Alloys

TUBE OD (INCH)	TUBE DASH NO.	THREAD SIZE	PLUG AN814 or MS 24391 (IN-LB)	PLUG AN814 or MS 24391 (Nm)	UNION AN815 or MS 24392 & DYNAMIC BEAM SEAL FITTINGS (IN-LB)	UNION AN815 or MS 24392 & DYNAMIC BEAM SEAL FITTINGS (Nm)
0.1250	2	0.3125 -- 24	15 -- 20	1.6947720 -- 2.2596960	12 -- 15	1.3558176 -- 1.6947720
0.1875	3	0.3750 -- 24	25 -- 30	2.8246200 -- 3.3895440	20 -- 25	2.2596960 -- 2.8246200
0.2500	4	0.4375 -- 20	40 -- 45	4.5193920 -- 5.0843160	35 -- 40	3.9544680 -- 4.5193920
0.3125	5	0.5000 -- 20	50 -- 55	5.6492400 -- 6.2141640	45 -- 50	5.0843160 -- 5.6492400
0.3750	6	0.5624 -- 18	75 -- 80	8.4738600 -- 9.0387840	50 -- 55	5.6492400 -- 6.2141640
0.5000	8	0.7500 -- 16	140 -- 150	15.8178720 -- 16.9477200	105 -- 115	11.8634040 -- 12.9932520
0.6250	10	0.8750 -- 14	210 -- 230	23.7268080 -- 25.9865040	185 -- 195	20.9021880 -- 22.0320360
0.7500	12	1.0625 -- 12	360 -- 380	40.6745280 -- 42.9342240	290 -- 380	32.7655920 -- 42.9342240
			(FT-LB)	(Nm)	(FT-LB)	(Nm)
1.0000	16	1.3125 -- 12	35 -- 40	47.4536300 -- 54.2327200	35 -- 40	47.4536300 -- 54.2327200
1.2500	20	1.6250 -- 12	55 -- 60	74.5699900 -- 81.3490800	50 -- 55	67.7909000 -- 74.5699900
1.5000	24	1.8750 -- 12	70 -- 80	94.9072600 -- 108.4654400	70 -- 75	94.9072600 -- 101.6863500

TUBE OD (INCH)	TUBE DASH NO.	THREAD SIZE	NUT AN924 (IN-LB)	NUT AN924 (Nm)
0.1250	2	0.3125 -- 24	12 -- 15	1.3558 -- 1.6947720
0.1875	3	0.3750 -- 24	15 -- 20	1.6948 -- 2.2596960
0.2500	4	0.4375 -- 20	30 -- 35	3.3895 -- 3.9544680
0.3125	5	0.5000 -- 20	35 -- 40	3.9545 -- 4.5193920
0.3750	6	0.5624 -- 18	55 -- 60	6.2142 -- 6.7790880
0.5000	8	0.7500 -- 16	105 -- 115	11.8634 -- 12.9932520
0.6250	10	0.8750 -- 14	165 -- 175	18.6425 -- 19.7723400
0.7500	12	1.0625 -- 12	280 -- 300	31.6357 -- 33.8954400
			(FT-LB)	(Nm)
1.0000	16	1.3125 -- 12	25 -- 30	33.8955 -- 40.6745400
1.2500	20	1.6250 -- 12	45 -- 50	61.0118 -- 67.7909000
1.5000	24	1.8750 -- 12	60 -- 65	81.3491 -- 88.1281700

Table 513. Dynamic Beam Seal Tubing and Fittings

Torque Values for Dynamic Beam Seal Tubing and Fittings - Assemblies with Lubricants TUBE ALL STEEL OR TITANIUM PARTS				
TUBE OD (INCH)	TUBE DASH NO.	THREAD SIZE	ALL STEEL OR TITANIUM PARTS (IN-LB)	(Nm)
0.1875	3	0.3750 -- 28	84 -- 108	9.4907232 -- 12.2023584
0.2500	4	0.4375 -- 24	144 -- 168	16.2698112 -- 18.9814464
0.3125	5	0.5000 -- 24	156 -- 192	17.6256288 -- 21.6930816
0.3750	6	0.5624 -- 20	240 -- 300	27.1163520 -- 33.8954400
0.5000	8	0.7188 -- 20	420 -- 480	47.4536160 -- 54.2327040
0.6250	10	0.8438 -- 18	576 -- 660	65.0792448 -- 74.5699680
0.7500	12	1.0000 -- 16	720 -- 840	81.3490560 -- 94.9072320
0.8750	14	1.1250 -- 16	864 -- 1020	97.6188672 -- 115.2444960
1.0000	16	1.2500 -- 14	984 -- 1128	111.1770432 -- 127.4468544

Table 514. Coupling Nuts, Flareless Tube

TUBE SIZE	CODE*	Lubrication from Table 503 AL(6061-T6) TUBING WALL THICK. (in.)		TORQUE			
		HEAVY	THIN	MINIMUM (IN-LB)	MAXIMUM (IN-LB)	MINIMUM Nm	MAXIMUM Nm
-2	A,B			75	85	8.4738600	9.6037080
-3	C	.028		95	105	10.7335560	11.8634040
-3	A,B			95	105	10.7335560	11.8634040
-4	C	.035		135	145	15.2529480	16.3827960
-4	D		.028	120	135	13.5581760	15.2529480
-4	A,B			135	145	15.2529480	16.3827960
-5	A,B			175	195	19.7723400	22.0320360
-6	C	.049		215	245	24.2917320	27.6812760
-6	D		.028	190	215	21.4671120	24.2917320
-6	A,B			215	245	24.2917320	27.6812760
-8	C	.065		470	510	53.1028560	57.6222480
-8	D		.035	340	380	38.4148320	42.9342240
-8	D		.049	340	380	38.4148320	42.9342240
-8	A,B			470	510	53.1028560	57.6222480
-10	C	.083		620	680	70.0505760	76.8296640
-10	D		.035	380	450	42.9342240	50.8431600
-10	D		.049	380	450	42.9342240	50.8431600
-10	A,B			620	680	70.0505760	76.8296640
-12	C	.095		855	945	96.6020040	106.7706360
-12	D		.049	400	470	45.1939200	53.1028560
-12	D		.065	400	470	45.1939200	53.1028560
-12	A,B			855	945	96.6020040	106.7706360
-16	C	.065		1140	1260	128.8026720	142.3608480
-16	D		.049	750	850	84.7386000	96.0370800
-16	A,B			1140	1260	128.8026720	142.3608480
-20	D		.049	1000	1100	112.9848000	124.2832800
-20	A,B			1520	1680	171.7368960	189.8144640
-24	A,B			1900	2100	214.6711200	237.2680800
-32	A,B			2660	2940	300.5395680	332.1753120

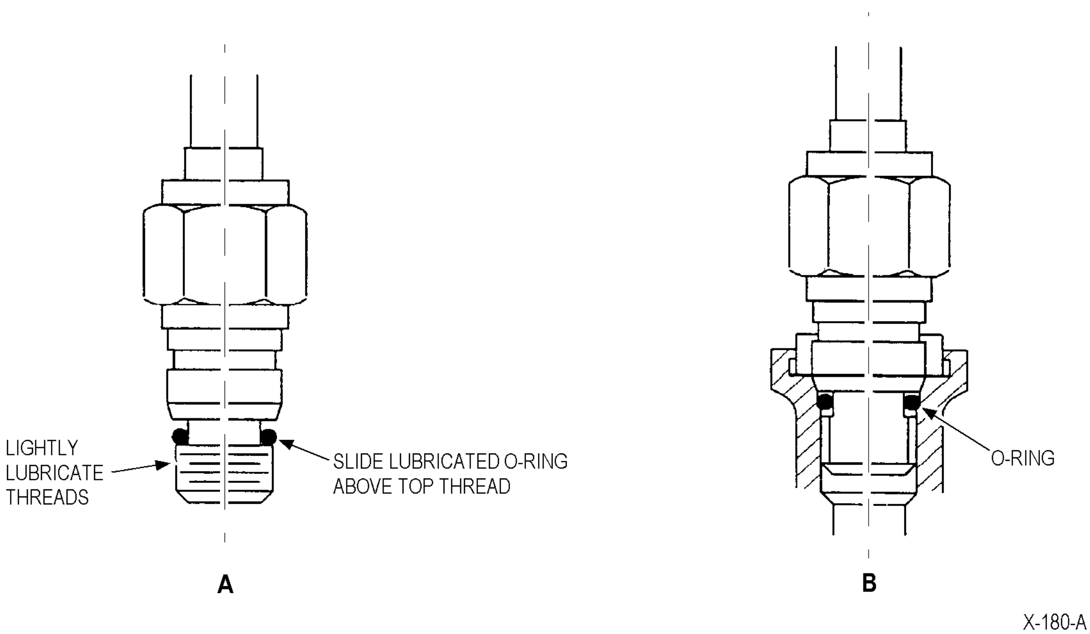
*CODE:
A. Steel or CRES nut, tube, or fitting
B. Aluminum fittings or nuts used with CRES tubing
C. Aluminum fittings or nuts used with heavy wall aluminum tubing
D. Aluminum fittings or nuts used with thin wall aluminum tubing (6061-T6)

E. Procedure - Preparing and Installing O-rings on Fittings

(1) Apply small amount of oil (MIL-L-7808) or (MIL-L-23699) lubricant to the o-ring.

(2) Install o-ring on fitting as shown in Figure 505, View A.

(3) Insert fitting assembly with installed o-ring into boss until it bottoms tightly as shown in Figure 505, View B.



O-Ring Fittings
Figure 505

F. Procedure - Preparing and Installing Universal Fittings

Proper preparation, assembled, and tightening of Universal Fittings involves preparing the fitting threads, installing the gasket, and tightening the fitting nut to the specified torque value.

(1) Assemble the nut onto the fitting, running the nut above the upper threads. (Refer to Figure 506, View A)

(2) Apply a small amount of anti-seize lubricant to threads. (Refer to Table 503 to determine approved anti-seize lubricant.)

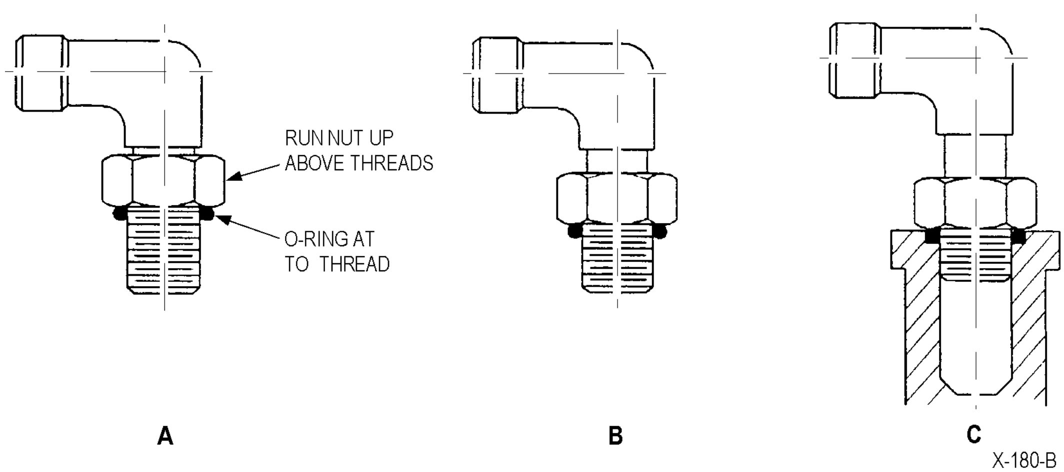
(3) Assemble o-ring against upper threads, making sure the packing is not twisted.

(4) Advance the nut until the top thread of the nut is flush with top thread of the fitting. (Refer to Figure 506, View B).

(5) Assemble fitting into boss until o-ring lightly contacts boss. (Refer to Figure 506, View C).

NOTE: If position of fitting is not correct, rotate it out slightly until the fitting is in proper position.

(6) Tighten nut to specified torque value. Do not back it out more than one turn.



Fittings with Lock Nuts
Figure 506

G. Procedure - Preparing and Installing Bulkhead Fittings

Boss application (refer to Figure 507(A) and Figure 507(B)):

(1) Apply anti-seize lubricant to threads in accordance with Table 503.

(2) Assemble jam nut on fitting, running jam nut past the o-ring groove.

(3) Apply a very small amount of lubricant uniformly to the o-ring in accordance with Table 501.

(4) Assemble the o-ring against the upper threads, making sure the o-ring is not twisted or rolled. Refer to Figure 507(A).

(5) Advance the jam nut until its bottom is flush with the bottom of the top thread. Refer to Figure 507(A).

(6) Assemble the fitting into the boss until the o-ring just contacts the boss. Refer to Figure 507(B). If the position (orientation) of the fitting is not correct, rotate fitting slightly until in correct position. Do not back out fitting more than one turn.

(7) Tighten the jam nut and torque in accordance with Table 510, Table 513 and Table 514 as applicable.

Bracket application (refer to Figure 507(C)):

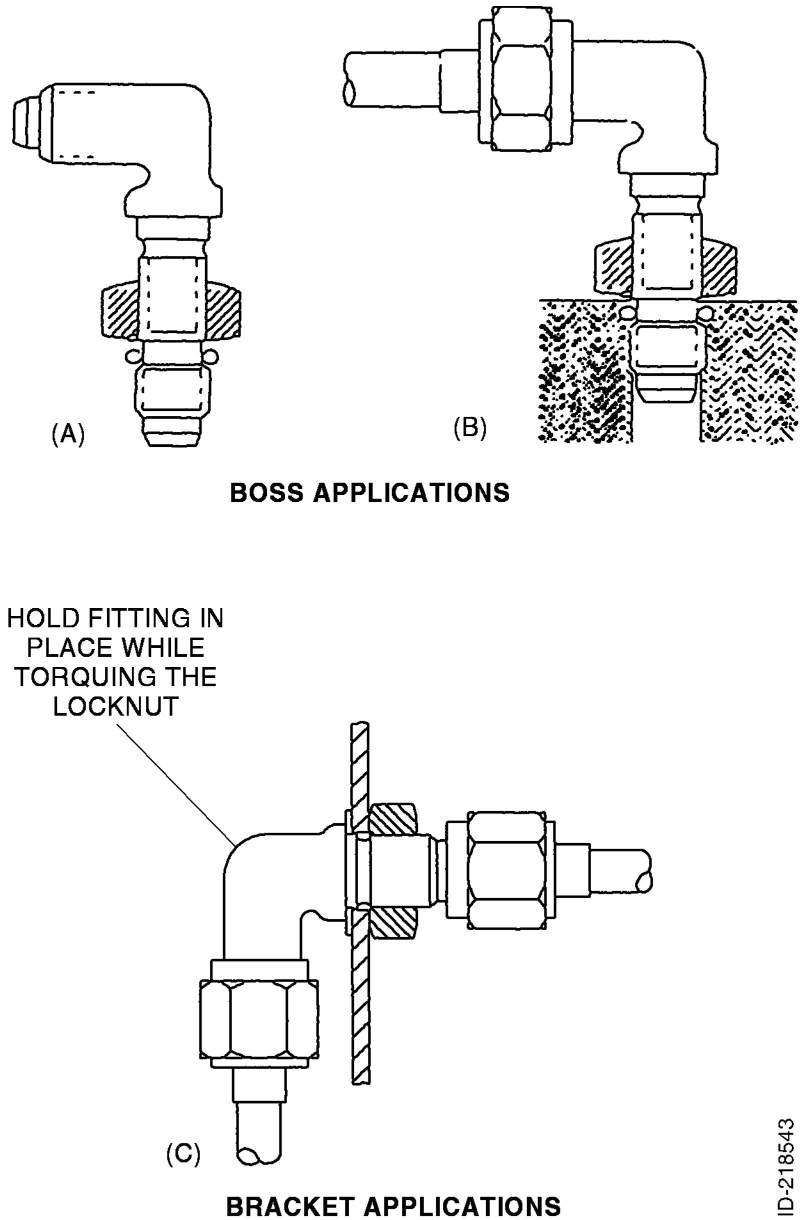
(1) Apply anti-seize lubricant to threads in accordance with Table 503.

(2) Assemble fitting on bracket. Refer to Figure 507(C).

(3) Assemble jam nut hand-tight on fitting. Align fitting in correct position (orientation).

(4) Connect tube or hose to fitting and tighten in accordance with Table 510, Table 513 and Table 514 as applicable.

(5) Tighten jam nut on fitting in accordance with Table 510, Table 513 and Table 514 as applicable.



Bulkhead Fittings
Figure 507

6. Lockwire Installation and Techniques

A. General

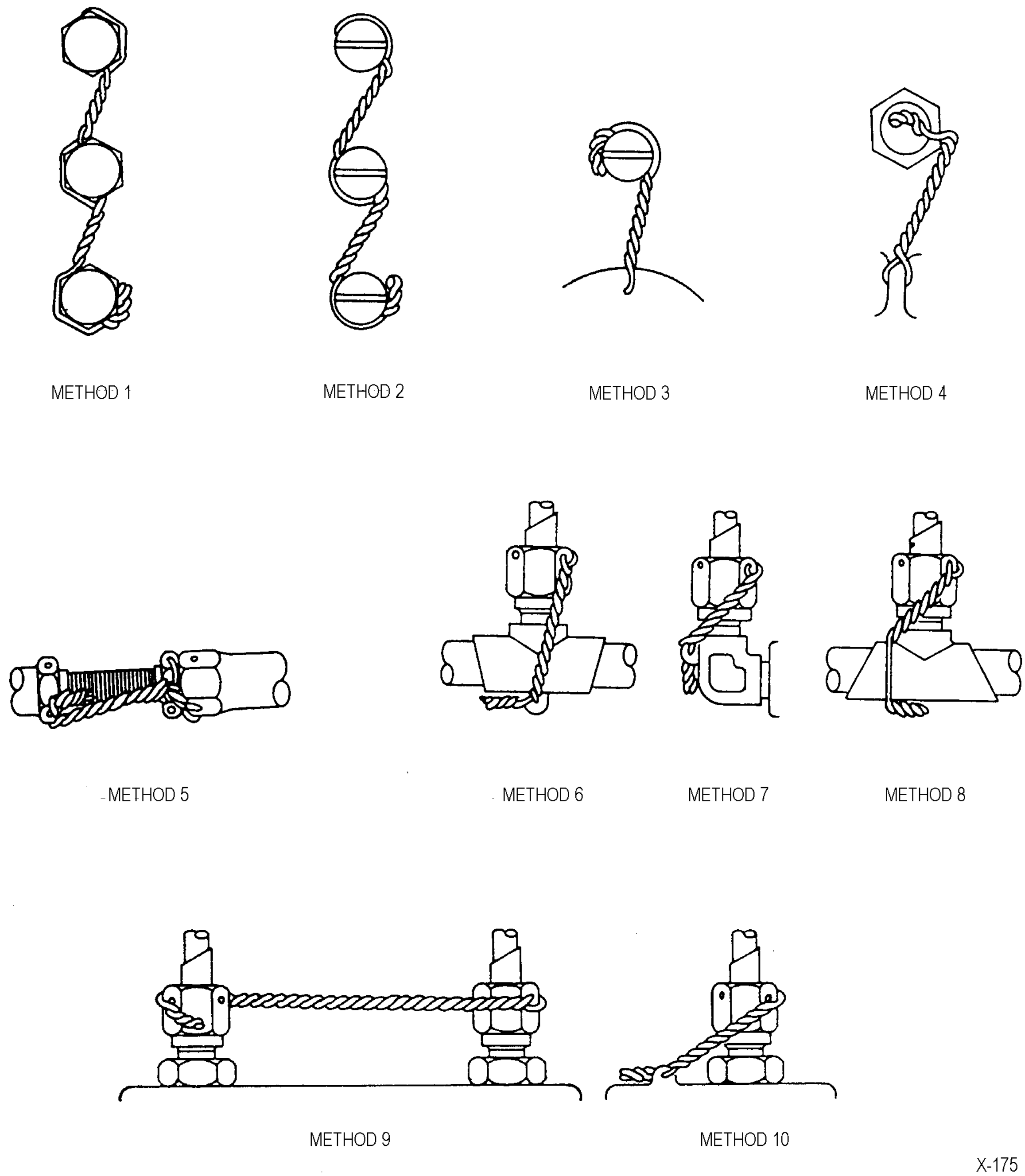
Appropriate diameter lockwire (specified in Aerospace Standard 567) is installed using the following techniques and techniques:

- Install lockwire so that loosening tendency of a part causes tightening of the lockwire.
- Make sure lockwire consists of two strands twisted together unless otherwise specified.
- Pull lockwire taut while twisting and have approximately eight to ten turns per inch without being overstressed.
- Install lockwire so no wear or excessive load to part is experienced.
- Cut lockwire at the end of a series, leaving at least three full twists. Bend the end to eliminate safety hazard.

B. Lockwiring Examples

Examples of lockwiring are shown in Figure 508 and methods are explained as follows:

- Methods 1 and 2 apply to bolts and drilled head screws. The first section of lockwire is twisted clockwise and the second section is twisted counterclockwise.
- Methods 3 and 4 apply to a single drilled head screw or a plug lockwired to a drilled point.
- Method 5 applies to an adjustable connecting rod.
- Methods 6 through 10 apply to various types of tubing assemblies.



Various Lockwiring Methods
Figure 508

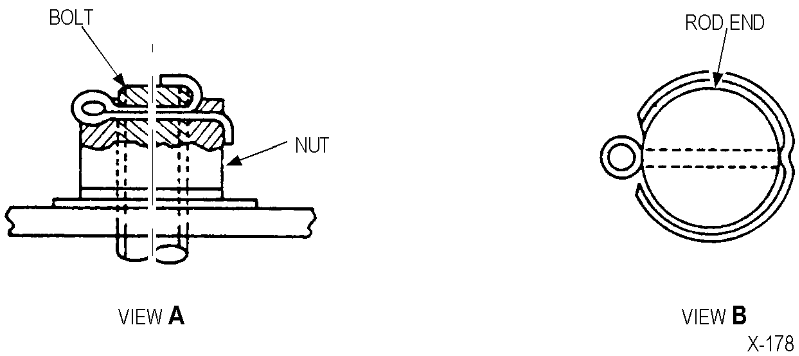
7. Cotter Pins and Key Washers

CAUTION: COTTER PINS ARE NOT REUSABLE. INSTALL NEW COTTER PIN AS SPECIFIED IN APPLICABLE MANUAL FOR UNIT IN WORK.

A. Cotter Pin Installation

(1) Install new cotter pins to lock nut as shown in Figure 509, View A.

(2) Install new cotter pins to retain clevis pins or rod end as shown in Figure 509, View B.



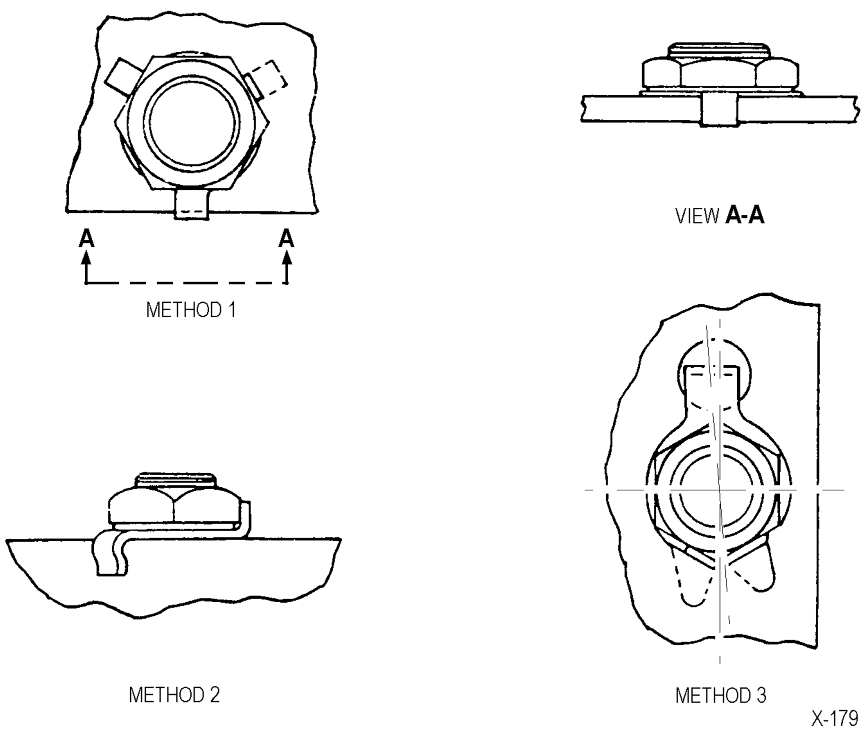
Typical Installation of Cotter Pins
Figure 509

CAUTION: COTTER KEY WASHERS ARE NOT REUSABLE. INSTALL NEW KEY WASHER AS SPECIFIED IN APPLICABLE MANUAL FOR UNIT IN WORK.

B. Cotter Key Installation

(1) Install new key washers to retain nuts as shown in Figure 510.

NOTE: Methods 1, 2, and 3 are typical examples.



Typical Installation of Key Washers
Figure 510

8. Marman Clamps

A. Marman Clamp (Coupling) Installation

(1) Position clamp over mating component flanges as described in applicable manual.

(2) Engage bracket of clamp and tighten nut of attaching bolt to torque specified in applicable manual.

(3) Using a rawhide mallet (SECTION VII), tap around outside diameter of clamp to make sure that clamp is properly seated.

(4) Retighten nut on attaching bolt of clamp to torque specified in applicable manual.

SECTION VI – PACKAGING

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SECTION PAGE

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SECTION VI – PACKAGING

1. General

   Refer to applicable manual for unit in work for general packaging procedures. For APUs, refer to Service Bulletin 49-7997 for Preservation and Storage guidelines.

2. Bearing Preservation, Handling, and Storage

   - Coat bearings with preservative oil (MIL-L-6085) (SECTION VII).
   - Individually seal bearings in plastic bags (SECTION VII).
   - Store in a dry area cooled by refrigeration. Do not store in areas cooled by evaporative coolers.
   - Do not store bearings near electrical motors or transport in electrically operated trucks to preclude possibility of magnetizing.

SECTION VII – APPENDIX

TABLE OF CONTENTS

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SECTION VII – APPENDIX

1. General

   (a) Equipment and consumables called out in the text are listed on individual tables.

2. Equipment List

Equipment called out in text is listed in Table 701.

NOTE: Equivalent substitutes may be used for equipment listed.

Table 701. Equipment and Manufacturer List

Equipment	Manufacturer/Source
Abrasive blast (Superhone)	Commercially available
Actual mass flow computer (Actual Mass Flow Computer)	Commercially available
Balancing machine	Commercially available
Bearing analyzer (BA-96)	Bearing Inspection Inc, 4422 Corporate Center, Los Alamitos, CA 90720-2539 Phone: 714-484-2400
Calibrated orifice	Commercially available
Capillary leak detector (PN 3791761-1)	Honeywell Ground Support Solutions, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Curvic coupling checking machine (Gleason No. 19)	Gleason Works, 1000 University Ave, Rochester, NY 14607-1239 Phone: 585-461-8168
Demagnetizing unit (Model SB2824T)	Magnaflux, 3600 West Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160
Digital multimeter (Fluke Model 8000A Digital Multimeter)	Fluke Corp, 6920 Seaway Blvd Everett, WA 98203 Phone: 425-446-4620 Fax: 425-446-5116
Digital panel indicator (Digital Temperature Indicator Dorice Model DS500)	Doric Instruments 4750 Viewridge Ave, San Diego, CA 92123 Phone: 858-569-1601 Fax: 858-569-8474
Fuel pressure gage (Range: 0 to 300 PSIG (0 to 2068 kPa))	Commercially available
Fuel pressure gage (Range: 5 to 50 PSIG (34 to 345 kPa))	Commercially available

Table 701. Equipment and Manufacturer List (Cont)

Equipment	Manufacturer/Source
Fuel pressure gage	Commercially available
(Range: 50 to 250 PSIG (345 to 1724 kPa))	
Fuel spray angle protector	Commercially available
(Range: 50 to 130°F (10 to 54°C))	
Flow restrictor	Honeywell Ground Support Solutions, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Flow regulating valve	Commercially available
Fluorescent penetrant unit	Magnaflux, 3600 West Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160
Hand crimp tool (M22520/1-01) (Daniels AF8 Tool) (12 AWG thru 26 AWG)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Hand crimp tool (M22520/2-01) (Daniels AFM8 Tool) (20 AWG thru 32 AWG)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Hand crimp tool (M22520/5-01) (Daniels HX4 Tool)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Hand crimp tool (Daniels WA22)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Hand crimp tool (Daniels WA27F)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Hex crimp tool (M22520/10-01) (Daniels HX3 Tool)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Inlet pressure transducer (Digital Readout)	Commercially available

Table 701. Equipment and Manufacturer List (Cont)

Equipment	Manufacturer/Source
Insertion and removal tool (MS24256)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Insertion and removal tool (MS90455)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Insertion and removal tool (MS90456)	Daniels Manufacturing Corp, 526 Thorpe Rd, Orlando, FL 32824-8133 Phone: 407-855-6161
Insertion tool (Keenserts Threaded Inserts)	Commercially available
Magnaflux 900 series	Magnaflux, 3600 West Lake Ave, Glenview, IL 60026 Phone: 937-332-3000 Fax: 937-332-3160
Manometer (Manometer 0 to 60 in. Hg (0 to 203.18 kPa))	Commercially available
Master bearing (M205)	Bearing Inspection Inc, 10041 Shoemaker Ave, Sante Fe Springs, CA 90670
Master curvics	Honeywell Ground Support Solutions, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Megohmmeter	Commercially available
Oscilloscope (Tektronix DPO3000)	Tektronix Inc, 14200 S.W. Karl Braun Drive, P.O. Box 500 Beaverton, OR 97077 Phone: 503-627-7111
Peening chamber (Perfecto-Peen Cabinet)	Commercially available
Pressure extrusion gun	Courtaulds Aerospace, SEMCO Packaging and Applications Systems, 5454 San Fernando Rd, Glendale, CA 91203
Pressure gage (0 to 100 PSIG (0 to 689 kPa))	Commercially available

Table 701. Equipment and Manufacturer List (Cont)

Equipment	Manufacturer/Source
Pressure regulator (0 to 60 in. Hg (0 to 203.18 kPa))	Commercially available
Pressure regulator (0 to 100 PSIG (0 to 689 kPa))	Commercially available
Pressure regulating valve	Commercially available
Runout fixtures	Honeywell Ground Support Solutions, 3520 Westmoor St, South Bend, IN 46628-1373 Phone: 866-810-8944
Special fan-shaped extrusion nozzle	Courtaulds Aerospace, SEMCO Packaging and Applications Systems, 5454 San Fernando Rd, Glendale, CA 91203

3. Consumables List

Consumables called out in text are listed in Table 702 through Table 709.

Consumables are sorted by category to do easy the researching process and avoid the duplication of consumables and materials.

Code	Generic Name	Table
C01-XXXX	Adhesives, Plastics, Sealants	706
C02-XXXX	Anti-Seize compounds, Lubricants, Oils	708
C03-XXXX	Finishes and Protective Coatings	710
C04-XXXX	Cleaning Compounds and Solvents	711
C05-XXXX	Inspection and Marking Compounds	719
C06-XXXX	Weld Braze	720
C07-XXXX	Thermal Spray	721
C08-XXXX	Miscellaneous	722

NOTE: Equivalent substitutes may be used for compounds or materials listed.

Table 702. Adhesives, Plastics, Sealants,
Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C01-0001	Epoxy Paste Adhesive (Hysol EA 929NA)	Hysol Division, The Dexter Corp, 211 Franklin St, Olean, NY 14760-1211
C01-0002	Epoxy Paste Adhesive (Hysol EA 9394/C-2)	Henkel Corporation Aerospace Group, 2850 Willow Pass Rd, P.O. Box 312 Bay Point, CA 94565 Phone: 925-458-8000
C01-0003	Heat Sealable Plastic Bag	MIL-PRF-22191
C01-0004	Barrier Material	MIL-PRF-131
C01-0005	Plastic Abrasive Blast Media	MIL-P-85891 (Type 1,2,3,4,5)
C01-0006	Adhesive Sealant	MIL-A-46106
C01-0007	Adhesive Tape (NT-580 Plating Tape)	Commercially available
C01-0008	Adhesive Tape (Pressure Sensitive Tape (Teflon))	Commercially available
C01-0009	Adhesive Tape (Pressure Sensitive Tape Polyester))	Commercially available

Table 702. Adhesives, Plastics, Sealants,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C01-0010	Adhesive Tape (Pressure Sensitive Tape (Nylon))	Commercially available
C01-0011	Masking Wax Compound (Masking Wax M-1085)	Sasol Wax, 2 Corporate Drive, Suite 434 Shelton, CT 06484 Phone: 203-925-4300 Fax: 203-926-9844
C01-0012	Masking Wax Compound (Microwax C-562)	Tolber Chemical, 220 West 5th Street, Hope, AR 71801 Phone: 870-777-3251 Fax: 870-777-8056
C01-0013	Stop-Off Lacquer (Microshield)	Tolber Chemical, 220 West 5th Street, Hope, AR 71801 Phone: 870-777-3251 Fax: 870-777-8056
C01-0014	Polyethylene Sheet (Valeron Film (2.5, 3.0, 4.0, 5.0, 6.5 Mil))	Valeron Strength Films, 9505 Bamboo Rd, Houston, TX 77041 Phone: 713-462-6111 Fax: 713-690-2746

Table 703. Anti-Seize Compounds, Lubricants, Oils, Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C02-0001	Anti-Seize Compound (Fluoroglide FB)	Norton Chemplast DBA, 150 Dey Rd, Wayne, NJ 07470-4670 Phone: 201-696-4700
C02-0002	Anti-Seize Compound (Liqui Moly NV Thread Compound)	Lockrey Co, Inc, 2517 Finlaw Ave, Merchantville, NJ 08109 Phone: 856-665-4794
C02-0003	Anti-Seize Compound	MIL-PRF-907
C02-0004	Corrosion Preventive Compound	MIL-PRF-16173, Grade 3
C02-0005	Corrosion Preventive Compound	MIL-C-6529, Type III
C02-0006	Lubricant Oil	MIL-PRF-6085
C02-0007	Lubricant (Santovac OS-124 or Santovac 5)	Santos Lubes, 8 Governor Dr, St. Charles, MO 63301-73 Phone: 636-723-0240
C02-0008	Lubricant Oil (Turbine Lubricant)	MIL-PRF-7808
C02-0009	Lubricant Oil (Turbine Lubricant)	MIL-PRF-23699
C02-0010	Aircraft Lubricating Grease	MIL-PRF-81322, Grade A
C02-0011	Rust Preventive (Corrotek)	MagChem, 1271 Ampere, Boucherville, QC J4B5Z5, Canada Phone: 450-655-1344 Fax: 450-655-5428
C02-0012	Rust Preventive (Immunol 1228)	Harry Miller Corporation, 4309 North Lawrence Street, Philadelphia, PA 19140 Phone: 800-532-0093 Fax: 215-324-1258
C02-0013	Corrosion Preventive Compound	AMS 3065
C02-0014	Corrosion Preventive Compound	MIL-C-15074
C02-0015	Corrosion Preventive Compound (Ferrocoat 364AC)	Quaker Chemical Corporation, One Quaker Park, 901 Hector Street, Conshohocken, PA 19428-0809

Table 703. Anti-Seize Compounds, Lubricants, Oils, Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C02-0016	Corrosion Preventive Compound (Ferrocoat 366)	Quaker Chemical Corporation, One Quaker Park, 901 Hector Street, Conshohocken, PA 19428-0809
C02-0017	Petroleum Base Hydraulic Fluid (Red Oil)	MIL-PRF-5606H
C02-0018	Anti-Seize Compound (Ease-Off 990)	Texacone Company Inc, 4111 Forney Ave, Mesquite, TX 75149 Phone: 800-235-2727 Fax: 972-289-6285
C02-0019	Anti-Seize Compound (Never-Seez NS-165)	Bostik, Inc, 211 Boston Street, Middleton, MA 1949-2128 Phone: 888-603-8558 Fax: 978-750-7293

Table 704. Finishes and Protective Coatings,
Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C03-0001	Abradable Coating Compound (ADX-352)	Dexter Hysol Aerospace Inc, The Dexter Corp, 2850 Willow Pass Rd, Box 312 Pittsburgh, CA 94565
C03-0002	Chromate Conversion Coating	MIL-DTL-81706
C03-0003	Deoxidizer (Oakite 34)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C03-0004	Epoxy Paint (Koropon/CA 3000 series Gloss Black Num 17038)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 91209 Phone: 818-240-2060
C03-0005	Epoxy Paint (Koropon/CA 3000 series Gloss Blue Num 15187)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 91209 Phone: 818-240-2060
C03-0006	Epoxy Paint (Koropon/CA 3000 series Light Green Num 14670)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 91209 Phone: 818-240-2060
C03-0007	Primer (Green Num 34151)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 9120 Phone: 818-240-2060
C03-0008	Potting Compound (Epoxilite 810 Part A&B)	The Epoxilite Corporation, (Elantas PDG Inc), 5200 North Second Street Saint Louis, MO 63147 Phone: 314-621-5700
C03-0009	Aluminum Silicone Paint (Dutch Boy No. 5542)	N.L. Industries Inc, 5430 LBJ Freeway, Suite 1700, Dallas, TX 75240-2697 Phone: 972-233-1700 Fax: 972-448-1445
C03-0010	Primer Coat (Dow Corning 1200)	Dow Corning Corporation, 3901 S. Saginaw Rd, Midland, MI 48640 Phone: 800-248-2481

Table 704. Finishes and Protective Coatings, Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C03-0011	Epoxy Paint (Koropon/CA 3000 series Gloss Yellow Num 13538)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 91209 Phone: 818-240-2060
C03-0012	Epoxy Paint (Akzo Nobel 446-21 series Gloss Yellow Num 13538)	Akzo Nobel Aerospace Coatings, 1 East Water Street, Waukegan, IL 60085-5652 Phone: 847-623-4200
C03-0013	Epoxy Paint (Koropon/CA 3000 series Gloss Red Num 11136)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 91209 Phone: 818-240-2060
C03-0014	Epoxy Paint (Akzo Nobel 446-21 series Gloss Red Num 11136)	Akzo Nobel Aerospace Coatings, 1 East Water Street, Waukegan, IL 60085-5652 Phone: 847-623-4200
C03-0015	Primer Green (Deft 44GN11)	PRC-DeSoto International, 5454 San Fernando Road, Glendale, CA 91209 Phone: 818-240-2060
C03-0016	Epoxy Paint (Akzo Nobel 446-21 series Gloss Black Num 17038)	Akzo Nobel Aerospace Coatings, 1 East Water Street, Waukegan, IL 60085-5652 Phone: 847-623-4200

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C04-0001	Aluminum Oxide (24 Grit)	Commercially available
C04-0002	Aluminum Oxide (120 mesh)	Commercially available
C04-0003	Methyl-Ethyl-Ketone	ASTM D 740
C04-0004	Alcohol, Isopropyl	TT-I-735
C04-0005	Aqueous Cleaner (Ardrox 6025)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0006	Aqueous Cleaner (Ardox 6333)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0007	Aqueous Cleaner (Armekleen M-HP-2)	Armex, 469 N. Harrison Street, Princeton, NJ 08543 Phone: 609-497-7220 Fax: 609-683-5900
C04-0008	Aqueous Cleaner (Brulin 1990GD Cleaner)	Brulin & Company Inc, 2920 Dr. A.J. Brown Ave, Indianapolis, IN 46205 Phone: 317-923-3211 Fax: 317-925-4596
C04-0009	Aqueous Cleaner (CeeBee A7X7 Cleaner)	McGean, 2910 Harvard Ave, Cleveland, OH 44105 Phone: 216-441-4900 Fax: 216-441-1377
C04-0010	Aqueous Cleaner (Daraclean 282)	Magnaflux, 3600 West Lake Ave, Glenview, IL 60056 Phone: 937-332-3000 Fax: 937-332-3160
C04-0011	Alkaline Cleaner (Diversey 909/Ridoline 909)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976

Table 705. Cleaning Compounds and Solvents, Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0012	Alkaline Cleaner (Ecomate FN)	SOQ Environmental Technology, 2413 E. Manhatton Dr, Tempe, AZ 85285 Phone: 800-345-2892 Fax: 480-966-2912
C04-0013	Alkaline Cleaner (Novaclean 909)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0014	Alkaline Cleaner (Oaklite 61-B Cleaner)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0015	Alkaline Cleaner (Turco 5948-R Cleaner)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0016	Aqueous Cleaner (XI-T Plus Cleaner)	Fortune Chemical Company Inc, 225 West Deer Valley Road #4, Phoenix, AZ 85027-2108 Phone: 602-780-2296 Fax: 602-252-4470
C04-0017	Alkaline Rust Remover	AMS 1380
C04-0018	Alkaline Rust Remover (Ardrox 1854)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0019	Alkaline Rust Remover (Turco T-4181-L)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0020	Anodize Stripper (DW 511L)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0021	Caustic Soda	Commercially available
C04-0022	Calcium Sulfate	Commercially available
C04-0023	Chromic Acid (Flake or Crystalline)	A-A-55827
C04-0024	Cleaner (Dowclene EC)	McGean-Rohco Inc, 2910 Harvard Ave, Cleveland, OH 44105 Phone: 216-341-0020
C04-0025	Degreasing Solvent	MIL-PRF-680
C04-0026	Electrocleaner (FS)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0027	Generic Cleaning Powder (Oakite Rustripper)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0028	Liquid Nitrogen	A-A-59503
C04-0029	Methyl Alcohol	O-M-232
C04-0030	Mineral Spirit Solvent (Shellsol D60)	Shell Chemical LP, 5900 Hwy 225 P.O. Box 100, Deer Park, TX 77536 Phone: 713-246-1461
C04-0031	Muriatic Acid	ASTM E1146
C04-0032	Nitric Acid	A-A-59105
C04-0033	Paint and Carbon Remover (Turco Transpo S2)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0034	Paint and Carbon Remover (Strip Sol or Star Strip)	Griggs Paint Inc, 3635 S. 18th Street, Phoenix, AZ 85040-1305 Phone: 602-243-3293
C04-0035	Paint Remover	TT-R-251
C04-0036	Sodium Dichromate	Commercially available

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0037	Synthetic Resin Varnish	AMS 3132
C04-0038	Sand Blast Media (120 Grit)	MIL-A-22262
C04-0039	Sodium Bicarbonate	Commercially available
C04-0040	Thinner, Alcohol Ester	AMS 3170
C04-0041	Solvent	MIL-T-81533
C04-0042	Solvent	MIL-C-81302
C04-0043	Solvent	ASTM D 4080
C04-0044	Solvent	ASTM D 4376
C04-0045	Solvent (Safezone Precision Cleaning (MS-941/CO2))	Miller Stephenson, George Washington Hwy, Danbury, CT 06810 Phone: 203-43-4447 Fax: 203-791-8702
C04-0046	Chromic Acid (Pickle Solution)	AMS-M-3171
C04-0047	Distilled Water	Commercially available
C04-0048	De-ionized Water	Commercially available
C04-0049	Alkaline Rust Remover (Turco 4781-7 or Turco 4781-7L)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0050	Alkaline Rust Remover (Ardrox 185 or Ardrox 185L)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0051	Alkaline Rust Remover (HDP-2888)	MagChem, 1271 Ampere Boucherville QC J4B5Z5, Canada Phone: (450) 655-1344 Fax: (450) 655-5428
C04-0052	Alkaline Rust Remover (HDL-202)	MagChem, 1271 Ampere Boucherville QC J4B5Z5, Canada Phone: 450-655-1344 Fax: 450-655-5428

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0053	Alkaline Rust Remover (HTP-1150)	El Dorado Solutions, 12780 San Francisco Road, Los Angeles, CA 91342 Phone: 800-531-1038 Fax: 210-653-0825
C04-0054	Alkaline Rust Remover (HTP-1150L)	El Dorado Solutions, 12780 San Francisco Road, Los Angeles, CA 91342 Phone: (800-531-1038 Fax: 210-653-0825
C04-0055	Alkaline Rust Remover (Applied 5840)	Applied Australia PTY LTD, 92 Fairbank Road Clayton South, Victoria Melbourne 3169, Australia Phone: 61 3 85425111 Fax: 61 3 85425188
C04-0056	Alkaline Rust Remover (Turco 4008)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0057	Alkaline Rust Remover (Turco 4338-C or Turco 4338-L)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0058	Alkaline Rust Remover (Ardrox 188 or Ardrox 188-RFU)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0059	Alkaline Rust Remover (CeeBee J88 or CeeBee J88L)	McGean, 2910 Harvard, OH 44105 Phone: 216-441-4900 Fax: 216-441-1377
C04-0060	Alkaline Rust Remover (HTP-1190 or HTP-1190L)	El Dorado Solutions, 12780 San Francisco Road, Los Angeles, CA 91342 Phone: 800-531-1038 Fax: 210-653-0825

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0061	Paint and Carbon Remover (Ardrox 2302)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0062	Paint and Carbon Remover (Turco 5668)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0063	Paint and Carbon Remover (Kemstrip 596)	MagChem, 1271 Ampere, Boucherville QC J4B5Z5, Canada Phone: 450-655-1344 Fax: 450-655-5428
C04-0064	Paint and Carbon Remover (CeeBee A-477)	McGean, 2910 Harvard, OH 44105 Phone: 216-441-4900 Fax: 216-441-1377
C04-0065	Alkaline Cleaner (Formula 815GD)	Brulin & Company Inc, 2920 Dr. A.J. Brown Ave, Indianapolis, IN 46205 Phone: 317-923-3211 Fax: 317-925-4596
C04-0066	Solvent (Methyl Propyl Ketone)	Commercially available
C04-0067	Solvent (Teksol)	Commercially available
C04-0068	Solvent (Positron)	Ecolink, 2177-A Flintstone Drive, Tucker, GA 30084 Phone: 800-886-8240 Fax: 770-621-8245
C04-0069	Degreasing Solvent (Quantum 2000 Aerosol (CE-SX-94))	Selig Industries, 115 Kendall Park Ln, Atlanta, GA 30336-2904 Phone: 404-691-9220 Fax: 404-699-7024
C04-0070	Degreasing Solvent (Isoblast Bulk (GB-SX-94))	Selig Industries, 115 Kendall Park Ln, Atlanta, GA 30336-2904 Phone: 404-691-9220 Fax: 404-699-7024

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0071	Solvent (Skykleen 1000)	Solutia Inc, 575 Maryville Centre Drive, St. Louis, MO 63141 Phone: 281-213-3472
C04-0072	Solvent (Turco 4460)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0073	Solvent (Bioact 105)	Petroferm, 2416 Lynndale Road, Fernandina Beach, FL 32034 Phone: 904-277-5227
C04-0074	Solvent (Supersolve AS)	Arrow Chemicals LTD, Rawdon Road, Moira Swadilincote Derbyshire DE12 6DA, England
C04-0075	Degreasing Solvent (Skysol)	MagChem, 1271 Ampere, Boucherville QC J4B5Z5, Canada Phone: 450-655-1344 Fax: 450-655-5428
C04-0076	Gas Path Cleaner (Turbine Engine Gas Path Cleaning Compound)	MIL-PRF-85704
C04-0077	Solvent (Turco 6780)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0078	Aqueous Cleaner (Ardrox 6077)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C04-0079	Aqueous Cleaner (Evasol)	MagChem, 1271 Ampere, Boucherville QC J4B5Z5, Canada Phone: 450-655-1344 Fax: 450-655-5428

Table 705. Cleaning Compounds and Solvents,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C04-0080	Aqueous Cleaner (Nugear SC)	Nuvite, 213 Freeman Street, Brooklyn, NY 11222 Phone: 718-383-8351
C04-0081	Solvent (Bio T Max)	BioChem Systems, 8100 E 22nd St N Ste 1700-3, Wichita, KS 67226 Phone: 316-838-4739
C04-0082	Alkaline Cleaner (Turco Liquid Sprayeze NP-LT)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0083	Alcohol, Isopropyl	ASTMD770
C04-0084	Alkaline Rust Remover (Ferlon)	Henkel Surface Technologies, 32100 Stephenson Hwy, Madison Heights, MI 48071 Phone: 248-583-9300 Fax: 248-583-2976
C04-0085	Alkaline Rust Remover (HDP-2524)	MagChem, 1271 Ampere, Boucherville QC J4B5Z5, Canada Phone: 450-655-1344 Fax: 450-655-5428
C04-0086	Alkaline Rust Remover (Applied 5770)	Applied Australia PTY LTD, 92 Fairbank Road Clayton South, Victoria Melbourne 3169, Australia Phone: 61 3 85425111 Fax: 61 3 85425188
C04-0087	Solvent	ASTMD235
C04-0088	Alkaline Cleaner (Cee-Bee Cleaner Alko)	McGean, 2910 Harvard, OH 44105 Phone: 216-441-4900 Fax: 216-441-1377

Table 706. Inspection and Marking Compounds,
Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C05-0001	Flexographic Ink (127 ½ Violet)	Pannier Corporation, 207 Sandusky Street, Pittsburgh, PA 1512-5823 Phone: 412-3223-4900
C05-0002	Marking Compound (Hi Spot Blue)	Dykem, 805 E. Old 56 Highway, Olathe, KS 66061 Phone: 800-443-9536 Fax: 800-323-9536
C05-0003	Marking Compound (Gleason fluid orange)	Gleason Works, 1000 University Ave, Rochester, NY 22970 Phone: 585-473-1000
C05-0004	Fluorescent Magnetic Ink (Ardrox 8500)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C05-0005	Carrier Oil (Ardrox Base Oil HF)	Chemetall Oakite, 675 Central Ave, New Providence, NJ 07974 Phone: 800-526-4473 Fax: 908-464-9250
C05-0006	Fluorescent Magnetic Powder (Magnaglo 14A)	Magnaflux, 3600 West Lake Ave, Glenview, IL 60026 Phone: 937-332-3000 Fax: 937-332-3160
C05-0007	Water Conditioners (Magnaglo Water Conditioners WA-2B/WA-4)	Magnaflux, 3600 West Lake Ave, Glenview, IL 60026 Phone: 937-332-3000 Fax: 937-332-3160
C05-0008	Filtered Calibrating Fluid	MIL-PFR-7024
C05-0009	Leak Detection Compound (Leak Tec Formula 277C)	ASTM E515
C05-0010	Magnetic Base Oil (Magnaglo Carrier II)	Magnaflux, 3600 West Lake Ave, Glenview, IL 60025 Phone: 937-332-3000 Fax: 937-332-3160

Table 707. Weld Braze,
Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C06-0001	Silver Alloy Brazing Filler Metal	AMS 4774
C06-0002	Solder Flux (Sn 10 (Ag 1.5)	J-STD-004
C06-0003	Solder Flux (Sn 60) (Ag 1.5)	J-STD-0004
C06-0004	Solder Paste (Sn 10) (Ag 1.5)	J-STD-005
C06-0005	Solder Paste (Sn 60) (Ag1.5)	J-STD-005
C06-0006	Solder Paste	J-STD-006

Table 708. Thermal Spray,
Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C07-0001	Feb 24/16	Feb 24/16
C07-0002	Feb 24/16	Feb 24/16
C07-0003	Feb 24/16	Feb 24/16

Table 709. Miscellaneous, Consumables and Manufacturers List

Code	Generic Name	Specification/Supplier
C08-0001	Abrasive Cloth	ANSI B74.18
C08-0002	Abrasive Paper	ANSI B74.18
C08-0003	Abrasive Cloth (Scotch brite)	3M, 3M Center,, St. Paul, MN 55144-1000 Phone: 888-364-3577
C08-0004	Abrasive Paper 120 grit	Commercially available
C08-0005	Acetone	ASTM D 329
C08-0006	Alcohol, Ethyl	MIL-STD-1201
C08-0007	Anti-Seize Compound (Milk of Magnesia)	Commercially available
C08-0008	Aviation Turbine Fuel	MIL-DTL-5624
C08-0009	Lint Free Cloth	CCC-C-46
C08-0010	Crocus Cloth	ANSI B74.18
C08-0011	Eraser (Pink Pearl No. 101)	Eberhard-Faber Inc, Crestwood industrial Park, Wikes Barre, PA 18703
C08-0012	Garnet Grit (150 Grit Screen 100-200 Class III Size AF or A,G C10 or C3)	Commercially available
C08-0013	Glass Bead (130 Grit Screen 100-230 Class IV Size AF or AG)	Commercially available
C08-0014	Graphite	Commercially available
C08-0015	Suede Brush (1630-210)	Commercially available
C08-0016	Sharpening Stone (Arkansas Polishing Stone)	Commercially available
C08-0017	Tape (Raychem TMS-WM)	Tyco Electronics, 1050 Westlakes Dr, Berwyn, PA 19312 Phone: 610-893-9800
C08-0018	Toluene Technical	A-A-59107
C08-0019	Wiping Cloth (Rymple Cloth)	Commercially available
C08-0020	Abrasive Cloth (Hand Pad 7447)	3M, 3M Center, St. Paul, MN 55144-1000 Phone: 888-364-3577

Table 709. Miscellaneous,
Consumables and Manufacturers List (Cont)

Code	Generic Name	Specification/Supplier
C08-0021	Abrasive Paper (240 Grit Abrasive Paper)	Commercially available
C08-0022	Abrasive Paper (600 Grit Abrasive Paper)	Commercially available
C08-0023	Machining Coolant (Trim Sol)	Master Chemical Corporation, 501 West Boundary Street, Perrysburg, OH 43551 Phone: 419-874-7902 Fax: 419-874-7902
C08-0024	Abrasive Tool (Brightboy Stick ST70AL0612)	Abrasives & Tool Inc, 41 Orchard St, Ramsey, NJ 07446 Phone: 201-962-7434 Fax: 201-962-7437
C08-0025	Retention Test Tool (ATC-3075 for 20 Gauge Pins and Sockets)	Astro Tool Corp, 21615 SW Tualatin Valley Highway, Beaverton, OR 97006 Phone: 503-642-9853 Fax: 503-591-7766
C08-0026	Retention Test Tool (ATC-3076 for 16 Gauge Pins and Sockets)	Astro Tool Corp, 21615 SW Tualatin Valley Highway, Beaverton, OR 97006 Phone: 503-642-9853 Fax: 503-591-7766
C08-0027	Retention Test Tool (ATC-3077 for 12 Gauge Pins and Sockets)	Astro Tool Corp, 21615 SW Tualatin Valley Highway, Beaverton, OR 97006 Phone: 503-642-9853 Fax: 503-591-7766
C08-0028	Photo-Flo Solution (Kodak Photo-Flo Solution)	ITT Space Systems LLC, 800 Lee Rd, Bldg 601, Rochester, NY 14606 703-342-1603
C08-0029	Filter (Filter 10 Milimicrons)	Commercially available
C08-0030	Silicone Rubber X-TREME® Tape	Commercially available