CHAPTER

70

STANDARD PRACTICES - ENGINE

MD-80
AIRCRAFT MAINTENANCE MANUAL

CHAPTER 70
STANDARD PRACTICES - ENGINE

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CHAPTER 70
STANDARD PRACTICES - ENGINE

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STANDARD PRACTICES - ENGINE - DESCRIPTION AND OPERATION

1. General

CAUTION: CADMIUM-PLATED TOOLS SHOULD NOT BE USED ON TITANIUM PARTS, PARTICULARLY IF PARTS ARE MOUNTED NEAR ENGINE AND SUBJECT TO HEAT. SMALL CADMIUM DEPOSITS WHICH MAY BE LEFT ON SUCH PARTS WILL REACT WITH TITANIUM WHEN HEATED RESULTING IN BRITTLENESS AND POSSIBLY CRACKS.

A. Procedures and practices peculiar to the maintenance of the power plant are described in the Standard Practices chapter.

NOTE: Lead, zinc, silver, and tin react in a similar manner with titanium at temperatures above 121°C(250°F).

1. General

CAUTION: IT IS POSSIBLE TO ASSEMBLE CERTAIN ENGINE PARTS IN A LOCATION OR IN OTHER MODELS OF ENGINES FOR WHICH THESE PARTS WERE NOT INTENDED. BECAUSE SUCH MIS-ASSEMBLY CAN POSSIBLY RESULT IN A FAILURE, CHECK EACH PART TO BE SURE CORRECT PART IS USED.

A. To ensure proper reinstallation, tag and mark all parts, clips, and brackets as to their location.

B. During removal of tubes or engine parts, look for indications of scoring, burning, or other undesirable conditions. To facilitate reinstallation, observe location of each part during removal. Tag unserviceable parts and units for investigation and possible repair.

C. Extreme care shall be taken to prevent dust, dirt, lockwire, nuts, washers or other foreign matter from entering engine. If at any time such items are dropped, assembly process must stop until dropped articles are located, even though this may require considerable amount of time and labor. Before assembling or installing any part, be sure it is thoroughly clean. Suitable plugs, caps, and other covering shall be used to protect all openings as they are exposed.

NOTE: Dust caps used to protect open lines against contamination shall always be installed over tube ends and not in tube ends. Flow through lines may be blocked off if lines are inadvertently installed with dust caps in tube ends.

D. Lockwire, lockwashers, tablocks, tabwashers, or cotter pins shall never be reused. All lockwire and cotter pins must fit snugly in their holes. Install cotter pin so that head fits into castellation of nut, and unless otherwise specified, bend one end of pin back over stud or bolt and other end down flat against nut. Only lockwire and cotter pins made of corrosion-resistant steel shall be used. Bushing plugs shall be lock-wired to assembly boss or case. Do not lockwire plug to bushing.

E. Replace all gaskets, packings, and rubber parts at every removal/installation. Make sure that new nonmetallic parts to be installed (such as an oil seal) show no sign of having deteriorated in storage. If necessary, coat gasket surfaces with Gredag Lubricant to reduce possibility of gasket adhering to surfaces of mating parts.

NOTE: Gasket lubricant is known as Gredag Lubricant No. 55 Graphited, and may be procured from Acheson Industries Inc., Acheson Colloids Division, 1635 Washington Street, Port Huron, Michigan 48061.

CAUTION: BEFORE USING TOOLS WITH COVERED SURFACES, MAKE CERTAIN THAT THERE IS SUFFICIENT PROTECTIVE MATERIAL PRESENT TO PRECLUDE POSSIBILITY OF DAMAGING ENGINE PARTS.

F. In order to protect critical areas of engine parts (such as compressor and turbine disks) against scratches and nicks, tool surfaces contacting these areas must be covered with protective material.

CAUTION:

IF ENGINES WITH KEVLAR-WRAPPED FAN CONTAINMENT CASES DO NOT HAVE COVERS TO KEEP OUT PRECIPITATION, THE RESULT CAN BE WATER ABSORBED INTO THE KEVLAR. THIS WATER IN THE KEVLAR WILL MAKE A KEVLAR BELT REPLACEMENT REPAIR NECESSARY. SUCH A REPAIR IS VERY EXPENSIVE AND TIME-CONSUMING.

G. During engine transport and during short-term storage outdoors before engine transport or induction into a shop, it is important to put the correct covers on engines to keep out rain, snow, sleet, or hail.

H. If any part was coated with corrosion preventive compound all traces of this compound and accumulated foreign matter must be removed.

I. Tubes which incorporate fixed ferrule and loose nut shall have seal retaining nut at fixed ferrule end of tube tightened first.

J. Definitions for WARNING, CAUTION, and NOTE are as follows:

(1) A WARNING tells the operator that injury or death is possible if the operator does not obey the specified instruction.

(a) WARNING statements that are applicable to an instruction will precede (come before) the instruction and all CAUTION statements that are also applicable to that instruction.

(b) WARNING statements that are applicable to an entire (full) procedure will follow the procedure title, and will precede all CAUTION or NOTE statements that are also applicable to the entire procedure.

(2) A CAUTION statement tells the operator that damage to the part, engine, or equipment is possible if the operator does not obey the specified instruction.

(a) CAUTION statements that are applicable to an instruction will precede the instruction and will follow all WARNING statements that are also applicable to that instruction.

(b) CAUTION statements that are applicable to an entire procedure will follow the procedure title and all WARNING statements that are also applicable to the entire procedure, and will precede all NOTE statements that are also applicable to the entire procedure.

(3) A NOTE statement gives explanations and added information (data) that help the operator to do the specified instruction.

(a) NOTE statements that are applicable to an instruction will follow the instruction.

(b) NOTE statements that are applicable to an entire procedure will follow the procedure title and all WARNING and CAUTION statements that are applicable to the entire procedure.

(c) In some procedures that are not new, it is possible that a NOTE statement will include instructions or dimensional limits (for example, feature controls). If a NOTE statement includes instructions or dimensional limits, then it is necessary to obey this information because it is necessary to complete the procedure.

2. LIST OF MATERIALS (CONSUMABLE MATERIALS)

A. General

(1) Pratt & Whitney has made the subsequent list of consumable materials that are specified for engine line maintenance. See the consumable materials index for data on materials for use in powerplant maintenance.

(2) The subsequent consumable materials list is identified as follows:

TABLE	CATEGORY
01	Fuels
02	Hydraulic Fluids
03	Oils
04	Common Greases
05	Special Materials
06	Lubricants
07	Lacquers
08	Bonding and Adhesive Compounds
09	Sealants

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TABLE	CATEGORY
10	Anti-Ice and Deicing Materials
11	Cleaning Agents
12	Strippers
13	Pretreatment for Painting
14	Disinfectants
15	Storage Preservation
16	Structure Paints
17	Microbiological Contamination Protection Materials
18	Primer

WARNING: BEFORE YOU USE ANY OF THE MATERIALS SHOWN IN THIS PUBLICATION, YOU MUST KNOW ALL OF THE PRECAUTIONS RECOMMENDED BY THE MANUFACTURER OR THE SUPPLIER. THESE PRECAUTIONS TELL YOU HOW TO:

- USE THE MATERIAL SAFELY

- KEEP THE MATERIAL SAFELY

- DISCARD THE MATERIAL SAFELY

YOU MUST READ THE MATERIAL SAFETY DATA SHEETS (OSHA FORM 20 OR EQUIVALENT) TO LEARN THE RECOMMENDED PRECAUTIONS. THE SAFETY DATA SHEETS ARE SUPPLIED BY THE MANUFACTURER OR THE SUPPLIER OF THE MATERIAL.

(3) The subsequent list of consumables gives the item number, material designation, specification department, material manufacturers reference and/or specification, and supplier code.

NOTE: All supplier/vendor codes are in alphanumeric sequence in a vendor manufacturers code and address list at the end of this section.

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
01- FUELS				
P01-001	Fuel/Engine	Refer to SB 2016		LOCAL
02- HYDRAULIC FLUIDS				
P02-001	Hydraulic Fluid	Spec NSA 307.110	Hyjet IV or IVA	94548

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ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
			Skydrol 500/84 Skydrol LD4	76541
		03- OILS		
P03-001	Lubricant, Aircraft Turbine Engine, (Synthetic Base)	PWA 521, Type II (Latest Revision) MIL-PRF-23699	Royco 500 Royco 560 Exxon-Mobil Jet Oil 254 Exxon-Mobil Jet II Air BP Turbo Oil 2380 Air BP Castrol 5000 Air BP Turbo Oil 2197 Aeroshell Turbine Oil 500 Aeroshell Turbine Oil 560	07950 07950 1PWD8 1PWD8 1UGB2 1UGB2 1UGB2 54527 54527
P03-002	Oil, Lubricating	MIL-PRF-6081 Grade 1010 (Latest Revision) (Lubricating Oil, Jet Engine): PMC 9852	Royco 481 Winsor L-110-A Brayco 460 Aeroshell Turbine Oil 2	07950 1M647 2R128 KA832
P03-003	Fluid (Calibrating for Aircraft Fuel System Components)	MIL-PRF-7024, TYPE II (Latest Revision) PMC 9041		LOCAL
P03-005	Oil Lubricating Molybdenum Disulfide Silicone Base	MIL-L-25681 (Latest Revision)		12474
P03-006	Oil, Lubricating (Low Temperature)	MIL-PRF-7870 (Latest Revision) PMC 9851	Instrument Oil	1PWD8
P03-007	Oil, Gage Lubricant	PMC 9534	Marvel Mystery Oil	95015
P03-015	Fluid, Penetrating (Oil Type)	PMC 9545	318 Versatoil LPS LST Penetrant	27732 66724

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ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
			Knock'er Loose 03020 Aerosol - or - 03021, 03022, 03023, Bulk - or- Technician Grade Aerosol 401712 401724 Metal Guard 500 or Metal Guard Spray Formula	023V4 94853
P03-016	Fluid, Penetrating (Oil Type)	PMC 9503-1 & -3 PMC 9503-2	Aerokroil Kroil	13868 13868
P03-017	Oil, Penetrating	SPMC 188	Solvo-rust 81252 Super Penetrating Oil	05972
P03-019	Oil, Lubricating and Preservation, Aircraft Instrument and Bearings, Low Volatility	MIL-PRF-6085 PMC 9123		LOCAL
04- COMMON GREASES				
P04-001	Grease, Aircraft And Instrument, Gear and Actuator Screw	MIL-G-23827 (Latest Revision)		29700
P04-005	Grease (Extreme Pressure)	PMC 9630	Lubriplate No. 1200-2	73219
P04-006	Grease	PMC 9631	Plastilube No. 3	1V074
P04-007	Grease	MIL-G-81322 (Latest Revision)	Thrust Reverser System Lubrication	19135
05- SPECIAL MATERIALS				
P05-001	(Deleted)			
P05-004	Tape		Scotch Magic Mending Tape #810	52152
P05-005	Cloth, Cotton, Lint Free			LOCAL
P05-006	Compound, Lapping Silicone Carbide (280 Grain Size)	PMC 3011	Clover Silicone Carbide Grease Mix (39401 or 39403)	05972
P05-007	Leak Check, Bubble Type Liquid Leak Detector, Alternate	PMC 9569 OR PMC 2277	Leak TEC #372 Snoop Liquid Leak Detector	03530 02570

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ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P05-012	Tape, Adhesive (Double Sided)		Permacel 94, 96, 306, ED8112, ED8117 or ST8117	99742
P05-014	(Deleted)			
P05-015	Primer Silicone Rubber (Moved to P18-009)	PWA 556		
P05-017	Wipers, Cotton (Lint Free)			LOCAL
P05-018	Pencil, Metal Marking	PMC 4059-2 (Blue)	Stock No. 02443 for Prismacolor Verithin 741 Or Stock No. 20044 for Col-Erase 1276 Or Stock No. 03332 for Prismacolor Thick Lead 901	86874
		PMC 4059-3 (Light Green)	Stock No. 03341 for Prismacolor Thick Lead 910 Or Stock No. 20046 for Col-Erase 1278	86874
		PMC 4059-5 (Pink)	Stock No. 03357 for Prismacolor Thick Lead 929	86874
		PMC 4059-6 (Red)	Stock No. 00750 for Prismacolor Verithin 750 Or Stock No. 20045 for Col-Erase 1277 Or Stock No. 20066 for Col-Erase 1297 Or Stock No. 03351 for Prismacolor Thick Lead 922	86874
		PMC 4059-7 (Silver)	Stock No. 02460 for Prismacolor Verithin 753 Or Stock No. 03375 for Prismacolor Thick Lead 949	86874

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ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
		PMC 4059-8 (White)	Stock No. 03365 for Prismacolor Thick Lead 938 Or Stock No. 02429 for Prismacolor Verithin 734 Or Stock No. 20055 for Col-Erase 1286	86874
		PMC 4059-9 (Yellow)	Stock No. 03346 for Prismacolor Thick Lead 916 Or Stock No. 02431 for Prismacolor Verithin 735	86874
		PMC 4059-10 (Red)	Stock No. 00750 for Prismacolor Verithin 750	86874
		PMC 4059-11 (Orange)	Stock No. 02435 for Prismacolor Verithin 737 Or Stock No. 03348 for Prismacolor Thick Lead 918	86874
		PMC 4059-12 (Dark Green)	Stock No. 20046 for Col-Erase 1278	86874
		PMC 4059-13 (Caramine Red)	425T	3QND6
P05-019	(Deleted)			
P05-020	(Deleted)			
P05-021	(Deleted)			
P05-022	Dye - Layout and Identification	PMC 4062	Micrro Supreme Layout Dye, Purple	59460
P05-023	(Deleted)	MISC 41 (Deleted. Use PMC 4058, P05-232)		
P05-024	(Deleted)			
P05-025	Ink (Deleted, Refer to P05-411)	PMC 4021	1250, Black	4PNW1
P05-026	Ink, Metal Marking	PMC 4057-1	No. 9 Black SF	88303
P05-027	(Deleted)			
P05-028	Chromate Conversion Salts, Aluminum	PMC 1794	Alodine #600	71410

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P05-029	Chromate Conversion Salts, Aluminum	PMC 1631	Iridite No. 14-2 Compound	76071
P05-030	Wetting Agent	PMC 1632	ARP No. 2	76071
P05-031	(Deleted)			
P05-032	Penetrant, Fluorescent Post-Emulsified	PMC 4353-1	600	K2063
		PMC 4353-2	ZL27A	37676
		PMC 4353-3	RC65	21405
		PMC 4353-4	P230	S9502
		PMC 4353-5	(Deleted)	
		PMC 4353-6	985-P13	D1940 K6858 02CA7 23373
		PMC 4353-7	FP95A(M)	98733
		PMC 4353-8	F-6A/1P	S0126
P05-033	(Deleted)			
P05-034	(Deleted. See PMC 4357, P05-237)			
P05-035	(Deleted)			
P05-036	(Deleted, See PWA 36519, P05-020)			
P05-037	Enamel, Aluminized Epoxy	PWA 569	Enamel Base 529K002 Curing Solution 910K021	23354
P05-038	Cheesecloth Bleached, New, Woven, Unsized	GA 100-2	100% Cotton, 12x18 Inches (Minimum) to 20x40 Inches (Maximum), 40x32 Yarns/Inch	2A851 4N020 80769
P05-039	(Deleted)			
P05-040	Varnish Phenolic Resin, Corrosion-Preventative	AMS 3132	69X0545	78520
P05-041	(Deleted) Refer to P07-001	PMC 1641		
P05-042	(Deleted)			
P05-043	(Deleted)			
P05-044	(Deleted)			

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ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-045	Pen and Ink, Marking	PMC 4092-1 (Replaced by PMC 4050-7 in P05-423) PMC 4092-2 (Replaced by PMC 4050-12 in P05-423)		
P05-046	(Deleted)			
P05-047	(Deleted)			
P05-048	Stamping Ink, White (Deleted; use PMC 4057-2, P05-049)	PMC 4027	Dykem KXX-122 (No longer available; use PMC 4057-2)	
P05-049	Ink, Metal Marking	PMC 4057-2	White Metal Marking Ink No. 977-9	0ER09 LOCAL
P05-050	Abrasive Rod, Rubberized	.3750 OD x 6.0 in. (9.525 OD x 152.400 mm)	0066XF	86297
P05-052	Tape, Tying, Glass Fiber			00768
P05-053	Surfacer, Polyurethane	PWA 36013	8B6A Laminar X-500 Black (Base 8B6A and Curing Solution 50C3A)	0KXA5
P05-054	Surfacer, Polyurethane	PWA 36014	8W5 Laminar X-500 White Surfacer (Base 8W5 and Curing Solution 50C3)	0KXA5
P05-055	Emery Paper		No. 200-325 Grit	LOCAL
P05-056	Emery Paper		No. 60 Grit	LOCAL
P05-057	Tape, Tie		PN 190L0F21GIG/A	83309
P05-058	Brush, Plater's Tampico	GA 55-1	8313 M-904	33684 74291
P05-059	Wax, Paraffin	PMC 9552	Parvan 1300	1PWD8
P05-060	Demineralized Water	PMC 1737		LOCAL
P05-061	Crocus Cloth	P-C-458	1.500 in. (38.100 mm) Width	LOCAL
P05-062	Emery Cloth		No. 400	LOCAL
P05-063	Solvent Reducer	PWA 36050	Thinning Agent 020X324	92108
P05-064	Adhesive Precoat for Greaseless Compound	PMC 3091	Ad-Lea-Sive (ADL-3)	S0226
P05-065	Compound, Polishing, Medium Fine Greaseless	PMC 3048	Grade E	S0226
P05-066	Compound, Polishing Buffing	PMC 3061	No. 418 No. 50	S0226 0JYZ0

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ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-067	Brush, Soft Bristle, Nonmetallic			LOCAL
P05-068	Nitrogen	PMC 2214	Nitrogen, Nitrogen: 99.5% min. by volume (Argon is included in this percentage) Oxygen: 0.3% max. Dew Point: 0°F (-18°C)	00741 07098 3GMN8 36346
P05-069	Applicator, wood, cotton-tip		5-5-405	LOCAL
P05-074	Tape, Insulating (Glass Cloth, Adhesive)		No. 27	26066
P05-076	Abrasive Paper, Silicone Carbide Waterproof	P-P-101	No. 400 Grit	LOCAL
P05-087	Tape, Pressure Sensitive, Flat Black		No. 250	26066
P05-089	Color, Staining		Prussian Blue	98148
P05-094	Paper, Aluminum Oxide			LOCAL
P05-095	Coating, Conversion	MIL-C-5541, Class 1A (Latest Revision)		LOCAL
P05-099	Tape, Moisture Resistant, Adhesive (ASTMD5486 Type IV), Olive Drab	PMC 4141, -1 thru -5 PMC 4141, -1 thru -6:	AC5 Polyken 231 P-691 Tesa 53910	1VJW7 12861 80769 S0202 3XJ0
P05-104	Cloth, Emery		240 Grit	LOCAL
P05-110	Safety Wire (Lockwire)	MS9226-03	0.025 in. (0.635 mm)	LOCAL
NOTE: P05-288 is a preferred alternative to P05-110				
P05-113	Release Agent, Fluoro-carbon			18598
P05-124	Tie, Twist			LOCAL
P05-125	Tape, Teflon		6 Mil	71643
P05-126	Brush, Short Bristle Nylon			LOCAL
P05-127	Alodine, Brush		No. 1200 (Touch-up)	84063
P05-131	Non-metallic Grit Cloth		No. 90 Grit	LOCAL

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P05-132	Abrasive Paper		Light Grade 0	LOCAL
P05-133	Mold Release	PWA 36007-1 (Aerosol)	MS-122AD Or MS-122XD (Solvent Based)	18598
NOTE: Refer to P05-355 for a water based alternative.				
P05-135	Tape, Heat Reflective (Aluminum Foil Backed, Glass Cloth Laminated)	PMC 4235 36 Yard Rolls Width as Follows: -1, -6: 1/2 Inch -2, -7: 1 Inch -3, -8: 2 Inches -4, -9: 4 Inches -5, -10: 1/4 Inch -11: 1/8 inch -12: 3 Inches	(-1 Thru -12:) No. 363 No. P-100 No. 390 No. 407 No. 2925-7 (-6 Thru -12:) No. 06005	 52152 99742 1A319 60890 1E1X8 1E1X8
P05-136	Tape, High Temperature Glass Cloth	PMC 4273 Length = 36 or 60 yards Width as Follows: -1=1/4 Inch -2=1/2 Inch -3=1.0 Inch -4=2.0 Inch -5=4.0 Inch -6=6.0 Inch -7=4.0 Inch -8=3.0 Inch	All Dash Numbers Except -7: No. 361 Cloth Tape D/W 469 497 2915-7 All Dash Numbers: Permacel No. 212	 52152 60890 3TYN6 07512 99742
P05-137	Bonding Preventative, Teflon S	PWA 36038	Deleted. Use P05-489. (Was: DuPont Teflon (R) S 954-101)	
P05-142	Tape, Silicone Glass Cloth		Scotch No. 361	26066

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P05-145	Tape, Masking, Polyester Film (Mylar)	PMC 4188	Scotch No. 8402 or 8403 CT-931 Temp-R-Tape M50 No. 594 Blue Poly Flexible Tape 24-06BL115	52152 9X057 07512 3FJ16
P05-146	Abrasive Paper, Silicone Carbide		120 Grit	39428
P05-147	Milled Glass		Owens-Corning	45255
P05-152	Wetting Agent	PMC 1610	Alconox	17534
P05-153	Abrasive Paper, Silicone Carbide		240 Grit	LOCAL 03251 39428
P05-154	Coating, polyurethane, Erosion Resistant	PWA 36510	Chemglaze M331 and Chemglaze M201	30676
P05-155	Paper, Kraft Medium Duty	PMC 4128		80861
P05-169	Foil, Aluminum			LOCAL
P05-182	Cloth, Wire	PWA 1170-3	Wire: AMS5690; Weave: Plain Dutch; Warp: Nominal Wire Diameter = 0.0055 in. (0.14 mm); Nominal Wire Count = 50 / in. (25.4 mm); Fill: Nominal Wire Diameter = 0.0045 in. (0.114 mm); Nominal Wire Count = 250 / in. (25.4 mm).	S0190 S0118 S0119 S0172 1CXA3
P05-185	Paper, Test, pH		No. 345, Short Range 6.0 - 8.0	93255
P05-191	Tape, Electrical Insulating, Self Adhering, High Temperature		RL-6000 SA Series	LOCAL

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P05-198	Gloves, Plastic Polyethylene	GA 660-4	Edmont And Wilson No. 35-152	44926
P05-203	Paper, Kraft Light Duty	PMC 4127	No. 40 Kraft Paper	80861
P05-214	Cloth, Abrasive Impregnated Nylon, Fine Silicone Carbide	GA 814-3	Type S Fine Scotch - Brite Cleaning and Finishing Sheets	52152
P05-221	Filler, Aerodynamic Dent		800000–328	73168
P05-231	Tape, Adhesive Transfer	PWA 36745	Densil 4078K Adhesive Transfer Tape	62369
P05-232	Crayon, Metal Marking (Soft)	PMC 4058-1 (Black) PMC 4058-6 (Red) PMC 4058-8 (White) PMC 4058-10 (Orange)	02089 02059 02412 or 02060 Phano #92 02094	86874 86874 86874 70362 86874
P05-233	Brush, Tube Nylon Bristle		1/2 Inch OD and 18 Inch Long Minimum	LOCAL
P05-234	Penetrant Fluorescent, Post-Emulsified, Normal Sensitivity (Level 2)	PMC 4352-1 PMC 4352-2 PMC 4352-3 PMC 4352-4 PMC 4352-5 PMC 4352-6 PMC 4352-7 PMC 4352-8	555 ZL2C RC50 P220 (Deleted) 985-P12 FP93A(M) F-5-SP/1P	K2063 37676 21405 S9502 none D1940 K6858 02CA7 23373 98733 S0126

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-235	Penetrant Fluorescent, Post-Emulsified, Ultra High Sensitivity (Level 4)	PMC 4354-1 PMC 4354-2 PMC 4354-3 PMC 4354-4 PMC 4354-5 PMC 4354-6 PMC 4354-7 PMC 4354-8	668 ZL37 RC77 P240 (Deleted) 985P14 FP97A(M) F-6A-SP/1P	K2063 37676 21405 S9502 none D1940 K6858 02CA7 23373 98733 S0126
P05-236	Penetrant Fluorescent, Water Washable, High Sensitivity (Level 3)	PMC 4360-1 PMC 4360-2 PMC 4360-3 PMC 4360-4 PMC 4360-5 PMC 4360-6 PMC 4360-7 PMC 4360-8	446 ZL67 HM604 P130 (Deleted) 970-P25E FP923 F-4A-C/1P	K2063 37676 21405 S9502 none D1940 K6858 02CA7 23373 98733 S0126
P05-237	Developer Fluorescent Penetrant Non-aqueous	PMC 4357	Chemtall Oakite 9D1B Eishin Kagaku F-4S(NT)1 Ely LD3 Magnaflux ZP9F Marktec D701 Met-L-Chek D70 Sherwin D100	D1940 K6858 02CA7 23373 S0126 K2063 37676 S9502 98733 21405
NOTE: Ely LD3 has been discontinued. It is acceptable to use existing stock on hand.				
P05-238	(Deleted)			
P05-240	(Deleted, Use PMC 4513, P05-459)	PMC 4470 (No Longer Available)		
P05-243	Paper, Emery		No. 320 Grit	LOCAL
P05-245	Tape, Lacing		BMS13-54 Grade D, Type 3 or Gudebrod 718Z	82110

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-248	Tape, Rubber		Moxness 620-1 (Red or Black)	07099
P05-249	Coating, Urethane	Mil-C-83286, Type I, No. 26306 (Latest Revision)		97460
P05-250	Coating, Urethane	Mil-C-83286, Type II, No. 26251 (Latest Revision)		97460
P05-252	Pad, Scotch Brite			04963
P05-253	Paper, Abrasive		Silicone Carbide, 180 Grit	LOCAL
P05-254	Knife, Acrylic			LOCAL
P05-255	Tape, Masking		Scotch 8402 or 8403	52152
P05-256	Brush, Acid		No. 225	20696
P05-258	Coating, Silicone Insulation		MI-15 Type II Parts A, B, and C	53100
P05-259	Topcoat, Silicone Insulation		MI-15 Parts A and B, Thinner	53100
P05-260	Spatula, Acrylic or Fiber			LOCAL
P05-262	Lockwire	MS20995C32		LOCAL
NOTE: P05-288 is a preferred alternative to P05-262				
P05-264	Film, Bagging (VAC-PAC)		2 Mil Nylon	66442
P05-268	Film, Release	PMC 9977 -1, -3, -5, & 9 PMC 9977 -2, -4, -6, thru -8, & 10	A4000 (Perforated) A5000P (Perforated) A4000 (Non-Perforated) A5000 (Non-Perforated)	53912 3BEV4 53912 3BEV4
P05-272	Tape, Sealing		Scotch 425 or Scotch Y427	52152
P05-273	Syringe, Plastic Nozzle			LOCAL
P05-274	Paper, Abrasive		Silicone Carbide, 80 Grit	LOCAL
P05-277	Sheet, Rubber, Silicone		0.125 Inch (3.175 mm) Thick	LOCAL
P05-278	Tape, Protective Polyurethane		3M Part No. 8672	52152
P05-279	Coating, Clear Polyurethane		683-2	98502
P05-285	Fabric, Fiberglass, Epoxy		Type I HMF 2398D/76 Type II HMF 2367D/76	07314
P05-287	Safety Wire (Lockwire)	MS20995C20	0.020 in. (0.508 mm) Diameter	LOCAL

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
NOTE: P05-288 is a preferred alternative to P05-287.				
P05-288	Safety Wire (Lockwire) - steel Corrosion Resistant	AS3214-01 (AMS 5689, AISI 321)	0.020 in. (0.508 mm) Diameter	LOCAL 1A053 94129
NOTE: P05-288 is a preferred alternative to P05-110, P05-262, and P05-287.				
P05-289	Safety Wire (Lockwire) - steel Corrosion Resistant	AS3214-02 (AMS 5689, AISI 321)	0.032 in. (0.813 mm) Diameter	LOCAL 1A053 94129
NOTE: P05-332 is an approved alternative to P05-289.				
P05-291	Cable, Safety		C30B AS3510-0212C AS3510-0218C AS3510-0221C AS3510-0224C 0.032 Inch (0.813 mm) Diameter	70958
P05-292	Ferrule, Safety Cable		F30B50 AS3510-02F 0.032 Inch (0.813 mm) Diameter	70958
P05-303	Sponge, Silicone Rubber, 0.040 Inch Thick		AMS 3195	50744
P05-304	Sponge, Silicone Rubber, 0.080 Inch Thick		AMS 3195	50744
P05-317	Adhesion Promoter, Polyurethane Protective Tape		Adhesion Promoter 86A	52152
P05-332	Safety Wire (Lockwire)	MS9226-04	0.032 in. (0.813 mm) Diameter	LOCAL
NOTE: P05-289 is an approved alternative to P05-332.				
P05-350	Wheel, Grinding Rubber Bonded “Radiac”		C100-102CHSC	54916 S0055
P05-351	(Deleted, Not Available)			
P05-353	Wheel, Cloth			LOCAL
P05-354	Compound, Aluminum Oxide Polishing and Buffing	PMC 3017	Moco 1062	S0055
P05-355	Agent, Mold Release (For Composite Parts) (Water Base)	PMC 1108	Water-Shield	047D8

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-360	Applicator, Manual (LP-50 Cartridge)		9MGUN509X	30676
P05-361	Nozzle, Mixing		9742	30676
P05-366	Dye, Layout and Identification	PMC 4039-1: Purple	LM-170	S0144
		PMC 4039-2: Blue	Dykem Spray Steel Blue Part #80000	98148
P05-370	Coating, Fluoroelastome	PWA 36516-1	PLV 2000 (Black Accelerator #4)	24802
P05-371	Coating, Fluoroelastome	PWA 36516-2	PLV 2100 (Black Accelerator #4)	24802
P05-372	Coating, Fluoroelastomer protective	PWA 36516-4	PELSEAL 2112	24802
		PWA 36516-3	PLV 2038 (White Accelerator #4)	24802
		PWA 36516-5	PLV 3111 (Black Accelerator #4)	24802
		PWA 36516-6	PLV 3018 (Black Accelerator #4)	24802
		PWA 36516-7	PLV 2660 (White Accelerator #4)	1MRE7
		PWA 36516-8	PLV 3145 (Black Accelerator #4)	1MRE7
P05-376	Tape, Masking (Crepe Paper Backing) Length: 60 Yards; Width/Suffix: 1/8 Inch: (-1,-11,-21) 1/4 Inch: (-2,-12,-22) 3/8 Inch: (-3,-13,-23) 1/2 Inch: (-4,-14,-24) 3/4 Inch: (-5,-15,-25) 7/8 Inch: (-6,-16,-26) 1 Inch: (-7,-17,-27) 2 Inch: (-8,-18,-28) 4 Inch: (-9,-19,-29) 1 1/2 Inch: (-10,-20,-30)	PMC 4000-1 Thru -8 and -10	PG-500 PG-16 107-00 200 Paper Tape	1VJW7 1VJW7 0A9Y2 04963
		PMC 4000-1 Thru -8, -10, -20	PG-21	1VJW7

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
		PMC 4000-9 PMC 4000-21 Thru -30	PG-500 Scotch# 232 and 234	1VJW7 04963
P05-384	Compound, Silicone Carbide Deburring (150 Grit and Finer)	PMC 3088	Burring Compound No. 7280	S0055
P05-395	Beeswax (Was: P06-015)	PMC 9463	White Beeswax S.P. 422 W-27 Beeswax (Yellow - Natural) Beeswax (Yellow - Natural) Yellow Beeswax S.P. 6	0A341 94480 33629 0A341
NOTE: The alternative to PMC 9463, P05-395 Beeswax is PMC 9462, P05-396 paraffin Wax Blend, which is softer and more pliable.				
P05-396	Paraffin Wax Blend	PMC 9462	Schaefer No. 7 Wax (1 lb. (0.45 kg) Slab)	24269
NOTE: PMC 9462, P05-396 Paraffin Wax Blend is softer and more pliable than PMC 9463, P05-395 Beeswax or PMC 9552, P05-059 Paraffin Wax and can be used as an alternative to these materials.				
P05-399	Cloth, Aluminum Oxide		240 Grit	04963 06565 44197
P05-408	Marker, Felt Tip, White	SPMC 198-1	High Purity Action Marker #44729 - 4.5 X 25.4 mm Tip #33729 - 2.0 X 14.5 mm Tip	98148
P05-409	Marker, Metal Tip, Black	SPMC 198-2	High Purity Texpen #17470 - Fine Tip #17473 - Medium Tip #17474 - Broad Tip	98148
P05-410	Marker, Felt Tip	SPMC 198-3	Sharpie Fine Point Marker “Yellow”	86874
P05-411	Ink, Stamping (For Marking on Non-Porous Surfaces with a Rubber Stamp)	PMC 4021	Permanent Stamp Pad Ink No. 58757	86874
P05-412	Ink, White, Stamping (Deleted; use PMC 4057-2, P05-049)	PMC 4027 (Deleted; use PMC 4057-2)	Dykem KXX-122 (No longer available)	
P05-413	Ink, Temporary Marking	PMC 4500	16-2000 VideoJet Ink, (Black)	0V0Z6

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-414	Marker, Extra Fine Point (Black)	PMC 4557	Pilot SCA-UF	58595 70362
P05-415	(Deleted Refer to PMC 4050-20, P05-423)	(PMC 4556-1 Replaced by PMC 4050-20)		
P05-416	Chalk, White	PMC 4552	No. 1400 Crayola An-Du-Septic White Chalk	85419
P05-417	Marking Pen (Paint)	PMC 4554	63613 (White) and 63605 (Yellow)	86874
P05-418	Dye, Layout and Identification (Blue)	PMC 4504	Dykem Steel Blue DX-100	98148
P05-420	Marking Pencil (Hard)	PMC 4094	02460 or 21628	86874
P05-421	Pad, Scrub	PMC 4095	Scotch Brite, # 7447 General Purpose Pads 747 Non-woven Pad 54902	28124 1E1X8 17699
P05-422	Pad, Scrub	PMC 4435	Scotch Brite, Ultra Fine Pad #7448	28124
P05-423	Marker, Felt Tip, Rapid Drying	PMC 4050-1 (Black, Chisel Point) (Black, Chisel Point, (38264)) PMC 4050-2 (Blue, Chisel Point) PMC 4050-3 (Red, Chisel Point) PMC 4050-4 (Black, Fine Point)	Marks-A-Lot (08888 or 17888) Sharpie King Size Marker, and Magnum Marker Marks-A-Lot (08886 or 17886) Magnum 44 #44103 or King Size Marker #15103 Marks-A-Lot (08887 or 17887) Magnum 44 #44102 or King Size Marker #15102 (Discontinued, use remaining supplies) Marks-A-Lot (17878) Dixon Redisharp Sharpie 30000 Series - Black (Product Code #30001)	16956 86874 16956 86874 16956 86874 16956 70362 86874

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
		PMC 4050-5 (Green, Chisel Point)	Marks-A-Lot (08885 or 17885)	16956
		PMC 4050-6 (Blue, Fine Point)	Sharpie 30000 Series - Blue (Product Code #30003)	86874
		PMC 4050-7 (Red, Fine Point)	Sharpie 30000 Series - Red (Product Code #30002)	86874
		PMC 4050-9 (Red, Chisel Point)	Marks-A-Lot (08887 or 17887)	16956
		PMC 4050-10 (Yellow, Fine Point)	Sharpie 30000 Series (Product Code 30005)	86874
		PMC 4050-11 (Black, Extra Fine)	Sharpie 35000 Series (Product Code 35001)	86874
		PMC 4050-12 (Red, Extra Fine)	Sharpie 35000 Series (Product Code 35002)	86874
		PMC 4050-13 (Blue, Extra Fine)	Sharpie 35000 Series (Product Code 35003)	86874
		PMC 4050-14 (Black, Ultra Fine)	Sharpie 37000 Series (Product Code 37001)	86874
		PMC 4050-15 (Red, Ultra Fine)	Sharpie 37000 Series (Product Code 37002)	86874
		PMC 4050-16 (Blue, Ultra Fine)	Sharpie 37000 Series (Product Code 37003)	86874
		PMC 4050-17 (Black, Bold/Fine)	Sharpie 33000 Series (Product Code 33001)	86874
		PMC 4050-18 (Red, Bold/Fine)	Sharpie 33000 Series (Product Code 33002)	86874
		PMC 4050-19 (Blue, Bold/Fine)	Sharpie 33000 Series (Product Code 33003)	86874
		PMC 4050-20 (Black, Fine Tip)	TEC #13401 Fine Tip	86874
		PMC 4050-22 (Metallic Silver, Fine Tip)	Sharpie (Product Code 39100)	86874
NOTE: (1) Approved for use on nickel superalloys and ceramic, aluminide, and overlay coatings: PMC 4050-1, -4, and -17. (2) Approved for use on nickel superalloys, ceramic,and aluminide coatings: PMC 4050-6, -13, -16, and -19.				
P05-424	Penetrant, Fluorescent, Water Washable High Sensitivity	PMC 4351-1 PMC 4351-2	Ely Chemical 4455 Magnaflux ZL60D	K2063 37676

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
		PMC 4351-3	Sherwin HM406	21405
		PMC 4351-4	Marktec P121	S9502
		PMC 4351-5	(Deleted)	
		PMC 4351-6	Chemetall 970-P24	D1940 23373
		PMC 4351-7	Met-L-Chek FP922	98733
P05-425	Marker, Felt Tip	PMC 44421 (Replaced by PMC 4050 Refer to P05-423)		
P05-426	Compound, Polishing Greaseless, Coarse	PMC 3022	Greaseless Compound Grade 3022-1	S0226
P05-427		PMC 3023 (Deleted)		
P05-437	Pressure Sensitive polyester Tape	PMC 4096	Flashbreaker 1 (0.002 inch thick) and Flashbreaker 2 (0.003 inch thick) Flashtape 1 (0.002 inch thick)	53912 53912 3BEV4
P05-441	Ink, Metal Marking	PMC 4057-10	White Drawing Ink #9065-D	0ER09
P05-442	Wheel Abrasive Impregnated Nylon (80 Grit)		2 X 1/2 Bear-Tex	06565
P05-443	Wheel Abrasive Impregnated Nylon (120 Grit)		2 X 1/2 Bear-Tex	06565
P05-444	Wheel Abrasive Impregnated Nylon (180 Grit)		2 X 1/2 Bear-Tex	06565
P05-453	Tape, Masking (Cloth Backing)	PMC 4001	Shurtape PC-622	S0202
P05-454	Tape (High Temperature)	PMC 4009	PG-8 Clipper Tape 110 Permacel P-703 Tesa 53134 Scotch High Temperature #213	3EU06 0A9Y2 99742 S0099 28112

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P05-455	Tape, Fiberglass PTFE Coated	PMC 4107	5453 M520	52152 5R603
P05-459	Blue Dye	PMC 4513	Oil Blue B Liquid Dye	1ML15
NOTE: Refer to 70–00–00, Page 201, for Preparation of Blue Dye Oil System Leak Check Solution (PS 197). (Paragraph 34.)				
P05-462	Tape, Fluorocarbon, Pressure Sensitive	PMC 4467 -1: -2: -3 thru -27, -30 thru -37: -28:	 Teflease MG2 TM6115 Tooltec CSC TM6115-03 TM6115 Tooltec CA5	 53912 59688 53912 59688 59688 53912
P05-464	Mold Release Agent for Silicone (Water-Based)	PMC 1104	Perma-Mold 2580W	2W738 72430
P05-465	Ink, Metal Marking	PMC 4057-5	Green Metal Marking Ink #977-9	0ER09
P05-466	Ink, Metal Marking	PMC 4057-11	White Metal Marking Ink #977-9	
P05-467	Wire, Welding	AMS 5802	UNS #N19907	58401 LOCAL
P05-468	Wire, Welding	AMS 5823	UNS #S41780	2R602 55596 58401
P05-469	Developing Powder, Fluorescent Penetrant	PMC 4356	Chemetall Oakite 9D4A Ely Chemical PD3 Magnaflux ZP4B Marktec D700 Met-L-Chek D72A Sherwin D90G Eishin Kagaku F-5D/1	D1940 K6858 02CA7 23373 K2063 37676 S9502 98733 21405 S0126
P05-470	Marker, High Purity (Blue)	PMC 4563-1	High Purity Acton Marker 44 (44534)	98148

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05-471	Marker high Temperature (Blue)	PMC 4563-2	High Temperature Acton Marker 44 (44094)	98418
P05-472	Marker - High Purity, Black, Trace Element Certified	PJM 4564	High Purity Fine Line 33 (33404) High Purity Medium Line 44 (44404)	98148 98148
P05-473	Tape, Polyurethane	PMC 4121-8	Scotch 8663 (Black)	52152
P05-474	Film, Polyimide	PWA 36071-2	Kapton 200-HN (0.002 inch thick)	9A090
P05-475	Wire, Welding Titanium	PWA 1281	Titanium	2R602
P05-476	Compound, Coating	PWA36595	Aluminum, Inorganic Binder	53012
P05-478	Wire Nickel-Chromium/Aluminum Alloy	PWA 36947	8443 73MXC PoMet 886	C1840 26057 55596
P05-482	Solvent Reducer	PWA 36106	IP-715 Solvent Reducer	00BB6
P05-483	Enamel - Aluminized Epoxy, Room Temperature Curing, Chromate - Free, Low Volatile Organic Compound Content	PWA 36569	Enamel Base (IP-715A Base) + Curing Solution (IP-715B Catalyst)	00BB6
P05-486	Safety Wire (Lockwire)	MS20995N32	Inconel 0.032 in. (0.813 mm) diameter	LOCAL
NOTE: P05-289 is a preferred alternative to P05-486.				
P05-489	Bonding Preventative	PWA 36038	DuPont 954G-304	2S827
06- LUBRICANTS				
P06-001	Lubricant, Dry Film	PMC 9934-1	DGF-123 (CFC-free) Stock No. K5200	16837
P06-002	Petrolatum, White	PMC 9609	White Fonoline or White Protopet 1S Vaseline Penreco Regent or Penreco Snow	S0212 S0212 92469 00BA9
P06-003	Compound, Antigalling	PWA 586 (Replaces PWA 586-3)	Loctite C-200 Kaylube No. 3	05972 15653
P06-004	Lubricant, Spray-Type	PMC 1714	Everlube 620C	8F024

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P06-005	Compound Antigallant Metal Assembly Paste	PWA 587	G-N Metal Assembly Paste G-Rapid Plus Paste	71984 71984
P06-007	Petroleum Jelly (Deleted; use PMC 9609, P06-002)		Vaseline	
P06-009	Lubricant, Molybdenum Disulfide powder	PMC 9523	Molykote Powder	71984
P06-013	Lubricant, Solid Film (Air Cure)	MIL-L-23398 (Latest Revision)	3402C Bonded Lube	71984
P06-014	Lubricant, Gasket	PMC 9652	Gredag R-3	70079
P06-015	Beeswax	(Deleted; refer to PMC 9463, P05-395)		
P06-016	Compound, Antiseize and Antigalling (Cancelled)	PMC 9936 (See NOTE)		
NOTE: PMC 9936 (P06-016 No longer manufacture. For a replacement, refer to TASK 70-00-00, Page 201, for Antigalling and Antiseize Compounds (Paragraph 9.).				
P06-017	Lubricant, Anti-seize	PWA 541	Molybdenum Disulfide Powder: Z Moly Powder -PLUS- Grade 1010 Oil: Brayco 460 or Royco 481 or Winsor L110-A	 71984 2R128 07950 1M647
P06-019	Lubricant, Bolt	PMC 9866 (Not available; use PWA 521 P03-001)	All-Oil Gear Lube SAE 250 (No longer available; use any remaining supply)	
P06-020	Lubricant Molybdenum Disulfide, Silicone	DOD-L-25681 (Superseding MIL-L-25681)	Chemsol Royco 81MS Stock #9150005437220 Braycote 868	012L8 00BB6 07950 0PGK2 1UGB2
P06-021	Compound, Antigalling	PWA 550-3	Hi-T 650 Lubri-Bond HT	34227 8F024

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P06-023	Lubricant, thread	PWA 36001 PMC 9940	Silver Goop	02570
P06-035	Fluid, Lubricating	PWA 36511	3M Company FC-43	28112
P06-036	Compound, Antigallant	PWA 36035	Loctite Moly Dry Film	05972
P06-037	Compound, Anti-seize	PWA 36053-4	JET-LUBE NIKAL	0A307 8F024
P06-038	Compound, Antigallant	PWA 36545-3	Everlube Esnalube 382	8F024
P06-039	Lubricant, Anti-seize (Deleted; use PMC 9566, P06-055)			
P06-044	Compound, Antigallant	PWA 36240	NEVER-SEEZ Pure Nickel Special	5W425 75437
P06-044	Compound, Antigallant	PWA 36240	Dow Corning 321 Dry Film Lubricant Spray	5D028
P06-053	Lubricant, Sealing Ring	PWA 36500	Ultrachem Assembly Fluid #1 ROYCO HF825	56385 07950
P06-054	Compound, Paste, Anti-seize Compound, Paste, Anti-seize	PWA 36246-1 PWA 36246-2	Tiodize T8E Molykote P-37	34568 71984
P06-055	Compound, Anti-seize	PMC 9566 (-1, -2, -3, -4)	C5-A Copper Based Anti-Seize	05972
P06-059	Lubricant, Fluorinated Grease	PWA 36230	Krytox 283 AD High Temperature Anti-Corrosion Grease	23037(A)
07- LACQUERS				
P07-001	Lacquer	PMC 1641	Crystal Clear Acrylic Spray (No. 1303)	54636
08- BONDING AND ADHESIVE COMPOUNDS				
P08-001	Epoxy, Multi-Component Type	PWA 604-1	Resin Base, Eccobond 45 Hardener, Eccobond 15	04552
P08-002	Liquid Epoxy Resin (Medium Viscosity)	PWA 421-2	Epon No. 828	18598 54527 74230
P08-005	Adhesive	PWA 36027	Scotch Grip Rubber Adhesive No. 1300	52152

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P08-011	Thickening Agent	PWA 424-2	CAB-O-SIL-MS	3F733
P08-012	Epoxy Resin Curing Agent (Amine Type)	PWA 422-1	Epon Curing Agent "U" or Epicure 3282	18598 54527 74230
P08-016	Adhesive Paste, Epoxy, Non-Thixotropic, Aluminum-Filled	PWA 457-1	EA 934 NA	33564
I P08-020	Thickening Agent	PWA 424-1	Cab-O-Sil HS-5	3F733 65483
P08-021	Compound, Potting, Epoxy	PWA 603	Eccobond SF-40	04552
P08-024	Compound, Retaining	MIL-S-46163 (Latest Revision)		05972
P08-025	Adhesive Paste, Epoxy, Thixotropic, Aluminum-Filled	PWA 457-2	EA 9394	33564
P08-026	Adhesive, Epoxy Film		FM-300, Supported	07542
P08-030	Epoxy Potting Compound (Two Component Type)	PWA 36756	EC3524 B/A	6A670
P08-036	Resin and Curing Agent, Liquid Epoxy	PWA 466	EPON 828/ Curing Agent U Sempak Or Epi-cure 3282	23354 74230
P08-038	Adhesive, Urethane		7520A/B, LP-50 Cartridge	30676
P08-044	Adhesive Paste, Epoxy (Toughened), Thixotropic, Aluminum -Filled	PWA 457-5	EA 9392	33564
P08-047	Fabric, Fiberglass, Epoxy Resin Impregnated	PWA 36437	Cycom 306/7781	04622
P08-048	Fabric, Fiberglass, Epoxy Resin Impregnated	PWA 36406	Cycom 950/120 Fiberglass	1KU10
P08-049	Adhesive Film, Epoxy Scrim Supported	PWA 477	Hysol EA9628 Supported	33564
P08-050	Adhesive/Sealant Flame Resistant	PWA 36751-1 Liquid Adhesive and Liquid Curing Agent PWA 36751-2 Liquid Sealant and Liquid Curing Agent	DAPCO 18-4F DAPCO #2030	OJWE8 1XNT8 74230 1XNT8

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
NOTE: When PW 36751 is specified, PWA 36751-1 must apply. PWA 36751-1 is used as a filler material for sealing gaps in firewall structures. Compound is applied over a primer. PWA 36751-2 is used as a flame retardant coating and a cryogenic sealant.				
P08-053	Epoxy Paste Adhesive		Hysol EA 956	33564
P08-054	Epoxy Paste Adhesive		Hysol EA 9390	33564
P08-055	Adhesive/Promoter - Air Drying, Water based (Used with P08-046 for bonding to metal surfaces)		PR 182 Pink	23354 92108
P08-056	Compound, Sealing Polysulfide (T) Rubber. (Alternate to P08-046)		AMS 3265	23354
09- SEALANTS				
P09-001	Sealant, Silicone With Catalyst		DC-90-006 DC-90-006-2	71984
P09-002	Compound, Thread Locking and Retaining* *Specify Grade	PWA 549-1	Loctite Grade 609 Green - Retaining	05972
		PWA 549-2	Loctite Grade 640 Green - Retaining	
		PWA 549-3	Loctite Grade 635 Green - Retaining	
		PWA 549-4	Loctite Grade 222 Purple - Thread Lock	
		PWA 549-5	Loctite Grade 242 Blue - Thread Lock	
		PWA 549-6	Loctite Grade 271 Red - Thread Lock	
		PWA 549-7	Loctite Grade 290 Green - Thread Lock	
		PWA 549-8	Loctite Grade 567 Offwhite - Thread Lock	
		PWA 549-9	Loctite Grade 272 Red - Thread Lock	
		PWA 549-10 (can be a substitute for PWA 549-2)	Loctite Grade 620 Green - Retaining	
P09-003	Sealant, Silicone Rubber	PMC 9926	DC-4	71984

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P09-005	Compound, Jointing	PWA 36000 (Supersedes PWA 36000-1, PWA 36000-2, PWA 36000-3, and PWA 36000-4)	Hylomar AF (Advance Formulation)	B1050 K3237 S0101 460Y4
NOTE: When PWA 36000 is specified with or without a suffix, use the product above. The suffixes that indicated viscosity have been discontinued.				
P09-006	Sealing Compound	PWA 36000-4 (Replaced by PWA 36000; P09-005)		
P09-007	Sealing Compound (Deleted. See PWA 36002, P09-008)	PMC 9925 (Replaced by PWA 36002)		
P09-008	Sealing Compound	PMC 9931 (Canceled) PWA 36002 (Supersedes PMC 9931 and PMC 9925)	Gasket Sealant No. 2	05972
P09-009	Sealing Compound	PMC 9929	Parker O-Lube	02697
P09-013	Sealing and Coating Compound, Corrosion Inhibitive	MIL-S-81733 (Latest Revision)	AC-665 B-2	1DWR5
P09-014	Sealant, Silicone Rubber	PWA 36003-1 (Use when PWA 36003 is specified without a suffix)	RTV-159 (Red)	01139(B)
P09-027	Sealant, Silicone Rubber	PWA 36003-2	RTV 157 (Gray)	01139
P09-035	Compound, Sealing	MIL-S-83430 Class B 1/2 PR-1750, Class B (Latest Revision)		LOCAL
P09-051	Sealant, Silicone Rubber	PWA 36028	RTV 630	01139
10 - ANTI-ICE AND DEICING MATERIALS				
None Designated				
11- CLEANING AGENTS				
P11-001	Solution, Cleaning		Bendix 25-1 Detergent (Mixed with De-Ionized Water)	99251
P11-002	(Deleted)			
NOTE: For wipe procedures, replace PMC 9021 (P11-002) with one of the solvents in Degrease Engine Parts by Solvent Wipe (SPOP 208), (Paragraph 26.).				
P11-003	Kerosene	PMC 9021		LOCAL

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P11-004	Solvent, Petroleum	PMC 9010 140°F Flash Point	SAFETY-KLEEN Premium Solvent #6605 or Premium Gold Solvent 6638 Solvent 142 3% Aromatics Maximum	30530 34897
P11-005	Methyl Ethyl Ketone (MEK)	PMC 9076	Technical Grade Wt. = 6.7 lbs/gal (804 g/l)	LOCAL
P11-005A	Methyl Ethyl Ketone (MEK)	PMC 1820	ACS Reagent Grade	LOCAL
P11-006	(Deleted)			
P11-009	Alcohol, Denature	PMC 9009 -1 THRU -6 Denatured Ethanol; Specific Gravity 60/60°F: 0.800-0.820 Flash Point; 30°F (-1°C), minimum Boiling Range: Initial Boiling Point: 165°F (74°C), minimum 95% Over: 175°F (79°C), maximum Water: 5.0%, maximum Vapor Pressure at 68° F (20°C): 45 mm Hg, maximum PMC 9009-7 A405P-4		1KGE8
Do not denature with methanol.				
P11-013	Trichloro- ethylene	O-T-634, Type II: PMC 9004	Trichloro- ethylene	96717
P11-014	Alcohol, Isopropyl	PMC 9094	Technical Grade, 99% Minimum: (Liquid) R-503 (Aerosol) #1001-0911 (Saturated Wipers) SW420034 (Presaturated Wipers)*	LOCAL 98733 S0210 OM3C8
* Must meet the requirements of the latest issue of AMS 3819 (Cloths, Cleaning for Aircraft Primary and Secondary Structural Surfaces).				

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11-014A	Alcohol, Isopropyl	(P11-014A is deleted. Refer to PMC 9016, P11-078)		
P11-021	Cleaner, Gaspath *Solvent Type **Detergent Type (recommended in place of solvent-Type products for environmental reasons)	SPMC 87-1		
		SPMC 87-2		
		SPMC 87-3		
		SPMC 87-4	*B & B 3100	21361
		SPMC 87-5	**B & B TC100	21361
		SPMC 87-6	*Cee-Bee R-674	71361
		SPMC 87-7	*Penair M-5704A	56883
		SPMC 87-8	Deleted	
		SPMC 87-9A	**ECT R-MC (Part No. 4070 Pre-Mixed)	S0141
		SPMC 87-9B	**ECT R-MC (Part No. 4072 Concentrate)	S0141
		SPMC 87-10A	**Ardrox 6367	D1940 K6858 02CA7 23373
		SPMC 87-10B	**Ardrox 6368	D1940 K6858 02CA7 23373
		SPMC 87-11A	**Turco 6783-3	71410
		SPMC 87-11B	**Turco 6783-10	71410
		SPMC 87-11C	**Turco 6783-50	71410
		SPMC 87-12	*Turco T-5884	71410
		SPMC 87-13	**ZOK 27	1NCU0 U4628
		SPMC 87-14	**Turbo-K	S0170
P11-027	Solvent, Stoddard Petroleum	PMC 9001, MIL-PRF-680 Type II	141° - 199°F (61° - 93°C) Flash Point, TCC	LOCAL

(Continued)

CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
		-OR-		
		MIL-PRF-680 Type III	Flash Point, TCC 200° - 241° F (93° - 116° C)	
P11-031	Cleaner, Alkali (General Purpose)	PMC 1284	Blue Gold Cleaner Industrial	0GA37
P11-032	Acetone, Phenol-free	PMC 9008-1, -2, -5, -6, -7		LOCAL
		PMC 9008-3, -4	R-504 (Aerosol)	98733
		PMC 9008-8	SW420053 #1003–0911 (presaturated Wipers)	0M3C8 S0210
NOTE: Do not use PMC 9008, P11-032 for bonding applications where reagent-grade solvent is required. For those applications, PMC 1914, P11-065 must be used.				
P11-037		(Deleted)		
P11-038	(Deleted)			
NOTE: Replace P11-038 with one of the solvents in in Degrease Engine Parts by Solvent Wipe (SPOP 208), (Paragraph 26.).				
P11-039	Solvent, Cleaner	PMC 9060	DeSo Clean 45 Solvent Cleaner	23354
P11-040	Cleaner, Alkali	SPMC 106	Blue Gold Spray Washer	0GA37
P11-041	(Deleted)	SPMC 107		
P11-042	Cleaner/Remover, Fluorescent penetrant	PMC 4366	Magnaflux SKC-S	37676
P11-043	Solvent, Methyl Isobutyl Ketone (MIBK)	PMC 9079	Technical Grade	LOCAL
P11-044	Cleaner, Alkali (General Purpose)	SPMC 104	Cee-Bee A-7X7	71361
P11-045	Cleaner, Alkali (General Purpose)	SPMC 105	Turco 5948 DPM	71410
P11-046	(Deleted)			
P11-047	Cleaner, Alkaline Gel	SPMC 109	Turco 5948 DPM Thick	71410
P11-048	Cleaner, Alkaline Gel	SPMC 110	Aviawash Green Gel	D1940 K6858 02CA7 23373
P11-049	Cleaner, Aqueous	SPMC 148-1	Turco 6780 ECO-SOLV	71410

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
		SPMC 148-2	Ardrox 6077 Window Cleaner Plus	D1940 K6858 02CA7 23373
		SPMC 148-3	MAG-CHEM Evasol	35502
		SPMC 148-4	MC Spray & Wipe	0GA37
P11-050	(Deleted)			
P11-052	Cleaner, Heavy Duty		CALLA 855	8E913
P11-053	Remover, Alkaline Gel Carbon	SPMC 136	Turco 5805	71410
	Remover, Alkaline Gel Carbon	SPMC 137	Cee-Bee Alko	71361
P11-054	(Deleted)			
P11-055	Solvent, Cleaner	PMC 8914 PMC 8914-1: Aerosol PMC 8914-2: 1 Gallon (3.79 liter) container	Envirosolv 655	05867
P11-056	Solvent, Cleaner	SPMC 156	MAG-CHEM Teksol	35502
P11-057	Solvent, Cleaner	SPMC 168	Aviation C.I.C. Remover	023V4
P11-058	Solvent, Cleaner	SPMC 175	Quantum 2000 (CE-SX-94)	86938
P11-059	Solvent, Cleaner	SPMC 176	Isoblast (GB-SX-94)	86938
P11-060	Solvent, Cleaner	SPMC 179	CRC Precision Plus Cleaner	023V4
P11-062	Solvent, Dielectric (Ultra-High Purity)	PMC 8920	Positron	OWU71
P11-063	Solvent, Hand-Wiping	PMC 8917	EZE 662	89524
I P11-064	Solvent, Cleaner	SPMC 185	Cynergy (L-SX-94)	86938
P11-065	Acetone	PMC 1914	Regent Grade, A.C.S. (Liquid)	LOCAL 0AL61
			JT Baker 9006-05 (Liquid)	70829
			PC0048A-3	1HX90
			SW420030 #1004-0911 (Presaturated Wipers)	0M3C8 S0210
			TX8346	S0207
			AX0116	OAL61

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
NOTE: It is permissible to substitute Semiconductor grade acetone for reagent grade. Semiconductor grade is a higher purity chemical.				
P11-066	Solvent Hand-wiping	PMC 8929	Bioact 105, Precision Cleaner	OWUA8
P11-068	Enhancer, Electrical Contact	SPMC 205	Use P11-068A or P11-068B	
P11-068A	Enhancer, Electrical Contact	SPMC 205-1	Stabilant 22	38948
P11-068B	Enhancer, Electrical Contact	SPMC 205-2	Super Corr-A	S0238 6MWZ4
P11-069	Cleaner, Alkaline Gel	SPMC 112	Ardrox 1900B	D1940 K6858 02CA7 23373
P11-070	Cleaner, Alkaline Gel	SPMC 159	McGean-Rohco Super Bee 262	71361
P11-071	Cleaner, Alkaline Gel	SPMC 113	Mag-Chem DG Kleen	35502
P11-072	Degreaser, Aqueous	SPMC 151	NU-Gear-SC	1EYE7
P11-073	Degreaser, Aqueous	SPMC 195	Mirachem 500	63247
P11-074	Solvent, Cleaner	SPMC 213-1	Skysol Wipe Solvent	35502 F6892
P11-075	Wipe, Cleaner Solvent	SPMC 213-2	Skysol Wipe Solvent Pre-saturated Wipes	33502 F6892
P11-076	Solvent, cleaner	SPMC 216-1	Lotoxane Fast	U3115 3YAK8
P11-077	Wipe, Cleaner Solvent	SPMC 216-2	Lotoxane Fastwipes	U3115 3YAK8
P11-078	Alcohol, Isopropyl	PMC 9016 (all dashes except -7, -11, -12) PMC 9016-7 PMC 9016-11 PMC 9016-12	Reagent Grade, or Semiconduct grade: (Liquid) SW420078 #1002-0911 (Presaturated Wipers) TX8347 PX1834	LOCAL OM3C8 S0210 S0207 OAL61
NOTE: It is permitted to substitute semiconductor grade isopropyl alcohol for reagent grade. Semiconductor grade is a higher purity chemical.				
P11-079	Degreaser, Aqueous	SPMC 170	Ardrox 6333A	D1940 K6858 02CA7 8W836

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P11-080	Degreaser, Aqueous	SPMC 181	Cee-Bee Super Bee 300LF	71361
P11-081	Cleaner, Aqueous	SPMC 207	Ardrox 6376	D1940 K6858 02CA7 8W836
P11-082	Degreaser, Aqueous	SPMC 173	Cee-Bee Super Bee 300LFG	71361
P11-083	Cleaner, Aqueous	SPMC 233	AquaVantage 3887 GD	94058
12- STRIPPERS				
	None Designated			
13- PRE-TREATMENT FOR PAINTING				
	None Designated			
14- DISINFECTANTS				
	None Designated			
15- STORAGE PRESERVATION				
P15-001	Dehydrating Agent (Desiccant)		MIL-D-3464 SPMC 214	LOCAL
P15-002	Coating Peelable		AZ 534-2B	0A3C8
16- STRUCTURE PAINTS				
P16-001	Thinner		TL-29	98502
P16-002	Catalyst		Catalyst X-304	98502
P16-003	Base, Gloss, Black		443-3	98502
P16-004	Paint, (red color No. 11136)		MIL-PRF-85285 Type I, FED STD 595	LOCAL
17- MICROBIOLOGICAL CONTAMINATION PROTECTION				
	None Designated			
18- PRIMER				
P18-001	Primer, Epoxy Chemical and Solvent Resistant	MIL-PRF-23377 Type I, Class C2 (latest revision)	10P20-13 Base and EC-213 Curing Solution 513X419 Base and 910X942 Curing Solution CA7233 02Y040A	91342 12254 92108 23354 92108 33461

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CONSUMABLE MATERIALS INDEX				
ITEM NO.	**MATERIAL DESIGNATION**	**SPECIFICATION NUMBER**	**MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION**	**SUPPLIER CODE**
P18-001A	Primer, Epoxy Chemical and Solvent Resistant	MIL-PRF-23377 Type I, Class C2 (latest revision)	02GN089	33461
NOTE: Where P18-001A is specified, it is permitted to use P18-001 as an alternative.				
P18-003	(Deleted) Use P18-023	AMS 3110 (Superseded by AMS 3117)		
P18-007	Primer, Silicone	PWA 36086-1 PWA 36086-2	SS-4155 Dapco No. 1-100	01139 98500 58093
P18-009	Primer, Silicone Rubber (Red or Clear)	PWA 556	DC-1200	71984 98500
P18-011	Primer, Urethane Compatible	(Deleted) Use P18-001A		
P18-012	Primer, Epoxy Resin		463-12-8	98502
P18-013	Primer, Epoxy Adhesive		BR-127	07542
P18-015	Primer, Epoxy (Replaced By P18-016)		Base 463-6-27; Converter X337; Thinner TL52-66	98502
P18-016	Primer, Epoxy		Base 10P4-2	0KXA5
P18-018	Primer, Epoxy Corrosion Inhibiting	PWA 36515	44GN036 (for 2000-series aluminum alloys) 44GN098 (for all other base materials)	33461 33461
P18-020	Primer, Epoxy	PWA 36519–1 PWA 36519-2	EEAE 152A/B Eco-prime EWAE 118A/B Eco-prime	23354 23354
P18-023	Primer, Zinc Molybdate (Supersedes P18-003) TT-P-645B	AMS 3117 (Supersedes AMS 3110)	(Light Yellow)	LOCAL 77672 LOCAL 0W199 77672
P18-024	Primer, Epoxy Room Temperature Curing - Chromate Free, Low Volatile Organic Compound Content	PWA 36568	Primer Base (IP-714A Base) Curing Solution (IP-714B Catalyst)	00BB6

(4) Supplier Code Address List

NOTE: The addresses of the material manufacturers are included in alphanumeric order in the table that follows.

NOTE: All SOURCE CODES, except those in the S-series, refer to CAGE (Commercial And Government Entity) codes. The present CAGE code numbers were formerly called FSCM (Federal Supply Code for Manufacturers) and FSCNM (Federal Supply Code for Non-Manufacturers) codes. The actual five-digit codes assigned to companies as FSCMs or FSCNMs have remained the same but have been redesignated as CAGE codes. All SOURCE CODES in the S-series (that is, S0001 thru S0213) are assigned by P&W to those consumable material suppliers that have no CAGE code.

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
A0001	(Refer to LOCAL)
A0014	(Refer to 12861)
A0056	(Refer to S0029)
A0073	Speedry Products, Inc. Richmond Hill, NY (Current Address Unavailable)
A0075	(Refer to S0036)
A0285	(Refer to 98500)
A0290	(Refer to 95015)
A0292	(Refer to 97361)
B0006	(Refer to 93255)
B0007	(Refer to 71410)
B0008	Products Research & Chemical Co. Gloucester, NJ (Current Address Unavailable)
B0009	Paul & Co. - Steinhau, Germany (Refer to S0119)
B1050	Antwerp Lion Oil Works N.V. VLAMSE KAAI 2-5 Antwerpen, Belgium
B1571	Dow Corning S.A. Parc Ind. Zone C Seneffe, Belgium
C1840	Sulzer Metco Europe GmbH SPREESTRASSE 2 65451 KELSTERBACH GERMANY
C4298	Pruftechnik Dieter Busch AG Oskar-Messter-Strasse 19 to 21 Postfach/P.O. Box 1263 D-85737 Ishmaning, Germany

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
D1940	Chemetall GMBH Trakehner Strasse 3 D-60487 Frankfurt am Main, Germany
D2744	GKD - Gebr. Kufferath AG METALLWEBERSTRASSE 46 52353 DUEREN GERMANY
D3986	Linde AG Linde Gases Division SEITNERSTRASSE 70 82049 PULLACH GERMANY
EQ032	Foucault International Corp. 920 36th Court SW Vero Beach, FL 32968 USA
F6892	Socomor Finishing Technologies Zone Industrielle du Prat R. P. 3707 56037 Vannes, Cedex, France
KA832	Shell Aviation LTD Shell Centre London SE17NA, UK
K2063	Ely Chemical Co., Ltd. Lisle Lane Ely CB7 4A5, United Kingdom
K2884	(Refer to D1940)
K3237	Hylomar Ltd CALE LANE WIGAN WN2 1JT UNITED KINGDOM
K6858	Chemetall Plc 65 Denbigh Road Bletchley Milton Keynes, MK1 1PB, United Kingdom
LOCAL	Local Purchase
S0001	Refer to Service Bulletin SB 238
S0004	(Refer to 86874)
S0005	(Deleted)
S0006	(Refer to S9502)
S0007	(Refer to 08FS3)

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
S0008	(Refer to 0XB37)
S0025	(Refer to 1A319)
S0027	(Refer to 0GA37)
S0029	National Tape Corp. 5140 Storey Street New Orleans, LA 70123-5320 USA
S0036	Texrite Products Co. 10333 Shoemaker Street Detroit, MI 48213 USA
S0045	(Refer to 23037(D))
S0055	Mosher Co., Inc. 15 Exchange Street Chicopee, MA 01014 USA or P. O. Box 177 Chicopee, MA 01014-0177 USA
S0057	(Refer to 05972)
S0066	(Refer to B1571)
S0075	(Refer to 1TGF9)
S0076	(Refer to OJWE8)
S0077	(Refer to 35502)
S0078	(Refer to 23373)
S0083	(Refer to 1M647)
S0092	(Deleted)
S0099	(Refer to 38XJ0)
S0101	Power in Motion 16A Montesano Road Fairfield, NJ 07004 USA
S0113	(Refer to 0V0Z6)
S0117	Rhodia VSI (Was: Rhone-Poulenc Silicone VSI 405 Jordan Road Troy, NY 12180 USA
S0118	(Deleted)
S0119	Paul GmbH & Co. P.O. Box 1228 Industriegebiet West 36396 Steinau an der Strasse, Germany

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
S0126	Eishin Kagaku Co., Ltd. 1-2-13, Higashi-Shinbashi Minato-Ku Tokyo, Japan-105
S0141	ECT, Inc. Bridgeport Business Park 401 East 4th St., Building 20 Bridgeport, PA 19405 USA
S0144	Carco, Inc. P. O. Box 13859 10333 Shoemaker Street Detroit, MI 48213 USA
S0150	(Refer to 70362)
S0156	(Refer to 1ZC62)
S0163	Polyflow, Inc. 100 Pratt's Junction Road Sterling, MA 01564 USA
S0170	Turbo-K, Ltd. 31 Meadow Close London Colney AL2 1RH, England
S0171	Sefar America Inc. 333 South Highland Avenue Briarcliff Manor, N.Y. USA
S0172	G. Bopp & Company AG Bachmannweg 20 CH -8046 Zurich, Switzerland
S0176	Tyco Adhesives, A Tyco International Ltd. Co. 1400 Providence Highway Norwood, MA 02062-5044 USA
S0178	(Refer to K6858)
S0190	Gerard Daniel Worldwide - Europe Mountmahon Industrial Estate Abbeyfeale, Limerick, Ireland
S0202	Shurtape Technologies LLC 1506 Highland Avenue NE Hickory, NC 28601 USA
S0207	ITW Texwipe 300 B Route 17 South Mahwah, NJ 07430 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
S0210	Telesto Industrie, LLC 3718 Highway 90 Liberty, TX 77575
S0212	Sonneborn, LLC 575 Corporate Drive Suite 415 Mahwah, NJ 07430 USA
S0213	Aviation Fluids Services, Inc. 950 Kingsland Avenue St. Louis, MO 63130 USA
S0214	C-E Minerals 901 East 8th Avenue King of Prussia, PA 19406 USA
S0216	Momentive Performance Materials, Inc. 187 Danbury Road Wilton, CT 06897 USA
S0226	Jackson Lea (A Unit of Jason, INC.) 1715 E. Conover Boulevard Conover, NC 28613 USA
S0233	Unilever United States, Inc. 800 Sylan Avenue Englewood Cliffs, NJ 07832 USA
S0238	Envirotech Europe Ltd Corr-Ex Division 100A High Street Hampton Middlesex TW12 2ST UNITED KINGDOM www.corr-ex.com Tel: +44 (0) 20 8281 6370
S0242	FMI Chemical, Inc. 4 NORTHWOOD DRIVE BLOOMFIELD CT 06002 UNITED STATES OF AMERICA
S9502	Marktec Corp. 3-10, Sanno 2-Chome OHTA-KU Tokyo, Japan
U0638	(Refer to S0203)

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
U3115	Arrow Chemicals, Ltd. Div. of Reabrook, Ltd. Rawdon Road Moira, Swadlincote, Derbyshire, UK DE12 6DA
U4628	Airworthy, Ltd. Elsted Station Elsted, Midhurst West Sussex, GU29 0JT United Kingdom
00BB6	Indestructible Paint Inc. 1 Independence Drive Monroe, CT 06468 USA
0AH54	(Deleted)
0AL61	EMD Chemicals, Inc. 480 Democrat Road Gibbstown, NJ 08027 USA
0A341	Strahl And Pitsch Inc. 230 Great E. Neck Rd. P. O. Box 1098 West Babylon, New York 11704 USA
0A3C8	AZTEC Chemical Inc. 10770 Lower Azusa Road El Monte, CA 91731 USA
0A9Y2	Cantech Industries Inc. 2222 Eddie Williams Road Johnson City, TN 37601 USA
OBYN5	(Refer to 71410)
0ER09	American Marking Systems, Inc Harrisburg Stamp Company Division 2741 Paxton Street Harrisburg, PA 17111 USA
0EWP0	Garvey 871 Redna Terrace Cincinnati, OH 45215 USA
0GA37	Modern Chemical Inc. 7023 Centennial Road P. O. Box 368 Jacksonville, AR 72078 USA
0JWE8	Adchem, Inc. 369 Progress Drive, Suite 101 Manchester, CT 06040-2296 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
0JYZ0	SCI Corporation 812 East Broadway Streator, IL 61364 USA
0KX05	(Deleted)
0LV01	Praxair Inc 39 OLD RIDGEBURY ROAD DANBURY CT 06810 UNITED STATES OF AMERICA
0NYS9	(Refer to 23354)
0PGK2	S D B Consultants LTD 401 Whitney Avenue, Suit 120 Gretna, LA 70056-2500 USA
0V0Z6	Videojet Technologies, Inc. (Was Marconi Data Systems, Inc.) 1500 Mittel Boulevard Wood Dale, IL 60191-1073 USA
0WU71	Ecolink, Inc. (Was: Div. of Sentry Chemical Co., Inc.) 1481 Rock Mountain Blvd., Stone Mountain, GA 30083-1505 USA
OW199	The Sherwin-Williams Company 2390 Arbor Boulevard Dayton, OH 45439 USA
0ZDB5	Airgas, Inc. (Refer to 46AN7)
00BA9	Penreco, Div. of Pennzoil - Quaker State Co. 138 Petrolia Street Karns City, PA 16041-9799 USA
00046	(Deleted, Refer to 0ER09)
00741	BOC Gases (Was: Airco Industrial Gases, Div. of The BOC Group) (Refer to 46AN7)
00768	Western Filament, Inc. 630 Hollingsworth Street Grand Junction, CO 81505 USA
01058	Michigan Chrome & Chemical Co. 8615 Grinnell St. Detroit, MI 48213-1152 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
01139	Momentive Performance Materials, Inc. (Bought out General Electric Co., Rubber & Fluid products Dept.) 260 Hudson River Rd. Waterford, NY 12188 USA
01139(A)	(Sold. Refer to 01139)
01139(B)	(Sold. Refer to S0216)
012L8	Chemsol Inc. 8423 Boettner Road Bridgewater, MI 48115 USA
02CA7	Chemetall Oakite (Was: Oakite Products Inc.) 50 Valley Road Berkeley Heights, NJ 07922 USA
02SG7	Octel America, Inc. 200 Executive Dr. Newark, DE 19702 USA
02ZK3	(Refer to 1NCU0)
023V4	CRC Industries, Inc. 885 Louis Drive Warminster, PA 18974 USA
02570	Swagelok Co. 29500 Solon Road Solon, OH 44139-3492 USA
02697	Parker-Hannifin Corp. O-Ring Div. 2360 Palumbo Drive P.O. Box 11751 Lexington, KY 40512-1751 USA
03042	(Refer to 16956)
03530	American Gas & Chemical Co. Ltd. 220 Pegasus Ave. Northvale, NJ 07647-1904 USA
04347	Henkel Corporation 211 Franklin Street Olean, New York 14760 USA
04457	Mark-Tex Corp. 160 West Forest Ave. Englewood, NJ 07639 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
04552	Emerson & Cuming Specialty Polymers (Was: Grace W. R. and Co. Emerson and Cuming, Dewey and Almy Chemical Div.) 869 Washington Street Canton, MA 02021-2513 USA
04621	Hexcel Corp. 2350 Airport Fwy., Suite 550 Bedford, TX 76022-6027 USA
04622	CYTEC Engineered Materials, Inc. (Was: BASF Corp.) 1440 N. Kraemer Blvd. Anaheim, CA 92806 USA
047D8	Zyvax Inc. 1388 NW 2nd Avenue Suite 5 P. O. Box 825 Boca Raton, FL 33429-0825 USA
04963	3M Company, Tape And Specialties Div. 3M Center, Bldg. 220-7E-01 St. Paul, MN 55144-1000 USA
05045	The BG Service Co., Inc. 1400 Alabama Avenue - Suite 15 P. O. Box 2259 West Palm Beach, FL 33401 USA
05160	(Refer to S0190)
05867	Fine Organics Corp. 205 Main St. P.O. Box 687 Lodi, NJ 07644-0687 USA
05972	Henkel Loctite Corp. (Was: Loctite Corp.; Permatex Industrial Div. Of Loctite North America Group; and, Loctite VSI, Inc.) 1001 Trout Brook Crossing Rocky Hill, CT 06067-3582 USA
06565	Norton Co., (for domestic orders) Coated Abrasive Div. Tenth Avenue & 25th Street Watervliet, NY 12189 USA
07096	Burke Industries (Was: Burke Rubber Co., Purosil DIV) 13767 Freeway Drive Santa Fe Springs, CA 90670 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
07098	Praxair - Industrial Gases (Was: Union Carbide Corp., Linde Div.) 175 E. Park Drive P. O. Box 44 Tonawanda, NY 14151-0044 USA
07099	Flexfab Molded Products (Was: Moxness Molded Products; and, Moxness Products, Inc.) 2030 Young Street East Troy, WI 53120 USA
07314	Fiberite Corp. - Winona, MN (Obsolete)
07512	Saint-Gobain Performance Plastics 150 Dey Road Wayne, NJ 07470 USA
07542	CYTEC Engineering Materials (Was: CYTEC Fiberite, Inc.; and, American Cyanimide Co., Industrial Chemical and Plastics Div./Bloomingdale Dept.) 1300 Revolution Street Havre De Grace, MD 21078-3800 USA
07696	Kodak Canada, Ltd. 3500 Eglinton Avenue W Toronto M6M 1V3, Canada
07950	Anderol, Inc. (Was: Royal Lubricants Co., Inc.) 215 Merry Lane P. O. Box 518 E. Hanover, NJ 07936-0518 USA
08FS3	Vulcan Chemical Technologies (Was: Vulcan Chemicals, Div. of Vulcan Materials Co.) 1200 Urban Center Drive Birmingham, AL 35242 USA
09785	AGA Gas, Inc. 3300 Lakeside Ave. Cleveland, OH 44114-3751 USA
1A053	AAA Aircraft Supply Co. 36 Suffield Street P. O. Box 411 Windsor Locks, CT 06096-1320 USA
1CXA3	Sefar America Inc. 111 Calumet Street Depew, New York 14043-3734 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
1DWR5	Advanced Chemistry & Technology, Inc. 7341 Anaconda Avenue Garden Grove, CA 92841-2921 USA
1E1X8	Saint-Gobain Ceramics & Plastics, Inc. (DBA Saint-Gobain Ceramic Materials) 1 Bond Street P. O. Box 15137 Worcester, MA 01615-0137 USA
1EYE7	Nuvite Chemical Compounds 213 Freeman Street Brooklyn, NY 11222-1404 USA
1HX90	Brand-Nu Laboratories Inc. 377 Research Parkway Meriden, CT 06450-7155
1KGE8	Fisher Scientific Company Global Exports 3970 Johns Creek Court, Suite 500 Suwanee, GA 30024-1297 USA
1KU10	Cytec Engineered Materials Inc. 1300 Revolution Street Havre De Grace, MD 21078-3800 USA
1ML15	Octel Starreon, LLC 8375 S. Willow Street - 5th Floor Littleton, CO 80124 USA
1M647	Fuchs Lubricants Co. 281 Silver Sands Road P. O. Box 328 East Haven, CT 06512-4140 USA
1NCU0	Zokman Products, Inc. 1220 E. Gump Road Fort Wayne, IN 46845-9794 USA
1PWD8	Exxon Mobil Corp. 3225 Gallows Road - Room 4W917 Fairfax, VA 22037 USA
1TGF9	Ohio Industrial Lubricants, Inc. 250 Mahoning Avenue Cleveland, OH 44113 USA
1UGB2	Air BP Lubricants Division of BP Products North America Inc. Parsippany, NJ 07054-4406 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
1VJW7	Intertape Polymer Management Corp. 3647 Cortez Road West Bradenton, FL 34210-3169 USA
1V074	Sulflo, Inc. 1158 Erie Avenue North Tonawanda, NY 14120-3507 USA
1XNT8	Cytec Engineered Materials Inc. D Aircraft Products 1191 N. Hawk Circle Anaheim, CA 92807 USA
1ZC62	Valco Cincinnati, Inc. (Was: W. Canning, Inc.) 411 Circle Freeway Drive Cincinnati, OH 45246 USA
10009	RM Engineered Products, Inc. N. Charleston, SC (Current Address Unavailable)
11770	(Refer to 8F024)
11851	Daniels Manufacturing Corp. 526 Thorpe Road Orlando, FL 32824-8133 USA
12474	Bel-Ray Co., Inc. 1201 Bowan Avenue Wall, NJ 07719 USA
12861	Intertape Polymer Group, Inc. (Was: Armak Co., Tape Div.) 317 Kendall Avenue Marysville, MI 48040-1911 USA
13868	Kano Laboratories, Inc. 1000 Thompson Lane Nashville, TN 37211-4101 USA
15653	Fairchild Fasteners - Fullerton Operations (Was: Kaynar Manufacturing Co.) 800 S. State College Blvd. Fullerton, CA 92831-3004 USA
16193	(Obsolete)
16837	Miracle Power Products Corp. 1101 Belt Line Street Cleveland, OH 44109-2849 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
16956	Avery Dennison (For Orders) (Was: Dennison Mfg. Co., Identification Systems Div.) 50 Pointe Drive Brea, CA 92821-3699 USA
17125	(Deleted)
17209	(Deleted)
17534	Alconox Inc. (Was: Standard Scientific Supply Co.) 30 Glenn Street Suite 309 White Plains, NY 10603 USA
17699	Weiler Brush Co. 1 Wildwood Drive RD 1 P.O. Box 149 Cresco, PA 18326 USA
18034	(Refer to 02570)
18598	Miller-Stephenson Chemical Co. Inc. 55 Backus Ave. Danbury, CT 06813 USA
18873	E. I. duPont de Nemours and Co., Inc. 1007 Market St. P. O. Box 1635 Wilmington, DE 19899 USA
19135	Mobil Oil Co. Interstate 10 P. O. Box 3311 Beaumont, TX 77704 USA
19354	Daniel Gerard & Co., Ltd. 5 Plain Avenue New Rochelle, NY 10801-2204 USA
2A851	John R. Lyman Co. 60 Depot Street Chicopee, MA 01013-1251 USA
2B975	Hexcel Corp. 1913 N. King Street Seguin, TX 78155-2115 USA
2G152	(Deleted)

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
2M749	SKF Industries, Inc. Bearing Group 1100 1st Avenue King of Prussia, PA 19406 USA
2R128	Castrol Industrial Americas (Was: Castrol Industrial North America Div. of Endurance Technology) 1001 West 31st Street Downers Grove, IL 60515-5509 USA
2S827	E. I. du Pont de Nemours & Co Inc. 1007 MARKET STREET WILMINGTON DE 19898-0001 UNITED STATES OF AMERICA
20696	Maryland Brush Co. 3221 Frederick Avenue Baltimore, MD 21229-3807 USA
21361	B & B Tritech, Inc. (Was: B & B Chemical Co., Inc.) 875 West 20th Street Hialeah, FL 33010-2310 USA
21405	Sherwin Inc. 5530 Borwick Ave. South Gate, CA 90280-7402 USA
22527	Fisher Scientific Co. 2000 Park Lane Pittsburgh, PA 15275 USA
22819	Avial Services, Inc. 2000 Park Lane Pittsburg, PA 15275 USA
22873	(Refer to 23354)
23037(A)	E. I. dupont de Nemours Co., Inc. Chemical And Pigments Dept. 1007 Market St. Wilmington, DE 19898 USA
23037(D)	E. I. dupont de Nemours Co., Inc. Fabrics & Finishes Dept. 1007 Market St. Wilmington, DE 19898 USA
23354	PRC-Desoto International, Inc. PPG Aerospace Div. 823 East Gate Drive, Unit 4 Mount Laurel, NJ 08054-1202 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
23373	(Refer to 8W836)
24269	Schaefer Machine Co., Inc. 200 Commercial Drive Deep River, CT 06417 USA
26057	TAFA Inc. 146 Pembroke Road Concord, NH 03301-5706 USA
26066	Minnesota Mining & Mfg. Co., Industrial Tape Div. (Obsolete. Refer to 04963)
27674	(Refer to 86938)
27732	Ensign Products Co., Inc. 3528 East 76th Street Cleveland, OH 44105-1510 USA
28112	Minnesota Mining and Mfg. Co., Performance Materials Div. (Was: Performance Chemicals and Fluid; and, Industrial Chemical Products Div.) 3M Center Building 223-06-S-04 St. Paul, MN 55144-0001 USA
28124	3M Co., Abrasive Systems Div. 3M Center, Building 0223-06-N-01 Saint Paul, MN 55144-1000 USA
28139	(Refer to S0233)
28506	(Refer to 00741)
29700	(Refer to 1PWD8)
3A487	(Refer to 97361)
3DYZ1	Crompton Corp. (Was: Witco/A Crompton Business) 1 American Lane Greenwich, CT 06831 USA
3EU06	Intertape Polymer Group Inc. DBA American Tape 317 Kendall Avenue Marysville, MI 48040-1911 USA
3F733	Cabot Corp. Cab-O-Sil Div. 700 East U.S. Highway 36 Tuscola, IL 61953 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
3FBZ6	Hexion Specialty Chemicals, Inc. Division of Epoxy & Phenolic Resins 1600 Smith Street, Floor 24 Houston, TX 77002-7362 USA
3FJ16	Echo Engineering & Production Supplies Inc. (DBA Echo Supply) 5406 W 78th Street Indianapolis, IN 46268-4149 USA
3TYN6	CS Hyde Company, Inc. 1351 N Milwaukee Avenue Lake Villa, Illinois 60046 USA
3YAK8	Atlanco, Inc. No. 2 Bomar Street Inman, SC 29349 USA
30479	Van Straaten Chemical Co. 149 Grant St. P.O. Box 227 North Aurora, IL 60542-1603 USA
30530	Safety-Kleen Corp. 1301 Gervais Street - Suite 300 Columbia, SC 29201 USA
30676	Lord Corp., Chemical Products Div. 2000 W. Grandview Boulevard Erie, PA 16514-0038 USA
32988	(Refer to S0163)
33461	Deft, Inc. 17451 Von Karmen Avenue Irvine, CA 92614 USA
33564	Henkel Loctite Corp. (Was: Dexter Corp. Dexter Adhesive & Coating Systems) P. O. Box 312 2850 Willow Pass Road Bay Point, CA 94565-0031 USA
33629	The Kindt-Collins Co. 12651 Elmwood Ave. Cleveland, OH 44111-5911 USA
33629	Kindt-Collins Co. 12651 Elmwood Ave. Cleveland, OH 44111-5911 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
33684	Stanley Home Products, Inc. Industrial Div. 116 Pleasant St. East Hampton, MA 01027-1118 USA
34227	Sandstrom Products Co. 224 South Main St. Port Byron, IL 61275 USA
34568	Tiodize Co., Inc. 5858 Engineer Drive Huntington Beach, CA 92649 USA
34897	Ashland Chemical Co., A Div. of Ashland Oil, Inc. P. O. Box 2219 Columbus, OH 43216-2219 USA
35502	Magnus Chemicals, Ltd. (Was: Mag-Chem, Inc.) 1271 Ampere Boucherville, Quebec, Canada J4B 5Z5
36023	(Refer to 19354)
36346	Praxair - Industrial Gases (Was: Union Carbide Corp., Linde Div.) Old Ridgebury Road Danbury, CT 06817 USA
37676	Magnaflux Corp., Div. of Illinois Tool Works, Inc. 3624 W. Lake Avenue Glenview, IL 60025 USA
37995	Burmah-Castrol Canada Ltd. 3660 Lakeshore Boulevard W. Toronto, Ontario, Canada M8W 1P2
38XJ0	Tesa Tape, Inc. 5825 Carnegie Boulevard Charlotte, NC 28209 USA
38597	Lockheed Martin Corp. (Was: Martin Marietta Corp. Aero And Naval Systems) 2323 Eastern Boulevard E-5 Baltimore, MD 21220-4207 USA
38948	D. W. Electrochemicals, Ltd. 3-97 Newkirk Road (North), Richmond Hill, Ontario L4C 3G4 Canada

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
39428	McMaster-Carr Supply Co. 600 County Line Road Elmhurst, IL 60126-2034 USA
4G117	BGF Industries, Inc. 401 Amherst Avenue P. O. Box 592 Altavista, VA 24517 USA
4L7R8	Gerard Daniel Worldwide 34 BARNHART DRIVE HANOVER PA 17331 UNITED STATES OF AMERICA
4N020	CCP Industries, Inc. (Was: Cleveland Cotton Products Co.) 670 Alpha Drive Highland Heights, OH 44143 USA
4PNW1	Rubber Stamps Unlimited, Inc. 334 South Harvey Plymouth, MI 48170 USA
44197	(Refer to 1E1X8)
44926	Olympic Glove and Safety Company 75 Main Avenue Elmwood Park, NJ 07407 USA
45255	Owens-Corning Fiberglas Corp. Fiberglas Tower - T/11 One Owens Corning Parkway Toledo, OH 43659-0001 USA
45681	Parker Hannifin Corp. 6035 Parkland Boulevard Mayfield Heights, OH 44124 USA
46AN7	Airgas Inc 259 NORTH RADNOR-CHESTER RD STE 100 RADNOR PA 19087 UNITED STATES OF AMERICA
460Y4	Hylomar USA Inc 39520 WOODWARD AVE, STE 215 BLOOMFIELD HILLS MI 48304 UNITED STATES OF AMERICA
47695	PPG Industries, Inc. Chemical Group One PPG Place Pittsburgh, PA 15272-0001 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
5D028	Dow Corning Corp. 3901 South Saginaw Road Midland, MI 48640 USA
5R603	Merco Company 205 Lee Place Hackensack, NJ 07601-3304 USA
5T4Y0	Momentive Specialty Chemicals Inc. 180 EAST BROAD STREET COLUMBUS OH 43215 UNITED STATES OF AMERICA
5W425	Bostik, Inc. 211 Boston Street Middleton, MA 01949 USA
5Y661	Shurtape Technologies, Inc. (Was: Shuford Mills, Inc. Tape Div.) 1620 Highland Avenue P. O. Box 1530 Hickory, NC 28603-1530 USA
50744	Kirkhill-TA Company (DBA SFS Division) 300 E Cypress Street Brea, CA 92821-1530 USA
52152	Minnesota Mining And Mfg. Co., Industrial Tape And Specialties Div. 3M Center St. Paul, MN 55144-1000 USA
53012	Coatings for Industry, Inc 319 Township Line Road Souderton, PA 18964-1905
53100	Lockheed Martin Space Systems Co. - Michoud Operations (Was: Lockheed Martin Corp.; and, Martin Marietta Corp.) 13800 Old Gentilly Road - MS 2300 P. O. Box 29304 New Orleans, LA 70129-2218 USA
53912	Airtech International, Inc. 5700 Skylab Road Huntington Beach, CA 92647-2055 USA
54527	Shell Oil Company 1 Shell Plaza P. O. Box 2463 Houston, TX 77001 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
54636	The Sherwin-Williams Co., Krylon Products Group 101 Prospect Street Cleveland, OH 44115 USA
54916	Radiac Abrasives, Inc. 1015 South College Avenue Salem, IL 62881-2428 USA
55596	Polymet Corp. 10073 Commerce Park Drive Cincinnati, OH 45246-1333 USA
56385	Ultrachem 900 Centerpoint Boulevard Newcastle, DE 19720 USA
56883	Penetone Corp. 74 Hudson Avenue Tenafly, NJ 07670 USA
57635	(Refer to 1PWD8)
58093	(Refer to 1XNT8)
58401	U.S. Welding 3579 Highway 50 East Carson City, NV 89701 USA
58595	Pilot Corp. of America 60 Commerce Drive Trumbull, CT 06611 USA
58913	Sermatech International, Inc. 155 S. Limerick Road Limerick, PA 19468-1699 USA
59460	Pyramid Plastics, Inc. Tobler Div. 220 West 5th Street Hope, AR 71801-5212 USA Tel: (870) 722-5739 Fax: (870) 777-8056
6A670	3M, ITSD Aerospace (Was: Adhesives, Coatings & Sealers Div.) 3211 E. Chestnut Expressway P. O. Box 300 M Springfield, MO 65802-2548 USA
60218	Graphite Products Corp. 5756 Sharon-Warren Road P. O. Box 207 Brookfield, OH 44403-9507 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
60890	Dewal Industries, Inc. 15 Ray Trainor Drive P. O. Box 372 Saunderstown, RI 02874 USA
61637	Danbury Union Carbide Corp. 39 Old Ridgebury Road Danbury, CT 06817-0001 USA
62369	Flexcon Co., Inc. 1 Flexcon Industrial Park Spencer, MA 01562 USA
62758	(Refer to 23354)
63247	Mirachem Corp. 4645 McDowell Road - Unit 103 Phoenix, AZ 85035 USA
64220	Ruger Chemical Co., Inc. 83 Cordier Street Irvington, NJ 07111-4035 USA
65483	Deleted, (Current address not available)
66442	Richmond Aircraft Products 13503 Pumice Street Norwalk, CA 90650 USA
66724	LPS Laboratories, Inc. 4647 Hugh Howell Road Tucker, GA 30085-5052 USA
6MWZ4	Corr-Ex, LLC 216 King Cotton Rd Brunswick, GA 31525 USA www.correxllc.com Tel: 1-912-399-1559 Fax: 1-912-319-5015
70079	Acheson Colloids Co., Div. of Acheson Industries, Inc. 1600 Washington Avenue P. O. Box 611747 Port Huron, MI 48061-1747 USA
70362	Dixon Ticonderoga Co. (World Headquarters) 195 International Parkway Heathrow, FL 32746 USA
70752	(Deleted)

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
70829	Mallinckrodt Baker Inc. 222 Red School Lane Phillipsburg, NJ 08865-2219 USA
70958	Bergen Cable Technologies, Inc. 343 Kaplan Drive Fairfield, NJ 07004 USA
71191	Kop-Coat, Inc. 5431 District Boulevard Los Angeles, CA 90040 USA
71361	McGean (Was McGean, Cee-Bee Aviation Products, and, McGean-Rohco, Inc./ Cee-Bee Chemical Div.) 2910 Harvard Avenue Cleveland, OH 44105-3010 USA
71410	Henkel Aerospace Div. of Henkel Technologies, Surface Treatments 32100 Stephenson Highway Madison Heights, MI 48071 USA
71643	Saint-Gobain Performance Plastics, Inc. (Was: CHR Industries, Inc. An Armco Co.) 407 East St. New Haven, CT 06511 USA
71984	Dow Corning Corp. 2200 West Salzburg Road Midland, MI 48640-8531 USA
72008	(Deleted)
73165	(Refer to 05972)
73168	Kidde - Fenwal (Was: Fenwal, Inc. Div. of Kidde, Inc.) 400 Main Street Ashland, MA 01721-2150 USA
73219	Fiske Brothers Refining Co. 129 Lockwood St. Newark, NJ 07105-4720 USA
73277	Houghton International, Inc. (Was: E. F. Houghton & Co.) P.O. Box 930 Madison & VanBuren Ave. Valley Forge, PA 19482 USA
74230	FMI Paint & Chemicals (Was: FMI Chemical Corp.) 158 Hartford Rd. Manchester, CT 06040 USA

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SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
74291	Solo-Horton Brushes, Inc. 122 Summer Street Torrington, CT 06780 USA
75273	Witco Chemical Corp. Kendall/Amalie Motor Oil (Was: Kendall Refining Co. Div. of WITCO Chemical Co.) 77 N. Kendall Avenue P. O. Box 2000 Bradford, PA 16701-1726 USA
75364	(Deleted. Only sells to distributors. Refer to local art supply for source.)
75437	EOE, Inc. 585 Fourth Street P. O. Box 177 Troy, NY 12181 USA
75554	(Deleted. Use S0226)
75668	Sherwin-Williams Co. 2390 Arbor Boulevard Dayton, OH 45439 USA
75957	LUDECA Inc. 1527 NW 89th Street Miami, FL 33172 USA
76071	MacDermid, Inc. 245 Freight Street Waterbury, CT 06702-1802 USA
76381	3M Company 3M Center - Building 225-3S-20 St. Paul, MN 55144-1000 USA
76541	Monsanto Co. 800 N. Lindbergh Blvd. St. Louis, MO 63167 USA
77163	(Refer to 1V074)
77359	(Refer to 75668)
77445	United Technologies Corp. Pratt & Whitney Large Comercial Engines, Spare Parts Sales 400 Main Street East Hartford, CT 06108-0969 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
77490	Quaker Chemical Corp. One Quaker Park 901 Hector Street Conshohocken, PA 19428-0809 USA
77672	Randolph Products Co. Inc. 33 Haynes Circle Chicopee, MA 01020 USA
77988	(Deleted)
78369	(Refer to 3DYZ1)
78520	Stanchem Inc. 401 Berlin St. East Berlin, CT 06023 USA
8E913	Zip-Chem Products 408 Pickering Drive Pinkerington, OH 43147-1367 USA
8F024	Everlube Products, (Was: E/M Co.) Div. of Morgan Advanced Ceramics 100 Cooper Circle Peachtree City, GA 30269-3025 USA
8S927	(Refer to 0WU71)
8W836	Chemetall US INC. 13177 S Huron River Drive Romulus, MI 48174-3631 USA
80769	Polyken Technologies, A Div. of The Kendall Co. (Was: The Kendall Co., Polyken Div.) 15 Hampshire Street Mansfield, MA 02048 USA
80798	(Refer to 3F733)
80861	International Paper Co. One Penn Plaza - Suite 2814 New York, NY 10119 USA
81853	Crayola LLC 1100 Church Lane Easton, PA 18040-6638 USA
82110	Gudebrod, Inc. 274 Shoemaker Road Pottstown, PA 19464 USA
82726	(Deleted)

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
83309	Electrical Specialty Co. - South San Francisco, CA (Current Address Unavailable)
83334	Tuck Industries, Inc. - New Rochelle, NY (Current Address Unavailable)
84063	(Refer to 71410)
84163	Borden, Inc. Chemical Div. 180 East Broad Street Columbus, OH 43215-3705 USA
85419	(Refer to 81853)
85570	(Refer to 23354)
86297	Cratex Manufacturing Co., Inc. 328 Encinitas Blvd. - Suite 20 Encinitas, CA 92024 USA
86459	(Refer to 00BA9)
86460	Elf Atochem North America, Inc. 2000 Market Street Philadelphia, PA 19103-3222 USA
86874	Sanford Corp. 2711 Washington Boulevard Bellwood, IL 60104 USA
86938	Selig Industries 1420 Seaboard Industrial Atlanta, GA 30318 USA
87187	(Refer to 84163)
88303	Phillips Process Co., Inc. 20 Magnolia Street Rochester, NY 14608-2931 USA
88597	Volger's Ink Manufacturers (Out of Business)
89524	Ondeo Nalco Co. 1 Ondeo Nalco Center Naperville, IL 60563-1198 USA
9A090	DuPont Company Electronics Department U. S. Route 23, South & DuPont Road P. O. Box 89 Circleville, OH 43113 USA

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
9X057	Technical Laminations & Coatings (Was: Custom Tapes, Inc.) 7125 Gunnison Street Harwood Heights, IL 60656-3830 USA
91342	AKZO Nobel Aerospace Coatings, Inc. (Was: Dexter Specialty Coatings) 1 E. Water Street Waukegan, IL 60085-5652 USA
92108	PRC-Desoto International Inc. (Aerospace) 12780 SAN FERNANDO RD SYLMAR, CA 91342
92469	(Deleted. Refer to S0233)
94129	Brookfield Wire Co. Route 9 - P. O. Box 248 Brookfield, MA 01506 USA
94480	(Deleted. Refer to 1KGE8)
94548	Chevron Chemical Co. Agriculture Chemical Div. 575 Market St. San Francisco, CA 94119 USA
94853	The Hubbard-Hall Chemical Co. 563 South Leonard Street P. O. Box 790 Waterbury, CT 06708 USA
95015	Marvel Oil Co., Inc. 331-337 N. Main Street Port Chester, NY 10573-3305 USA
95643	(Deleted)
96717	Dow Chemical Co. 2030 Willard H. Dow Center Midland, MI 48674-0001 USA
97361	Unisource & Alco Standard Co. (Was: Chatfield Paper Co.) 21 Dodge Ave. North Haven, CT 06473 USA OR (Was: Rourke-Eno Paper Co.) 100 Helmsford Way Windsor, CT 06095-0740 USA
97460	(Refer to 23354)
97854	(Deleted)

(Continued)

SUPPLIER LOCATION	
SUPPLIER CODE	**NAME/ADDRESS**
98079	CVC Products, Inc. 525 Lee Road Rochester, NY 14606-4236 USA
98148	ITW Dykem/Dymon 805 East Old 56 Highway Olathe, KS 66061 - 0340 USA
98500	AGC Inc. 106 Evansville Ave. Meriden, CT 06450-5135 USA
98502	Akzo Coatings Inc. Aerospace Finishes Div. 434 W. Meats St. Orange, CA 92665 USA
98733	Met-L-Chek Co. 1639 Euclid Street Santa Monica, CA 90404-3723 USA
99251	Bendix Corp., Instrument and Life Support Div. 2734 Hickory Grove Road P. O. Box 4508 Davenport, IA 52808 USA
99384	Huntsman Advanced Materials Americas, Inc. (Was: Vantico, Inc.) 5121 San Fernando Road West Los Angeles, CA 90039-1071 USA
99742	Permacel Nitto Denko Co. (Was: Permacel, Div. Of Nitto Denko America; and, Permacel, Div. of Johnson & Johnson) U. S. Highway 1 P. O. Box 671 New Brunswick, NJ 08903 USA
99891	Products Research and Chemical Corp. 5430 San Fernando Rd. Glendale, CA 91203 USA

3. Standard Torques

A. Use standard torque values in locations where no specific torque is given in the test or clearance charts (Fits and Clearances sections).

B. The torque limits listed in this section shall be interpreted as follows:

(1) Torque values in pound-inches.

(2) Angles of turn in degrees.

(3) Stretch values in inches.

C. Unless otherwise specified, thread lubricants shall be applied to parts which are to be torqued. Thread lubricants shall be engine oil, or equivalent, or specific antiseize compound.

D. In order to facilitate subsequent disassembly, apply antiseize/ antigalling compound (Fel-Pro C-200 or C-300) to all threaded parts in hot section of engine, except on silver plated threaded parts, fuel fittings, and locations where another compound is specified.

E. If part to be tightened is hot, allow sufficient time to elapse to allow temperature of part to reach a temperature equilibrium with surrounding area before final torquing.

F. Flange bolts shall be drawn up evenly by having two mechanics working simultaneously 180 degrees apart.

G. Torque applications should be done slowly and evenly for consistency and best possible accuracy. There may be instances where other than specific torque limits are used and where it is obvious that standard torque required should not be used due to the kind of material or design of engine part involved. Common sense and good judgment should of course be exercised in such cases.

4. Torque Indicating Devices

A. Check torque indicating devices daily and calibrate by means of weights and a measured lever arm to make sure that there are no inaccuracies. Checking one torque wrench against another is not sufficient. Some wrenches are quite sensitive to the way they are supported during tightening operation, and every effort must be made to adhere to instructions furnished by respective manufacturers.

B. Torque Wrench and Extensions

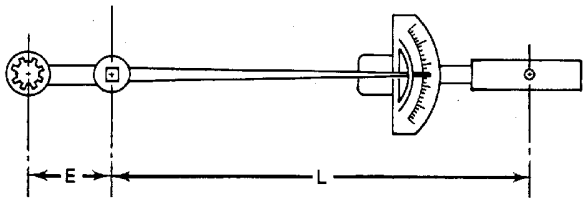
(1) Occasionally, it is necessary to use a special extension, or adapter wrench together with a standard torque wrench. (Figure 201)

(2) Example: A torque of 1440 lb-in. is desired on a part, using special extension having a length of three inches from center to center of its holes, and a torque wrench, measuring 15 inches from center of handle or handle swivel pin to center of its square adapter.

$$\text{THEN:} \quad R = \frac{LT}{L + E} = \frac{15 \times 1440}{15 + 3} = 1200$$

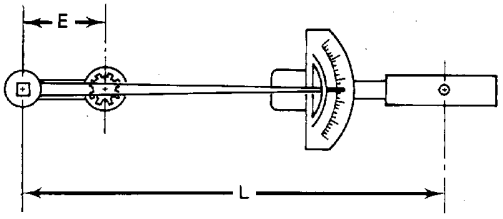
With axis of extension or adapter and torque wrench in a straight line, tightening to wrench reading of 1200 lb-in. will provide the desired torque of 1440 lb-in. on the part.

NOTE: Effective length of PWA special extensions, adapters, and wrenches is stamped on tool.



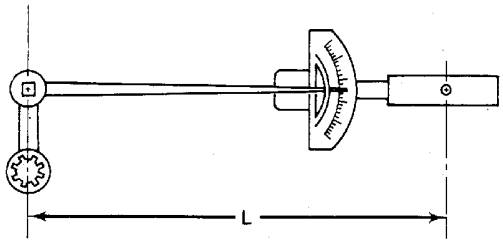
A CORRECTION OF THE INDICATED TORQUE READING IS REQUIRED WHEN AN ADAPTER IS USED, WHICH CHANGES THE EFFECTIVE LENGTH OF A TORQUE WRENCH. APPLY FOLLOWING FORMULA TO OBTAIN THE CORRECTED TORQUE READING.

$$R = \frac{L \times T}{L + E}$$



A CORRECTION OF THE INDICATED TORQUE READING IS REQUIRED WHEN AN ADAPTER IS USED, WHICH CHANGES THE EFFECTIVE LENGTH OF A TORQUE WRENCH. APPLY FOLLOWING FORMULA TO OBTAIN THE CORRECTED TORQUE READING.

$$R = \frac{L \times T}{L - E}$$



A CORRECTED TORQUE READING IS NOT REQUIRED WHEN AN ADAPTER IS USED WHICH DOES NOT CHANGE THE EFFECTIVE LENGTH OF THE TORQUE WRENCH.

LEGEND

T = DESIRED TORQUE
E = EFFECTIVE LENGTH OF EXTENSION OR ADAPTER
L = EFFECTIVE LENGTH OF TORQUE WRENCH
R = CORRECTED TORQUE READING

NOTES

(1) DO NOT USE A HANDLE EXTENSION ON ANY TORQUE WRENCH.
(2) EFFECTIVE LENGTH OF PWA SPECIAL EXTENSIONS, ADAPTERS, AND WRENCHES IS STAMPED ON TOOL.

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Torque Wrench and Extension
Figure 201/70-00-00-990-801

5. General Torque Recommendations

A. Lubricants and Lubrication

(1) Oil Lubricated Parts

(a) Torque limits given in this section for oil lubricated parts apply specifically to the use of engine oil, or equivalent, on the parts.

(2) Antiseize Lubricated Parts

(a) Torque limits given in this section for antiseize coated parts apply specifically to the use of antiseize compounds applied per SPOP 146, 156, 160, or 161, or to wet applications of Fel-Pro C-200 and C-300 or to Kaylube 3.

B. Standard Nuts, Bolts, and Screws

(1) Torque values listed in Figure 202 for nuts, bolts, and screws have been established to provide sufficient preload without overstressing parts and are based on materials having minimum ultimate tensile strengths of 125,000 pounds per square inch, equivalent to Rockwell C26 hardness for steel parts.

NOTE: These torque values do not apply to hollow bolts or screws. Torque value specified apply to bolts in helical coil inserts as long as full thread engagement of the insert is accomplished.

(2) Torque values in Figure 202 shall apply to nuts where height of nut is greater than 75 percent of major diameter of thread. For thin nuts, where height of nut is 40 percent to 75 percent of size of major diameter, reduce torque values 50 percent. Slots in slotted nuts should be disregarded figuring height of nuts. Values do not apply to hollow bolts and screws.

(3) After castle nut, screw, or bolt has been tightened to proper torque, it should not be loosened to permit insertion of lockwire or cotter pin. If slot in nut or lockwire hole in bolt or screw is not properly aligned at minimum torque limit, nut, screw or bolt should be further tightened to next aligning position, but maximum torque limit must not be exceeded. If alignment cannot be accomplished without exceeding maximum limit, back off nut, screw or bolt, half turn, then retighten. Occasionally it may be necessary to select a new part.

C. Self-Locking Nuts

(1) Free Spinning Locknuts

(a) Free spinning locknuts are nuts that spin freely on bolt or stud until it contacts mating surface with activation of the locking feature produced with additional torque. Use torque values listed in Figure 202.

(2) Prevailing Torque Type Locknuts

(a) Prevailing torque type locknuts are nuts that spin freely on a bolt or stud until threads enter locking position of nut. At this point bolt interferes with deformed section of nut causing tight frictional hold on bolt thread flanks. Use torque values listed in Figure 203 except when nut is on stud, then use Figure 202.

NOTE: Helical coil self-locking inserts are categorized as prevailing torque type locknuts. The torques for bolts used in such inserts are listed in Figure 203.

(b) Effective locking of slotted steel locknuts on bolts or studs requires full engagement of all locknut threads. It is not necessary for bolt or stud to protrude beyond outer end of locknuts because chamfered part of locknut ID does not exceed locking force on bolt or stud.

D. Steel Pipe Plugs in Aluminum and Magnesium Cases

(1) Do not tighten a pipe plug beyond the limits given in Figure 204 if it is found to leak and antiseize white lead base sealing compound has been applied. Remove plug and apply more sealing compound to thread; then reinstall and retighten to desired limits.

(2) Torque limits shall be reduced about 20 percent when installing steel plugs in a hot engine.

E. PWA Flexible Fittings and Sealastic Type Fittings (Figure 205) (Figure 206)

NOTE: For identification purposes, the material composition and part number of each packing is marked on the packing package. Unless otherwise indicated, it is the current design practice to specify using AMS 7260 synthetic rubber, 70-80 durometer A, packings for fuel seals, and PWA 401 fluorocarbon rubber, 70-77 durometer C (95-100 durometer A), for oil, air, or water seals. The maximum allowable temperature exposure for this latter material is 450°F (232°C).

(1) When assembling flexible fittings, the packing and fitting threads must be lubricated with a light film of P03-002 (PMC 9852) Lubricating oil, P06-002 (PMC 9609) Petrolatum or P06-053 (PWA 36500) Seal Ring Lubricant. The packing must be bottomed and tube aligned before applying torque listed in Figure 206.

NOTE: It is expected that these flexible tube connections will experience loss of torque over a period of time due to seating of rubber in mating parts. To minimize this condition, parts should be torqued to the listed value, then loosened, and torqued again to the listed value.

It is optional to use petrolatum as a replacement for P06-053 (PWA 36500) Seal Ring Lubricant, but it is better to use the seal ring lubricant. Use petrolatum only if seal ring lubricant is not available.

F. Conical Seat Connectors (Figure 207)

(1) Refer to Figure 209 for torque values for 37 degrees conical seat connectors without gaskets.

(2) Refer to Figure 208 for torque values for 37 degrees conical seat connectors with nickel gaskets.

(3) Do not attempt to correct leakage at the point by over-torquing. Disassemble fitting and check for nicks, burrs, or foreign matter. Use new parts if necessary.

G. Jamnuts (Figure 207) (Figure 210)

(1) The torques listed in Figure 211 are to be used for all steel and aluminum jamnuts (locknuts) of the type used on fittings for tube and hose connections.

NOTE: Refer to Paragraph 5.L. or Paragraph 5.M. for procedure for recutting 37 degree conical seats on male or female tube connectors.

(2) On elbow type fittings, the jamnut must be torqued after the connecting tube or hose has been installed and properly aligned.

NOTE: The thread sizes shall be used for determining torque rather than the listed tubing sizes.

H. Installation of Crush Type, Asbestos Filled Gaskets

WARNING: ASBESTOS IS AN AGENT THAT IS CARCINOGENIC. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ASBESTOS IS USED.

- DO NOT GET ASBESTOS IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE ASBESTOS CONTAMINATION MATERIAL.

(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Install all crush type gaskets except the self-centering type, with the unbroken surface against the flange of the plug or part being tightened against the seal. Turn mating part until sealing surfaces are in contact and tighten to the angle of turn shown in Figure 212 for the appropriate thread pitch.

I. Hex-Head Straight Threaded Flange Plugs (MS9015, MS9193, or Similar)

CAUTION: EXCESSIVE TIGHTENING WILL RESULT IN DAMAGE TO THREADS OF MATING PARTS.

(1) The torques in Figure 213 are based on strength of thread in cast aluminum or magnesium; they may also be used in stronger materials.

J. Installing and/or Attaching the Various Components of Ignition System and Thermocouple Systems (Figure 214)

(1) Torque all plug-in type threaded connections finger-tight plus a 45° maximum turn.

(2) Torque spark igniter plugs 300.0 in-lb (33.9 N·m)-360.0 in-lb (40.7 N·m).

CAUTION: INSUFFICIENT TORQUE ON IGNITION SYSTEM HIGH TENSION LEAD NUTS AT IGNITION EXCITER AND/OR IGNITER PLUG END CAN CAUSE IGNITION-RADIATED NOISE IN AIRCRAFT RADIO EQUIPMENT.

(3) All cigarette-type electrical connections (intermediate voltage leads and high tension leads) should be torqued until connection is bottomed on its shoulder. This normally takes approximately 140.0 in-lb (15.8 N·m)-160.0 in-lb (18.1 N·m) of torque. (Figure 214).

(4) All exhaust temperature probe terminal attaching nuts and thermocouple harness-to-lead attaching screws shall be torqued per Figure 215.

(5) In the exhaust gas temperature junction box, all harness terminal and bus bar attaching nuts shall be torqued per Figure 216.

K. Torque Check for Reuse of Self-Locking Fasteners

(1) Check self-locking nuts for adequate torque before reuse. Discard nut if locking capability is impaired. Do not attempt repair.

(2) Torque Limits

(a) Self-locking nuts, bolts and helical coil inserts shall be capable of meeting torque requirements in Figure 217.

NOTE: Minimum break-away torque: minimum torque required to turn unseated nut or bolt initially in self-locking fastener shall not be less than value given in Figure 217.

Maximum break-away torque: torque required to turn unseated nut or bolt continually in self-locking fastener shall not exceed value given in Figure 217.

(b) For torque testing stainless steel, corrosion and heat resistant steel, nickel alloy steel, and AMS 6304 nuts, major, minor, and pitch diameters of bolts should be reduced 0.003 inch below dimensions specified for listed 0.190-32 UNF-3A, 0.190-24 UNC-3A and larger bolt sizes.

(3) Unplated Nuts

(a) Unplated stainless steel, corrosion resistant steel, nickel alloy steel, and AMS 6304 steel nuts that have threads undercut for plating at assembly, shall be silver plated 0.0003 - 0.0006 inch thick for test purposes, and check for requirements of unplated bolts threaded per Figure 217.

(b) Unplated stainless steel, corrosion-resistant steel, nickel alloy steel, and AMS 6304 steel nuts that are permanently attached to brackets as other similar parts, and that are not subsequently plated at assembly, shall be checked for requirements of Figure 217 with bolts that are plated 0.0003 - 0.0006 inch thick. Plated bolts 0.190 inch in diameter and larger shall have threads reduced 0.0003 from class 3A limits on major, minor, and pitch diameters. Bolts smaller than 0.190 inch in diameter shall have class 2A tolerances.

(c) Unplated carbon or alloy steel nuts shall be cadmium plated 0.0002 - 0.0005 inch thick and checked with cadmium plated bolts threaded per Figure 217.

(d) Unplated aluminum nuts shall be checked with cadmium plated bolts threaded per Figure 217.

L. Tube Connector Male Conical Seat Repair (Figure 218)

(1) Check

(a) Install bluing gage detail of appropriate tool through screw and then insert bar through hole in gage detail. Thread sleeve detail onto male end of tube.

(b) Charge conical surface of gage with the carbon from carbon paper lightly moistened with AMS 3160 Stoddard Solvent.

(c) Turn screw detail of tool into sleeve detail until conical surfaces are in contact. Seat gage by rotating once, 45 degrees maximum, then return to starting point. After seating, rotate gage one-half turn and return to starting position to define pattern of contact.

(d) Check Limits

1) Circumferential ridging is acceptable on sealing surface seats provided ridges are uniform around entire circumference and do not exceed 0.003 inch in height.

2) Conical surfaces containing ridges which are not uniform or do not extend around entire circumference or are over 0.003 inch but do not exceed 0.005 inch in height may be refaced.

3) Vertical scratches are not acceptable. Vertical scratches not exceeding 0.005 inch in depth may be removed by refacing.

(2) Repair

CAUTION: OPERATORS MUST WEAR CLEAN, LINT-FREE GLOVES WHEN HANDLING REWORKED FITTINGS TO PREVENT STAINING FINISHED CONICAL SEAT SURFACES.

(a) Install cutter detail of appropriate tool through screw and then insert bar through hole in cutter detail. Thread sleeve detail onto male end of tube.

(b) Assemble screw to sleeve then rotate cutter to machine off least amount of material necessary to remove damage and obtain required cone. Surface Y may be machined to obtain dimensions shown. Axis of conical surface must be concentric with respective thread pitch diameter within 0.005 inch FIR.

(c) Check refaced conical seat per Paragraph 5.L.(1). If acceptable seat has been obtained, omit steps (d) through (g).

(d) Install lap detail of appropriate tool through screw and then insert bar through hole in lap detail. Thoroughly degrease male seat surface then thread sleeve detail onto male end of tube.

(e) Charge lap detail with PMC 3014 Silicone Carbide Lapping Compound, 240 grain size.

(f) Assemble screw to sleeve then hand lap conical seat.

(g) Check lapped conical seat per Paragraph 5.L.(1). If necessary, repeat sequence of operations until an acceptance cone is obtained.

(h) Degrease fitting. If fitting has been lapped, ensure all lapping compound is removed. Install threaded protective cap on fitting.

M. Tube Connector Female Conical Seat Repair (Figure 219).

(1) Check

(a) Install bluing gage detail of appropriate tool through screw and then insert bar through hole in gage detail.

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL-VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

(b) Charge conical surface of bluing gage with the carbon from carbon paper lightly moistened with cleaning solvent (P-D-680).

(c) Turn screw detail of tool into tube nut until conical surfaces are contacted. Seat gage by rotating once, 45 degrees maximum, then return to starting point. After seating, rotate gage one-half turn and return to starting position to define pattern of contact.

(d) Check Limits

1) Circumferential ridging is acceptable on sealing surface seats provided ridges are uniform around entire circumference and do not exceed 0.003 inch in height.

2) Conical surfaces containing ridges which are not uniform or do not extend around circumference or are over 0.003 inch but do not exceed 0.005 inch in height may be refaced.

3) Vertical scratches are not acceptable. Vertical scratches not exceeding 0.005 inch in depth may be removed by refacing.

(2) Repair

CAUTION: OPERATORS MUST WEAR CLEAN, LINT-FREE GLOVES WHEN HANDLING REWORKED FITTINGS TO PREVENT STAINING FINISHED CONICAL SEAT SURFACES.

(a) Install cutter detail of appropriate tool through screw and then insert bar through hole in cutter detail.

(b) Assemble screw to tube nut then rotate cutter to machine off least amount of material necessary to remove nicks, chatter marks, low spots, etc. Surface E must be square with axis of Surface C within 0.005 inch FIR. Surface C must be concentric with Diameter A within 0.005 inch FIR.

(c) Check refaced conical seat per Paragraph 5.M.(1). If acceptable seat has been obtained, omit steps (d) through (g).

(d) Install lap detail of appropriate tool through screw and then insert bar through hole in lap detail. Thoroughly degrease female seat surface.

(e) Charge lap detail with PMC 3014 Silicone Carbide Lapping Compound, 240 grain size.

(f) Assemble screw to tube nut then hand lap conical seat.

(g) Check lapped conical seat Paragraph 5.M.(1). If necessary, repeat sequence of operations until an acceptable cone is obtained.

(h) Degrease fitting. If fitting has been lapped, ensure all lapping compound is removed. Install threaded protective cap on fitting.

Thread Size**	Torque (lb.—in.)					
	Oil Lubricated			Antiseize Coated		
	Max.	Min.*		Max.	Min.*	
		Type I	Type II		Type I	Type II
.112–40	6	4.5	5	4.5	3.5	4
.138–32	11.5	8.5	10	8.5	6.5	7.5
.164–32	22	16	20	16.5	12.5	15
.164–36	24	18	22	18	13.5	16
.190–24	30	23	27	21.5	16	19.5
.190–32	36	24	32	26	19.5	23
.216–24	48	35	43	35	26	31
.216–28	50	35	45	38	28	34
.250–20	70	50	65	50	37	45
.250–28	85	65	75	60	45	54
.3125–18	150	110	135	105	80	95
.3125–24	170	125	150	120	90	110
.375–16	270	200	250	185	140	170
.375–24	300	225	275	215	160	190
.4375–14	425	325	375	300	225	270
.4375–20	475	350	425	340	255	310
.500–13	650	500	600	450	340	400
.500–20	750	550	675	515	390	460
.5625–12	950	700	850	675	500	600
.5625–18	1050	800	950	750	550	675
.625–11	1300	1000	1200	900	675	800
.625–18	1500	1150	1350	1025	775	925
.750–10	2300	1700	2100	1600	1200	1450
.750–16	2600	2000	2400	1800	1350	1600
.875–9	3700	2800	3400	2600	1950	2350
.875–14	4200	3200	3800	2900	2200	2600
1.000–8	5600	4200	5100	3900	2900	3500
1.000–12	6400	4800	5800	4300	3200	3850
1.125–7	7900	5900	7200	5400	4100	4900
1.125–8	8400	6300	7600	5700	4300	5100
1.250–7	11200	8400	10100	7700	5800	6900
1.250–8	11700	8800	10600	7900	5900	7100
1.375–6	14700	11000	13300	10100	7600	9100
1.375–8	15900	11900	14400	10600	8000	9500
1.500–6	19600	14700	17700	13300	10000	12000
1.500–8	21100	15800	19000	14000	10500	12600
1.750–5	30900	23200	27900	21100	15800	19000
1.750–8	34500	25900	31100	22700	17000	20400
2.000–4.5	46600	35000	42000	31700	23800	28500
2.000–8	52600	39500	47400	34400	25800	31000

*Use Type I minimum torque values where alignment of locking holes (for cotterpins, lockwire, etc.) is required at assembly. Use Type II minimum values where locking hole alignment is not required at assembly.

**For screws larger than 0.164 thread size having screwdriver slots only (no external wrenching provision):

1. For non-self-locking applications, 22 lb.—in. minimum is permissible.
2. For self-locking applications, permissible minimum torque is 22 lb.—in. plus torque required to turn screw through nut.

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Nuts, Bolts, Screws, and Self-Locking Nuts on Studs
Figure 202/70-00-00-990-802

Thread Size	Torque (lb.—in.)	
	Oil Lubricated	Antiseize Coated
.112–40	6–7	5–6
.138–32	12–14	9–11
.164–32	23–26	18–20
.164–36	25–28	20–22
.190–24	32–35	24–27
.190–32	36–40	27–30
.216–24	48–54	36–40
.216–28	50–56	40–44
.250–20	74–82	55–62
.250–28	85–95	62–72
.3125–18	160–175	115–130
.3125–24	180–200	125–140
.375–16	270–300	200–220
.375–24	290–325	225–250
.4375–14	420–465	315–350
.4375–20	450–500	340–380
.500–13	630–700	450–500
.500–20	720–800	515–575
.5625–12	950–1050	675–750
.5625–18	1050–1150	750–825
.625–11	1250–1400	900–1000
.625–18	1450–1600	1030–1150
.750–10	2200–2450	1600–1750
.750–16	2500–2750	1750–1950
.875–9	3600–4000	2500–2850
.875–14	4000–4450	2800–3100
1.000–8	5400–6000	3800–4200
1.000–12	6000–6700	4000–4500
1.125–7	7600–8200	5300–5700
1.125–8	8000–8700	5500–6000
1.250–7	10500–11600	7300–8100
1.250–8	11000–12100	7500–8300
1.375–6	13800–15100	9600–10500
1.375–8	1490 0 –16300	10000–11000
1.500–6	18200–20100	12500–13800
1.500–8	19500–21600	13100–14500
1.750–5	28500–31500	19600–21700
1.750–8	31700–35100	21000–23300
2.000–4.5	42800–47400	31800–32500
2.000–8	48200–53400	29300–35200

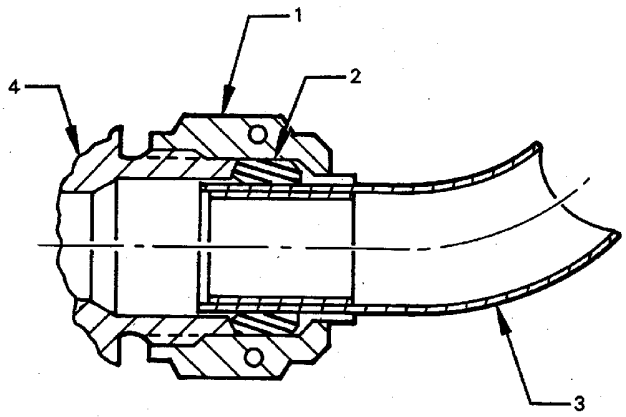
L-41645
7—75
BBB2-70-3

Torques For Self-Locking Nuts and Bolts
Figure 203/70-00-00-990-803

Thread size (ANPT or NPT)	Torque, (lb.—in.)	Thread size (ANPT or NPT)	Torque (lb.—in.)
.062	30– 40	.500	140–160
.125	30– 40	.750	210–230
.250	70– 85	1.000	285–315
.375	95–110	1.250	355–385

L—41637
BBB2-70-4

Steel Pipe Plugs in Aluminum or Magnesium Cases
Figure 204/70-00-00-990-804



1. NUT (REF FIGURE 206)
2. PACKING
3. TUBE
4. FITTING

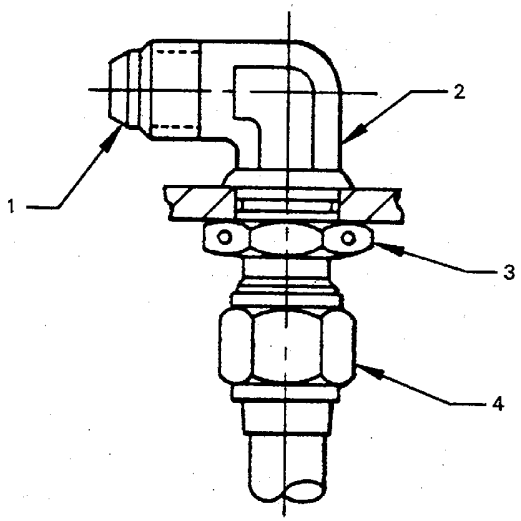
L-29739
3-72
BBB2-70-5

PWA Flexible Fitting Figure
Figure 205/70-00-00-990-805

TUBE DIA.	THREAD SIZE	PART NUMBER FOR 75 DUROMETER A PACKINGS: AMS 7260, 7267, OR 7273	TORQUE LB-IN	PART NUMBER FOR 77 DUROMETER (100 DUROMETER A PACKINGS: PWA 401	TORQUE LB-IN
0.250	0.625-18	227407	25-30	399615	55-60
0.3125	0.6875-16	227413	30-35	451083	65-70
0.375	0.750-16	226366, 626155	30-35	410629	65-70
0.4375	0.8125-16	227419	45-50		
0.500	0.875-14	227401, 598643, 669480	55-60	391009	110-120
0.5625	1.000-12	227425	60-65		
0.625	1.0625-12	226195	65-70	443330	130-140
0.750	1.1875-12	227427	70-80	389114	140-160
0.875	1.375-12	227431	75-85	452427	150-170
1.000	1.500-12	227433	100-110	389847	200-220
1.125	1.625-12	227451	100-110	409309	200-220
1.250	1.750-12	227439, 598678	100-110	414121	200-220
1.500	2.125-12	227445	100-110	409179	200-220

L-41621
0385
BBB2-70-6A

Flexible Tube Connections
Figure 206/70-00-00-990-806



1. CONICAL SEAT CONNECTOR
2. BULKHEAD FITTING
3. JAMNUT
4. CONICAL SEAT CONNECTOR NUT

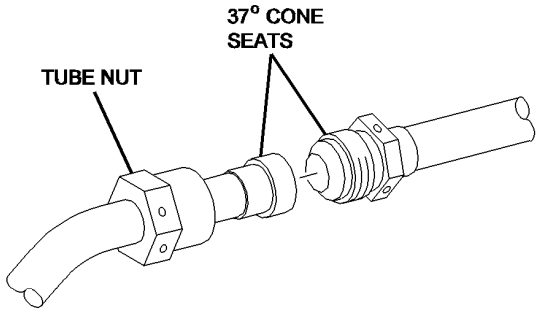
L-29740
BBB2-70-7

Conical-Seat Connector and Bulkhead Fitting
Figure 207/70-00-00-990-807

Hose size	Tubing OD	Thread size	Torque, lb.—in.		
			Steel fittings		Titanium fittings
			Oil lubricated	Anti-seize coated	Anti-seize coated*
–3	.1875	.375 –24	50– 60	40– 45	50– 60
–4	.250	.4375–20	90– 100	65– 75	90– 100
–5	.3125	.500 –20	135– 150	100– 110	135– 150
–6	.375	.5625–18	200– 220	150– 165	200– 220
––	.4375	.625 –18	250– 270	185– 200	250– 270
–8	.500	.750 –16	350– 400	270– 300	350– 400
––	.5625	.8125–16	400– 450	300– 350	400– 450
–10	.625	.875 –14	500– 550	360– 400	500– 550
––	.6875	1.000 –12	600– 700	480– 530	600– 700
–12	.750	1.0625–12	700– 800	540– 600	700– 800
––	.875	1.1875–12	800– 900	600– 675	800– 900
–16	1.000	1.3125–12	1000–1100	750– 825	1000–1100
––	1.125	1.500 –12	1300–1400	900–1000	1300–1400
–20	1.250	1.625 –12	1400–1500	1000–1100	1400–1500
–24	1.500	1.875 –12	1600–1700	1200–1300	1600–1700

L—41605
7—75
BBB2-70-9

Conical-Seat (37 Degrees) Connectors With Nickel Gaskets
Figure 208/70-00-00-990-808



HOZE SIZE	TUBIING OD (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)*					
			ALUMINUM FITTINGS**		STEEL FITTINGS		STEEL FITTINGS TITANIUM FITTINGS***	
			ALL LUBRICANTS		OIL LUBRICATED		ANTI-SEIZE COATED	
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
-3	0.1875	0.375-24	30 (3.390)	50 (5.649)	70 (7.909)	80 (9.039)	50 (5.649)	60 (6.779)
-4	0.250	0.4375-20	40 (4.519)	65 (7.344)	90 (10.169)	100 (11.298)	65 (7.344)	75 (8.474)
-5	0.3125	0.500-20	60 (6.779)	80 (9.039)	135 (15.253)	150 (16.948)	100 (11.298)	110 (12.428)
-6	0.375	0.5625-18	75 (8.474)	125 (14.123)	270 (30.506)	300 (33.895)	200 (22.597)	225 (25.422)
--	0.4375	0.625-18	100 (11.298)	175 (19.772)	320 (36.155)	350 (39.545)	225 (25.422)	250 (28.246)
--	--	0.6875-24	--	--	320 (36.155)	350 (39.545)	225 (25.422)	250 (28.246)
- 8	0.500	0.750-16	150 (16.948)	250 (28.246)	450 (50.843)	500 (56.492)	340 (38.415)	375 (42.369)
--	0.5625	0.8125-16	175 (19.772)	300 (33.895)	550 (62.142)	600 (67.791)	400 (45.194)	450 (50.843)
- 10	0.625	0.875-14	200 (22.597)	350 (39.545)	650 (73.440)	700 (79.089)	475 (53.668)	525 (59.317)
--	--	0.875-16	200 (22.597)	350 (39.545)	650 (73.440)	700 (79.089)	475 (53.668)	525 (59.317)
--	0.6875	1.000-12	275 (31.071)	450 (50.843)	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)
--	--	1.000-14	275 (31.071)	450 (50.843)	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)
- 12	0.750	1.0625-12	300 (33.895)	500 (56.492)	900 (101.686)	1000 (112.985)	675 (76.265)	750 (84.739)
--	0.875	1.1875-12	400 (45.194)	600 (67.791)	1100 (124.283)	1200 (135.582)	825 (93.212)	900 (101.686)
--	--	1.250-12	400 (45.194)	650 (73.440)	1150 (129.933)	1300 (146.880)	900 (101.686)	1000 (112.985)
- 16	1.000	1.3125-12	500 (56.492)	700 (79.089)	1300 (146.880)	1400 (158.179)	950 (107.336)	1050 (118.634)
--	1.125	1.500-12	600 (67.791)	900 (101.686)	1500 (169.477)	1600 (180.776)	1050 (118.634)	1200 (135.582)
- 20	1.250	1.625-12	600 (67.791)	900 (101.686)	1700 (192.074)	1800 (203.373)	1150 (129.933)	1300 (146.880)
- 24	1.500	1.875-12	600 (67.791)	900 (101.686)	2100 (237.268)	2200 (248.567)	1500 (169.477)	1600 (180.776)

* IF THE NUT OR EITHER OF THE MATING SEALING SURFACES IS ALUMINUM, THE REQUIRED TORQUE LIMITS FOR ALUMINUM FITTINGS APPLY.

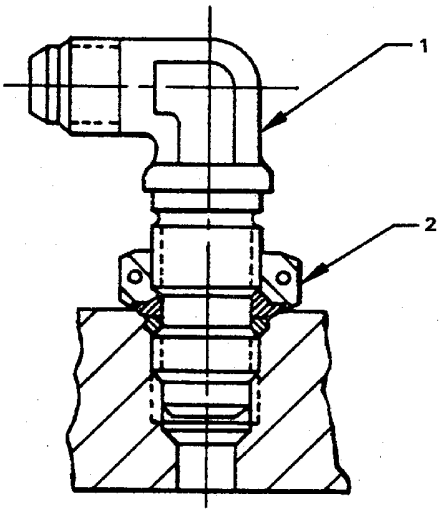
** FOR THRUST REVERSER AIR LINE FITTINGS, USE TORQUES FOR ALUMINUM FITTINGS, REGARDLESS OF MATERIAL, UNLESS OTHERWISE SPECIFIED.

*** FOR MIXED MATERIAL ASSEMBLY (STEEL CONNECTOR WITH TITANIUM CONNECTOR WITH STEEL NUT), USE TITANIUM TORQUE.

L-61898 (0703)
PWV

BBB2-70-40
S0000195266V1

Torques For 37 Degree Cone Seat Connectors (Without Gaskets)
Figure 209/70-00-00-990-835



1. Boss Fitting
2. Jamnut

L-29741
BBB2-70-10

Preformed Packing and Jamnut-Type Connector
Figure 210/70-00-00-990-809

Thread size	Torque, lb.—in.	Thread size	Torque, lb.—in.
.250 –28	14– 16	1.000 –12	260–290
.3125–24	22– 24	1.0625–12	285–315
.375 –24	28– 32	1.1875–12	350–390
.4375–20	38– 42	1.250 –12	380–420
.500 –20	58– 62	1.3125–12	475–525
.5625–18	70– 80	1.500 –12	570–630
.625 –18	95–105	1.625 –12	570–630
.750 –16	145–155	1.875 –12	570–630
.8125–16	165–185	2.250 –12	570–630
.875 –14	190–210	2.500 –12	570–630

L—41597
BBB2-70-11

Jamnuts
Figure 211/70-00-00-990-810

Thread Pitch on Part to be Tightened (Threads per inch)	Angle of Turn (Degrees, + 5 Degrees)*	
	Aluminum/Asbestos	Copper/Asbestos Nickel/Asbestos Steel/Asbestos
8	135	67
9	135	67
10	135	67
11	180	90
12	180	90
13	180	90
14	180	90
16	270	135
18	270	135
20	270	135
24	360	180
28	360	180

*These values provide for compression of approximately 40 percent for aluminum/asbestos and 20 percent for copper/asbestos, nickel/asbestos, and steel/asbestos gaskets.

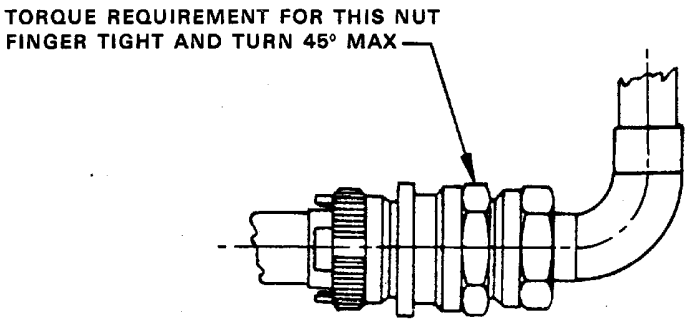
L—41589
7—75
BBB2-70-12

Crush Type Asbestos Filled Gaskets
Figure 212/70-00-00-990-811

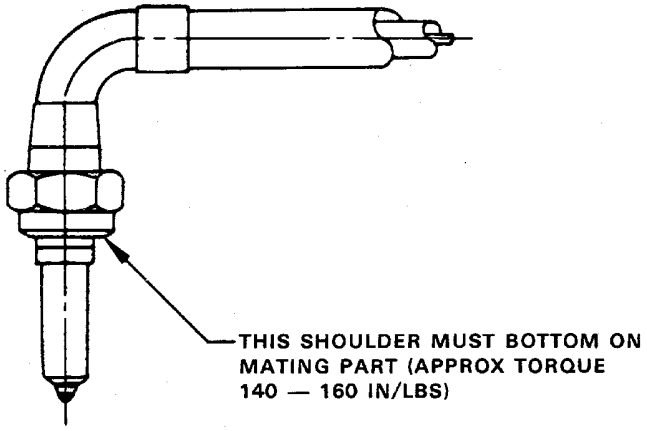
Thread size	Torque, lb.—in.	Thread size	Torque, lb.—in.
.250 –28	15– 20	1.0625–12	375–425
.3125–24	35– 40	1.1875–12	450–550
.375 –24	40– 50	1.250 –12	500–600
.4375–20	65– 75	1.3125–12	525–625
.500 –20	90–100	1.500 –12	600–700
.5625–18	110–120	1.625 –12	650–750
.625 –18	150–170	1.750 –12	650–750
.750 –16	200–225	1.875 –12	650–750
.8125–16	225–250	2.250 –12	650–750
.875 –14	250–275	2.500 –12	650–750
1.000 –12, –14	275–300		

L—41629
7—75
BBB2-70-13

Hex-Head Straight Threaded Fittings and Plugs
Figure 213/70-00-00-990-812



ELECTRICAL CONNECTORS
AN 3100 THRU AN 3108



LEADS —
ELECTRICAL CONNECTIONS

L-50247
7—75
BBB2-70-14

Ignition Connector Installation
Figure 214/70-00-00-990-813

Thread size	Torque, lb.—in.
.138–32	8–10
.164–32	8–12
.190–32	10–15
.216–32	30–35
.250–32	35–40

L—41581
BBB2-70-15

Temperature Probe Nut and Screw Torque
Figure 215/70-00-00-990-814

Thread size	Torque, lb.—in.
.190–32	25–30
.164–32	20–25

L—41573
BBB2-70-16

EGT Harness and Terminal Nut Torque
Figure 216/70-00-00-990-815

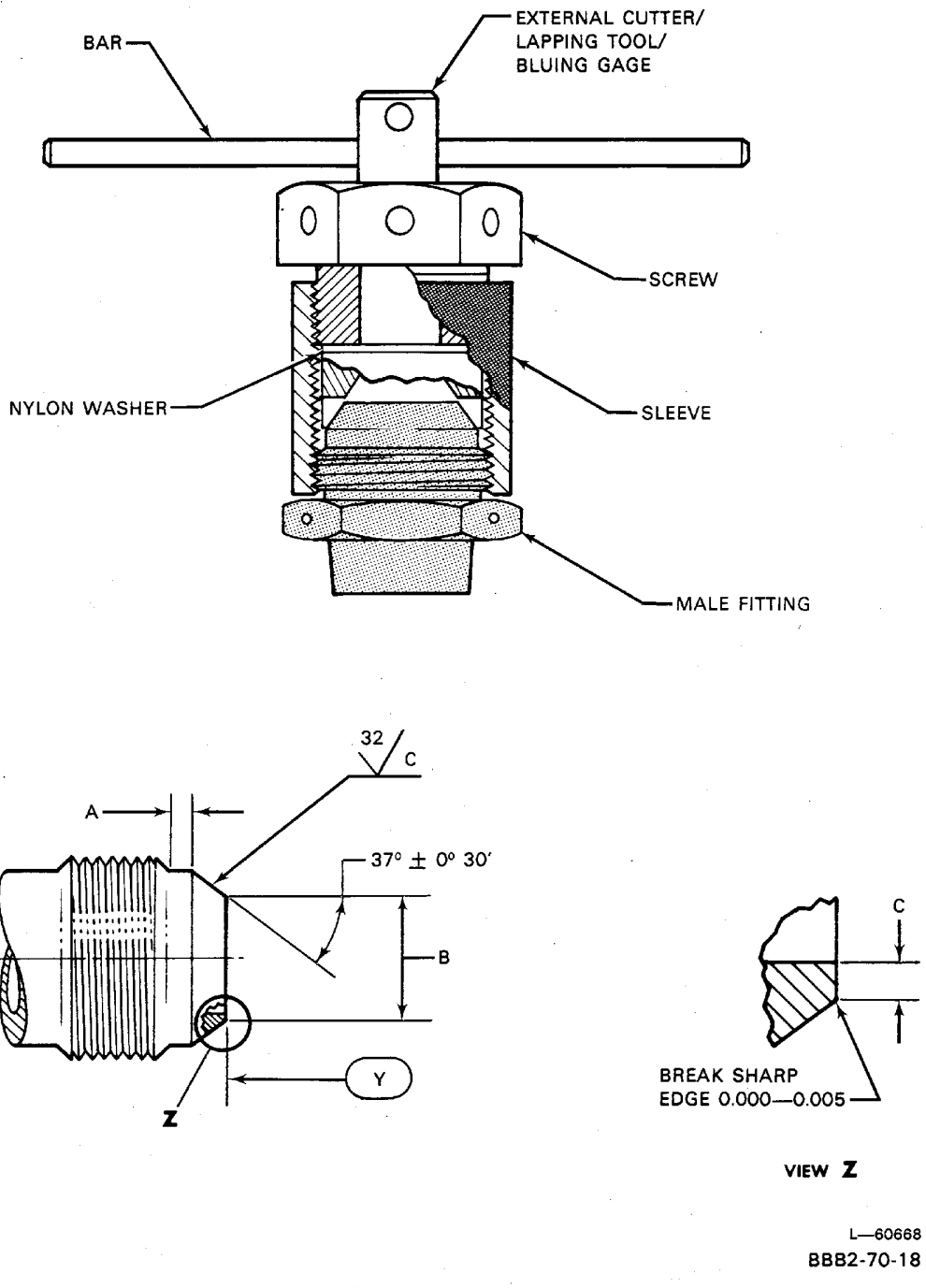
Fine Thread Series			Coarse Thread Series		
Mating Bolt Thread Size**	Max Locking Torque*	Min Break-away Torque	Mating Bolt Thread Size**	Max Locking Torque*	Min Break-away Torque
.112 –48NF–2A	3	0.5	.112 –40NC–2A	3	0.5
.138 –40NF–2A	6	1.0	.125 –40NC–2A	4	1.0
.164 –36NF–2A	9	1.5	.138 –32NC–2A	6	1.0
.190 –32UNF–3A	13	2.0	.164 –32NC–2A	9	1.5
.250 –28UNF–3A	30	3.5	.190 –24UNC–3A	13	2.0
.3125–24UNF–3A	60	6.5	.250 –20UNC–3A	30	4.5
.375 –24UNF–3A	80	9.5	.3125–18UNC–3A	60	7.5
.4375–20UNF–3A	100	14.0	.375 –16UNC–3A	80	12.0
.500 –20UNF–3A	150	18.0	.4375–14UNC–3A	100	16.5
.5625–18UNF–3A	200	24.0	.500 –14UNC–3A	150	24.0
.625 –18UNF–3A	300	32.0	.5625–12UNC–3A	200	30.0
.750 –16UNF–3A	400	50.0	.625 –11UNC–3A	300	40.0
.875 –14UNF–3A	600	70.0	.750 –10UNC–3A	400	60.0
1.000 –14NF–3A	800	92.0	.875 –9UNC–3A	600	82.0
1.125 –12UNF–3A	900	117.0	1.000 –8UNC–3A	800	110.0
1.250 –12UNF–3A	1000	143.0	1.125 –8UNC–3A	900	137.0

*Installation or removal.

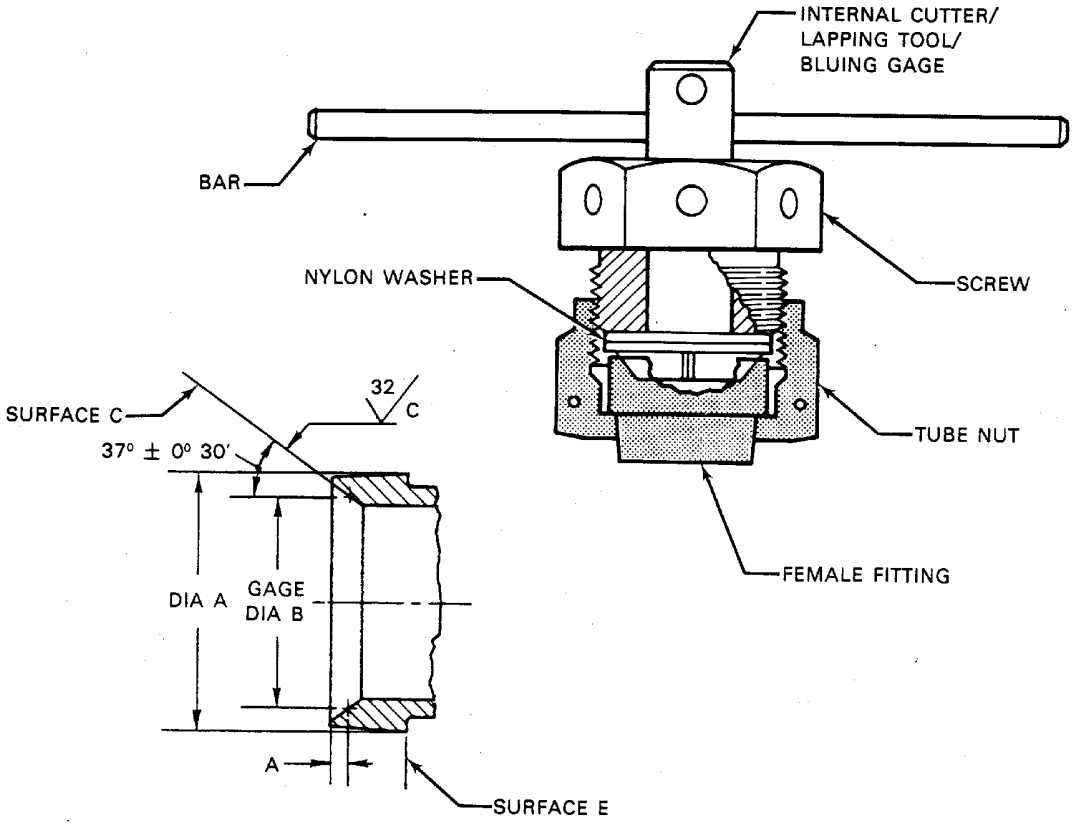
**Use the listed bolt sizes for torque testing cadminum plated nuts, carbon steel nuts, allow steel nuts, and aluminum nuts.

L—18667
BBB2-70-17

Torque Limits For Reuse of Self-Locking Nuts, Bolts and Helicoil Inserts (Inch-Pounds at Room Temperature and Lubricated with Engine Oil)
Figure 217/70-00-00-990-816



Tube Male Connector Conical Seat Repair
Figure 218/70-00-00-990-817



NOMINAL TUBE OD	THREAD	DIA A REF	DIA B GAGE	A MAX	PWA TOOL NO
0.250	0.4375 –20	0.380–0.383	0.242	0.054	18810
0.3125	0.500 –20	0.442–0.445	0.302	0.053	18811
0.375	0.5625 –18	0.499–0.502	0.358	0.049	18812
0.4375	0.625 –18	0.561–0.564	0.430	0.054	23444
0.500	0.750 –16	0.679–0.682	0.504	0.062	18813
0.5625	0.8125 –16	0.740–0.743	0.555	0.054	18814
0.625	0.875 –14	0.794–0.797	0.621	0.057	18815
0.750	1.0625 –12	0.969–0.972	0.769	0.072	18816
0.875	1.1875 –12	1.094–1.097	0.894	0.072	18817
					26608
1.000	1.3125 –12	1.219–1.222	1.021	0.073	18818
1.250	1.625 –12	1.531–1.534	1.299	0.092	18819

L—60667
BBB2-70-19

Tube Female Connector Conical Seat Connector
Figure 219/70-00-00-990-818

6. Identification Of Nuts And Bolts

A. General

CAUTION: USE PARTS THAT HAVE EITHER NO IDENTIFICATION OR THE MANUFACTURER'S OWN CODE IDENTIFICATION ONLY IN THE COLD SECTION OF THE ENGINE.

DO NOT USE PARTS WITH THE SAME MATERIAL CODE TOGETHER WITH PHYSICALLY SIMILAR PARTS THAT HAVE ANOTHER MATERIAL CODE.

USE ONLY NUTS AND BOLTS MADE OF SPECIAL HEAT RESISTANT ALLOYS IN THE HOT SECTION OF THE ENGINE. DO NOT USE HOT SECTION PARTS IN THE COLD SECTION OF THE ENGINE; DO NOT USE COLD SECTION PARTS IN THE HOT SECTION OF THE ENGINE.

DO NOT USE CADMIUM PLATED PARTS IN THE HOT SECTION OF THE ENGINE. CADMIUM PLATED PARTS MUST NOT TOUCH TITANIUM PARTS.

IF PARTS WITH CORRECT CODES ARE SERVICEABLE, INSTALL THEM IN THEIR ORIGINAL LOCATION DURING ASSEMBLY OF THE ENGINE OR ITS COMPONENTS. DO NOT ASSEMBLE A "C"-CODED PART IN AN "H"-CODED PART LOCATION; DO NOT ASSEMBLE AN "H"-CODED PART IN A "C"-CODED PART LOCATION.

DO NOT PUT PARTS FROM ONE ENGINE TOGETHER WITH THOSE FROM ANOTHER DURING DISASSEMBLY AND CLEANING.

(1) Permanent material codes used on engine hardware are important for the safety of the engine. Refer to the Illustrated Parts Catalogs for part numbers and the equivalent manufacturers numerical code identification.

B. The Material Code System Used on AN, MS, and AS/Company Parts

(1) The Letter Code (Prefix)

NOTE: The letter "E" in the material code system is used to show that a part is a standard AN, MS, or AS part with a six-digit part number.

The letter "E" is not used in the material code system for parts that are made by Pratt & Whitney.

- "EC" or "C" = Corrosion resistant steels
- "EH" or "H" = Heat resistant alloys for hot section parts
- "ET" or "T" = Titanium alloys
- "E" or "S" = Common temperature range alloys

NOTE: The prefix "E" is superseded by the prefix "S" in common temperature range material codes.

(2) The Number Code (Suffix)

(a) A one-or two-digit number follows the stamped or embossed letter code. Explanations of two example material codes, listed in the Materials Codes List are as follows:

ECI = Standard AN, MS, or AS engine parts made of AMS 5640 corrosion resistant steel.

H17 = Pratt & Whitney engine parts made of AMS 5649 heat resistant material.

(3) Location of Bolt and Nut Code Identification

(a) Bolt code identification will usually be found on the top of the bolt head. (Figure 220)

(b) Nut code identification will usually be found on one side of the hex. (Figure 220)

(4) New Code Identifications

(a) From time to time it will be necessary to add new code identifications. Refer to Special Materials in the Material Codes List.

(b) These new code identifications have the prefix "B" or "P" before the material code number. This is a temporary P&W code. Later, an "S", "C", "B" or "T" number will replace the temporary number. For example, refer to C15, H21, and T1 in the Material Codes List.

C. For lists of Common Temperature Range, Corrosion Resistant, Heat Resistant, Titanium or Titanium Alloy, and Special Materials, refer to the Material Codes List.

Table 201/70-00-00-993-802 MATERIAL CODES LIST

Material Code		Material Specification
Standard Parts AN, MS, AS	**Company Parts**	
COMMON TEMPERATURE RANGE MATERIALS		
E1	S1	AMS 6282, AMS 6320, AMS 6357, AMS 6535
E2	S2	AMS 7225
E3	S3	AMS 4121, AMS 4135, AMS 4153
E4	S4	AMS 5061
E5	S5	AMS 5045
E6	S6	AMS 6357 (Now E1/S1)
E7	S7	AMS 6280, AMS 6281, AMS 6355, AMS 6530, AMS 6550
E8	S8	AMS 6327, (Now E11/S11)
E9	S9	AMS 5024
E10	S10	AMS 5040
E11	S11	AMS 6322, AMS 6323, AMS 6325, AMS 6327, AMS 6358
E12	S12	AMS 4037, AMS 4120, AMS 4152
E13	S13	AMS 4045, AMS 4122, AMS 4139, AMS 4154
E14	S14	AMS 4152 (Now E12/S12)
E15	S15	AMS 4153 (Now E3/S3)
E16	S16	AMS 4154 (Now E13/S13)
E17	S17	AMS 5060
E18	S18	AMS 5062
E19	S19	AMS 5120
E20	S20	AMS 5121
E21	S21	AMS 6324
E22	S22	AMS 6328
E23	S23	AMS 6350, AMS 6370, AMS 6371
E24	S24	AMS 6352 (Non-current), AMS 6365, AMS 6372

Table 201/70-00-00-993-802 MATERIAL CODES LIST (Continued)

Material Code		Material Specification
Standard Parts AN, MS, AS	Company Parts	
E25	S25	---
E26	S26	AMS 6355 (Now E7/S7)
E27	S27	AMS 6358 (Now E11/S11)
E28	S28	AMS 6323 and AMS 6371 (Now E23/S23)
E29	S29	---
E30	S30	AMS 6381, AMS 6382
E31	S31	AMS 6412, AMS 6413
E32	S32	AMS 6440, AMS 6441
E33	S33	AMS 4500
E34	S34	AMS 6359, AMS 6415
E35	S35	---
E36	S36	AMS 6300 (Non-current)
E37	S37	AMS 6304, (Was PWA 722, P5), AMS 7454, AMS 7455, AMS 7458
E38	S38	AMS 6418
E39	S39	AMS 6485
E40	S40	AMS 4003
E41	S41	AMS 4150
E42	S42	AMS 4352
CORROSION RESISTANT MATERIALS		
EC1	C1	AMS 5640
EC2	C2	AMS 5628
EC3	C3	AMS 5515, AMS 5516, AMS 5517, AMS 5518, AMS 5519, AMS 5636 (Was EC5/C5), AMS 5637, AMS 7472
EC4	C4	AMS 7228
EC5	C5	AMS 5636 (Now EC3/C3)
EC6	C6	AMS 5354, AMS 5508, AMS 5616, AMS 7470
EC7	C7	AMS 5610
EC8	C8	AMS 5504 (Was EC11/C11), AMS 5612, AMS 5613
EC9	C9	AMS 5624
EC10	C10	AMS 5513, AMS 5560, AMS 5565, AMS 5566, AMS 5639
EC11	C11	AMS 5504 (Now EC8/C8)
EC12	C12	AMS 5738

Table 201/70-00-00-993-802 MATERIAL CODES LIST (Continued)

Material Code		Material Specification
Standard Parts AN, MS, AS	**Company Parts**	
EC13	C13	AMS 5630
EC14	C14	AMS 5643
EC15	C15	AMS 5625 (Was P10)
EC16	C16	AMS 5506, AMS 5620 (Was P3), AMS 5621
EC17	C17	AMS 5644 (Inactive for New Design)
EC18	C18	AMS 5743
Heat Resistant Materials		
EH1	H1	AMS 7229
EH2	H2	AMS 7232
EH3	H3	AMS 5526, AMS 5527 (Inactive for New Design), AMS 5721 (Inactive for new Design), AMS 7476
EH4	H4	AMS 5642
EH5	H5	AMS 5512, AMS 5571, AMS 5646
EH6	H6	AMS 5733 (Inactive for New Design) (Was PWA 746)
EH7	H7	AMS 5510, AMS 5557, AMS 5559, AMS 5570, AMS 5576, AMS 5645
EH8	H8	AMS 5524, AMS 5648
EH9	H9	AMS 5540, AMS 5580, AMS 5665
EH10	H10	AMS 5667 (Now EH14/H14)
EH11	H11	AMS 5521, AMS 5572, AMS 5651
EH12	H12	AMS 5522 (Inactive for New Design), AMS 5652
EH13	H13	(Now EH3/H3)
EH14	H14	AMS 5542, AMS 5667 (Was EH10/H10), AMS 5668
EH15	H15	Chromel
EH16	H16	Alumel
EH17	H17	AMS 5649
EH18	H18	AMS 5532, AMS 5768
EH19*[1]*	H19**[1]	AMS 5525, AMS 5731, AMS 5732, AMS 5734,
		AMS 5736, AMS 5737, AMS 7481
EH20	H20	AMS 5511, AMS 5647
EH21	H21	AMS 5754 (Was P19)
EH22	H22	AMS 5530, AMS 5750 (Inactive for New Design)
EH23	H23	AMS 5545, AMS 5712, AMS 5713, AMS 7469

Table 201/70-00-00-993-802 MATERIAL CODES LIST (Continued)

Material Code		Material Specification
Standard Parts AN, MS, AS	**Company Parts**	
EH24	H24	AMS 5551, AMS 5756, and AMS 5757 (All Inactive for New Design)
EH25	H25	AMS 5660, PWA 1003 (Was PWA 1002, P11)
EH26	H26	AMS 5706, AMS 5708 (Was PWA 90), AMS 5709 (Was P15), AMS 7471, PWA 686, PWA 687 (Was CF236, P18), AMS 5707 (Was PWA 1004)
EH27	H27	AMS 5759
EH28	H28	AMS 5662, PWA 1009
EH29	H29	AMS 5666 (Was P28)
Titanium or Titanium Alloy Materials		
ET1	T1	AMS 4921 (Was P8)
ET2	T2	AMS 4923
ET3	T3	AMS 4925
ET4	T4	AMS 4927
ET5	T5	AMS 4928 (Was PWA 682, P12), AMS 4967, AMS 7461
ET6	T6	AMS 4929
SPECIAL MATERIALS		
---	B7	ASTM A 193 Grade B7
---	B16	ASTM A 193 Grade B16
---	B660	ASTM A 453 Grade B660
---	P3	AMS 5620 (Now EC16/C16)
---	P5	PWA 722 (Now AMS 6304, E37/S37)
---	P8	AMS 4921 (Now Et1/T1)
---	P9	AMS 6302 (Inactive)
---	P10	AMS 5625 (Now EC15/C15)
---	P11	PWA 1002 (Now PWA 1003, EH25/H25)
---	P12	PWA 682 (Now AMS 4928, ET5/T5)
---	P15	AMS 5709 (Now EH26/H26)
---	P18	CF236 (Now EH26/H26)
---	P19	AMS 5754 (Now EH21/H21)
---	P20	PWA 1202
---	P21	PWA 1010
---	P23	AMS 7477
---	P24	AMS 7461

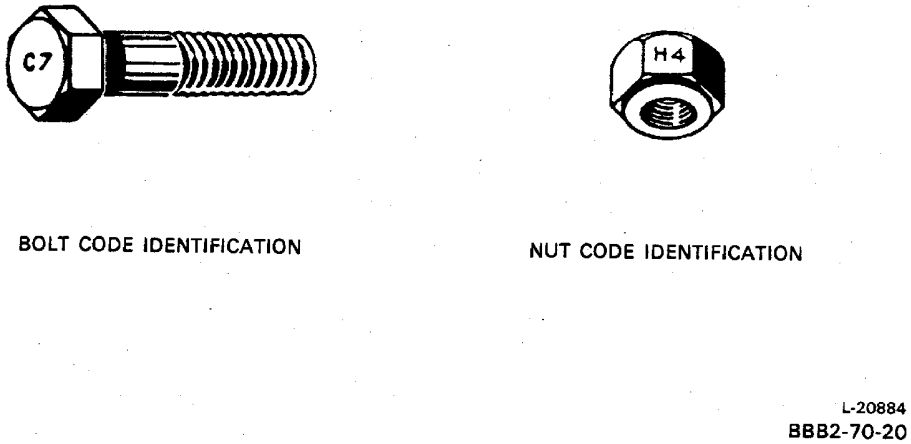
Table 201/70-00-00-993-802 MATERIAL CODES LIST (Continued)

Material Code		Material Specification
Standard Parts AN, MS, AS	Company Parts	
---	P25	PWA 91
---	P26	PWA 1006, PWA 1008, PWA 1013
---	P27	AMS 7236
---	P28	AMS 5666 (Now EH29/H29)
---	P29	PWA 92, AMS 5828
---	P30	AMS 5758

*[1] or Knurl (A knurl on the washer face diameter is sometimes used on double hex castellated nuts for material identification instead of the code.

D. Stainless Steel Bolts With Reduced Pitch Diameters

(1) At engine manufacture, it is the practice to provide bolts with reduced pitch diameter for use in the hot sections of the engines. This will minimize the possibility of bolt and nut seizure. This is standard practice for locations where the parts are subjected to temperatures in excess of 500°F (260°C).



Bolt and Nut Code Identification
Figure 220/70-00-00-990-819

7. Installation of Preformed Packing and Jamnut Type Connector (Universal Fittings)

A. Install jamnut type connectors as follows: (Figure 221)

WARNING: FAILURE TO ACCOMPLISH INSTALLATION PER INSTRUCTIONS MAY RESULT IN SUBSEQUENT FAILURE, FIRE, EXTENSIVE DAMAGE AND LOSS OF LIFE.

(1) Coat male threads of fittings, preformed packing and backup ring with PMC 9609 Petrolatum, P06-053 (PWA 36500) Seal Ring Lubricant or jet engine oil. Plastic packing requires no lubrication.

It is optional to use petrolatum as a replacement for P06-053 (PWA 36500) Seal Ring Lubricant, but it is better to use the seal ring lubricant. Use petrolatum only if seal ring lubricant is not available.

(2) Assemble nut on fitting with counterbored face toward engaging end.

WARNING: USE OF LEATHER BACKUP RINGS HAS BEEN DISCONTINUED TO PREVENT POSSIBILITY OF FUEL LEAKAGE.

(3) Work packing into nut counterbore.

(4) Install preformed packing on non-threaded annulus of fitting.

(5) Turn nut down until preformed packing is positioned in annulus firmly against threads to be installed in mating part.

(6) Install fitting into mating part, turning nut with fitting until preformed packing contacts mating part boss. This point can be determined by increasing torque. With fitting in this position and while holding nut to prevent its turning, screw fitting into mating part an additional one and one-half turns.

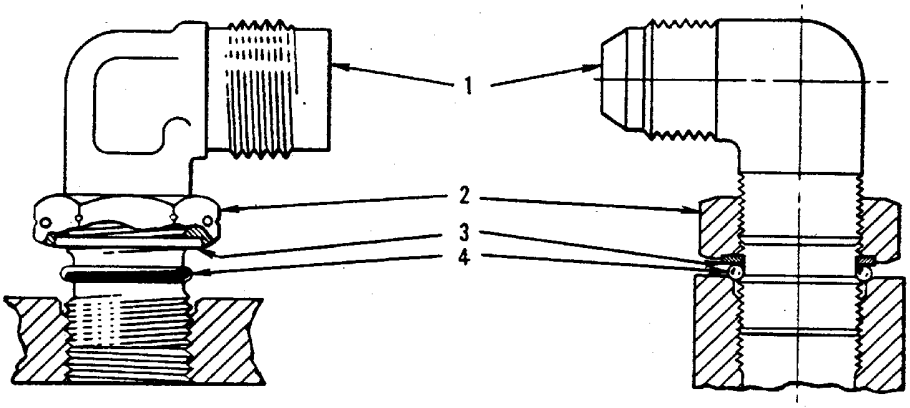
NOTE: From this point, fitting can be turned inward to a maximum of one additional turn for alignment purposes. If fitting tightens in nut before completing one and one-half turns or before fitting can be aligned, it is permissible for nut to turn with fitting for remainder of distance.

(7) With fitting held in properly aligned position, tighten jamnut to recommended torque and lockwire.

(8) Metal to metal contact between nut and mating part boss must be obtained without exceeding recommended torque values and no extrusion of preformed packing or backup ring is permitted. It is essential that proper values based on metal to metal contact mentioned above be observed when tightening jamnut. This will minimize possibility of fitting loosening and resultant thread wear.

B. Recommended torque limits and thread protrusion limits for various fitting are outlined in Figure 222. Measure thread protrusions as shown in Figure 221.

C. Figure 223 should be consulted before and/or after installation of fittings to prevent and/or correct leakage at various fittings.

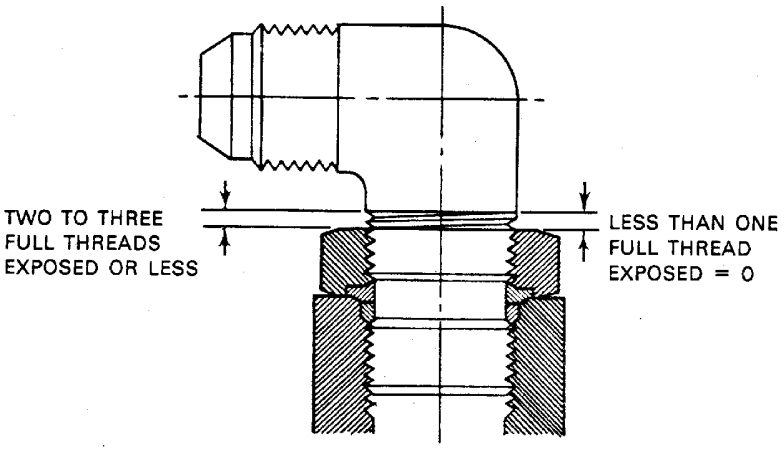


1. CONNECTOR ELBOW
2. JAMNUT
3. PACKING
4. SEAL

INITIAL CONTACT BETWEEN SEAL AND HOUSING

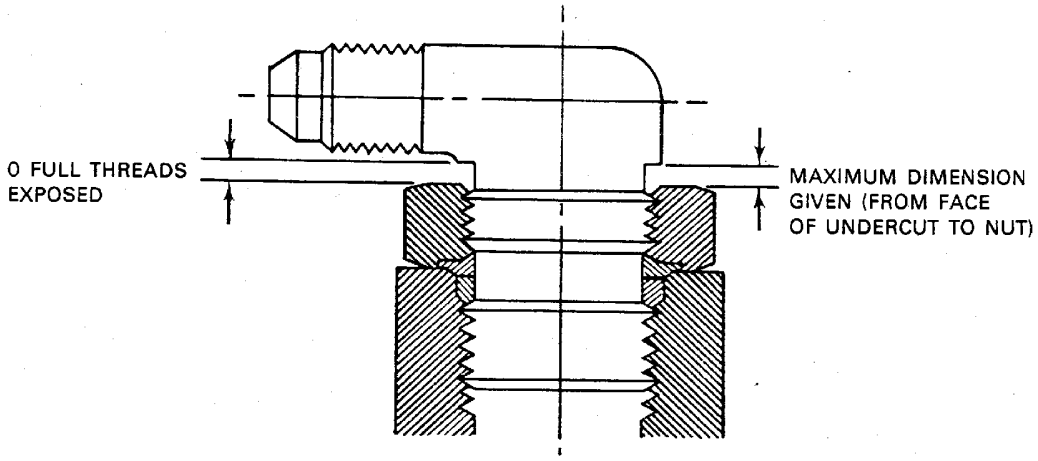
L-29972
5—75
BBB2-70-21

Jamnut Type Connector and Fitting
Figure 221/70-00-00-990-820 (Sheet 1 of 2)



A
TYPICAL POSITION AFTER
INSTALLATION (STANDARD FITTING)

$$\left(\text{THREADS EXPOSED} = \frac{0+1}{2} = 1/2\right)$$



B
TYPICAL POSITION AFTER
INSTALLATION (UNDERCUT FITTING)

L-7523
5—75
BBB2-70-22

Jamnut Type Connector and Fitting
Figure 221/70-00-00-990-820 (Sheet 2 of 2)

8. Assembly of Flexible Type Fittings

A. Flexible Fitting, Packing, and Retainer (Figure 224)

(1) Moisten rubber seal with PMC 9609 Petrolatum, P06-053 (PWA 36500) Seal Ring Lubricant or engine oil and install on tube end against ferrule. It is optional to use petrolatum as a replacement for P06-053 (PWA 36500) Seal Ring Lubricant, but it is better to use the seal ring lubricant. Use petrolatum only if seal ring lubricant is not available.

(2) Install retainer on tube positioning against packing or seal. Minimize stretching of retainer to ensure tight fit.

(3) Install tube to properly aligned connector and tighten nut to recommended torque.

CAUTION: IF RETAINER IS NOT USED, PACKING OR SEAL MAY PRO-TRUDE BETWEEN TUBE AND CONNECTOR AND PIECES OF RUBBER MAY ENTER SYSTEM.

B. Flexible Fitting, Lock, and Stopnut (Figure 225)

(1) Back off stopnut, install key washer on coupling nut, then install packing per Paragraph 8.A.(1).

(2) Position stopnut against stop on tube ferrule, then tighten stopnut fingertight on coupling nut. Back off one-half turn to next slot on stopnut and bend tabs of key washer to clinch stopnut.

(3) Check thread engagement between stopnut and coupling nut. Thread engagement must be to extent that a number 60 wire will not pass through the 0.063 inch diameter hole (both walls) of stopnut.

CAUTION: BEFORE TIGHTENING TUBE COUPLING NUTS BE SURE THAT ELBOWS ARE PROPERLY ALIGNED. TUBE ENDS MUST BE CENTERED AT THE ELBOWS AND BE FREE TO MOVE. BINDING OF TUBE AND FITTING OR MISALIGNMENT MUST NOT BE PRESENT.

C. Installation of Elbow Type Fittings

THREAD PROTRUSION AND TORQUE LIMITS

THREAD SIZE	TORQUE LIMITS	FITTING PART NUMBERS	THREAD PROTRUSION LIMITS*
1.625-12	600-900	332627, 462254	0.166" MAX FROM UNDERCUT
1.3125-12	500-700	183649	0-1
		226110, 227470, 323462	1/2 — 2-1/2
		170987 (WITH THREAD UNDERCUT)	1/2 — 1-1/2
		170987 (WITHOUT THREAD UNDERCUT)	2-3
1.0625-12	300-500	307450, 317408	0-1
		226112	1-2
		418842	5-8
0.875-14	200-350	321677	1-2
0.750-16	150-250	278121	0.100" MAX FROM UNDERCUT
		218217, 331583	0.234" MAX FROM UNDERCUT
		155974, 321675	1-2
		150697, 227456	2-3
0.5625-18	75-125	229161	1-2
0.500-20	60-80	222172, 265050	1/2 — 1-1/2
		303035, 315335, 363010	1-2
		431952	0.105" MAX FROM UNDERCUT
0.4375-20	40-65	240875	1/2 THREAD MAX
		168974, 170493, 237346	0-1
		243308, 252790, 331097, 433116, 454210	0-1
		164433, 224877	1/2 — 1-1/2
		266284	1/2 — 1-1/2
		210247	2-3
0.375-24	30-50	274359	1-3

* Limits shown are "Full Threads" exposed on the fitting, beyond the jamnut. A full thread is defined here as a thread crest with a complete root radius on each side of it.

High limit on thread protrusion is set to be sure that at least three full lower threads of fitting are engaged under all tolerance conditions. Thread protrusions below low limit indicate possible connection faults associated with fittings installed too deep (Seal or packing omission or extrusion, very loose nut, or inadequate seal annulus). If fitting is found to have too many threads exposed upon periodic service check, fitting must be removed and reinstalled. If there are still too many threads exposed, fitting must have extreme tolerances and if installation procedure was followed correctly, proper thread engagement may be assumed.

L-19071
BBB2-70-23

Thread Protrusions and Torque Limits
Figure 222/70-00-00-990-822

UNSATISFACTORY CONNECTION CONDITIONS AND METHODS OF PREVENTION

CONDITION	POSSIBLE RESULT	INSPECTION INDICATION
1. No Packing and/or seal	Leakage	Possibly beyond Thread Limits or Leakage Check
2. Inadequate Seal Groove - Fitting too deep	Leakage	Too few threads protruding or visible packing extrusion
3. Inadequate Seal Groove - Fitting too high	Leakage or See No. 4	Too many threads protruding
4. Insufficient lower thread engagement	Lower thread failure	Too many threads protruding
5. Loose Nut - Nut Under-torqued	Vibration failure of Lower threads	Test torque, or too few threads protruding or no metal to metal contact
6. Seal or packing Extrusion	See No. 5 (Torque lost due to relaxation of pinched packing)	No metal to metal contact or visible extrusion
7. Re-use of seals, repositioning of fitting after tightening nut	Leakage	Leakage Check

L-7522

BBB2-70-24

Fitting Inspection Chart
Figure 223/70-00-00-990-823

9. Antigalling and Anti-seize Compounds

A. General

(1) This task provides the general instructions for the application of approved antigalling and anti-seize compounds.

B. Consumable Materials

Name and Number	Manufacturer
(P03-002) Lubricating Oil (Mil-L-6081) (PMC 9852)	
(P06-009) Anti-seize Compound (PMC 9523)	
(P06-017) Anti-seize Lubricant (PWA 541)	
(P06-038) Antigallant Compound (PWA 36545-3)	

C. Procedure - General Information

CAUTION: IT IS TO APPLY ANTIGALLING AND ANTI-SEIZE COMPOUNDS IN A SMOOTH, THIN LAYER AND TO FULLY REMOVE ALL MATERIAL THAT IS NOT NECESSARY. THIS REMOVAL PREVENTS CONTAMINATION IN OR ON PARTS, PASSAGES, OR SURFACES WHERE THE MATERIAL CAN CAUSE MALFUNCTION OR EVEN FAILURE OF THE ENGINE.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Use antigalling and anti-seize compounds only when they are specified in assembly instructions.

(3) When necessary, you can apply anti-seize compounds at assembly as an aid in the disassembly of some hot section and free turbine threaded fittings. Apply such compounds only when specified by assembly or maintenance instructions.

(4) Use penetrating oils or fluids at disassembly as an aid in the removal of screws, nuts, and bolts (Paragraph 2.A.(3)).

(a) Apply one of the materials as follows:

- (P03-007) Penetrating Oil (PMC 9534)
- (P03-015) Penetrating Fluid (PMC 9545)
- (P03-016) Penetrating Fluid (PMC 9503)
- (P03-017) Penetrating Oil (SPMC 188).

NOTE: Penetrating oil prevents damage (for example, breaking or stripping) of the fastening hardware.

(5) Do not apply oil if you applied an antigalling or anti-seize compound during a repair or an assembly procedure.

D. Procedure - Materials

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) (P06-017) Anti-seize Lubricant (PWA 541) a mixture of molybdenum disulfide powder and grade 1010 oil, is satisfactory to use in some assembly procedures when specified. The make-up of (P06-017) Anti-seize Lubricant (PWA 541) follows:

(a) Fully mix the Anti-seize Compound (molybdenum disulfide powder) and Lubricating Oil (grade 1010) in these proportions:

1) (P06-009) Anti-seize Compound (PMC 9523): 80% ± 3% by weight.

2) (P03-002) Lubricating Oil (PMC 9852): 20% ± 3% by weight.

(b) Continue to mix until the lubricant is smooth and without lumps, cakes, skins, and grit.

(c) Keep the lubricant in a closed containers to prevent contamination.

(3) Heat can cause a yellow-white color to show on bolts, brackets, nuts and nut plates that have a layer of molybdenum disulfide-type dry film lubricants on them.

NOTE: (P06-038) Antigallant Compound (PWA 36545-3) is an example of a molybdenum disulfide-type dry film lubricant.

(a) This yellow-white color occurs because the molybdenum disulfide lubricant in the antigalling compound oxidizes to a molybdenum trioxide compound.

(b) This oxidation can start as low as 750° F (399° C) but increases quickly at temperatures higher than 900° F (482° C).

(c) The molybdenum trioxide compound is not harmful to the structure or function of the parts.

(d) Pratt & Whitney laboratory analysis tests show that this compound does not cause corrosion.

E. Torque Requirements

(1) The torque values, shown in Standard Torques Paragraph 3., include limits for parts lubricated with anti-seize compounds.

F. Restrictions

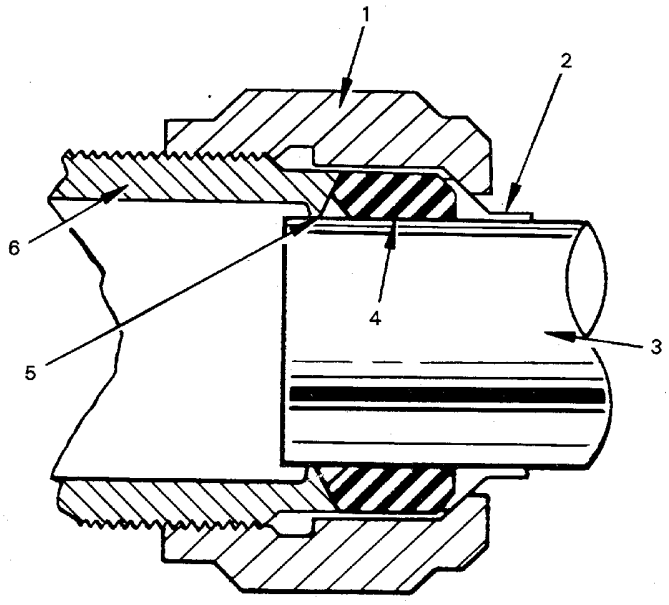
(1) Unless otherwise specified, anti-seize or antigalling compounds must not be used at the following locations.

(a) All face splines.

(b) All main rotor disk, hub, and spacer tight fits.

(c) Conical seats.

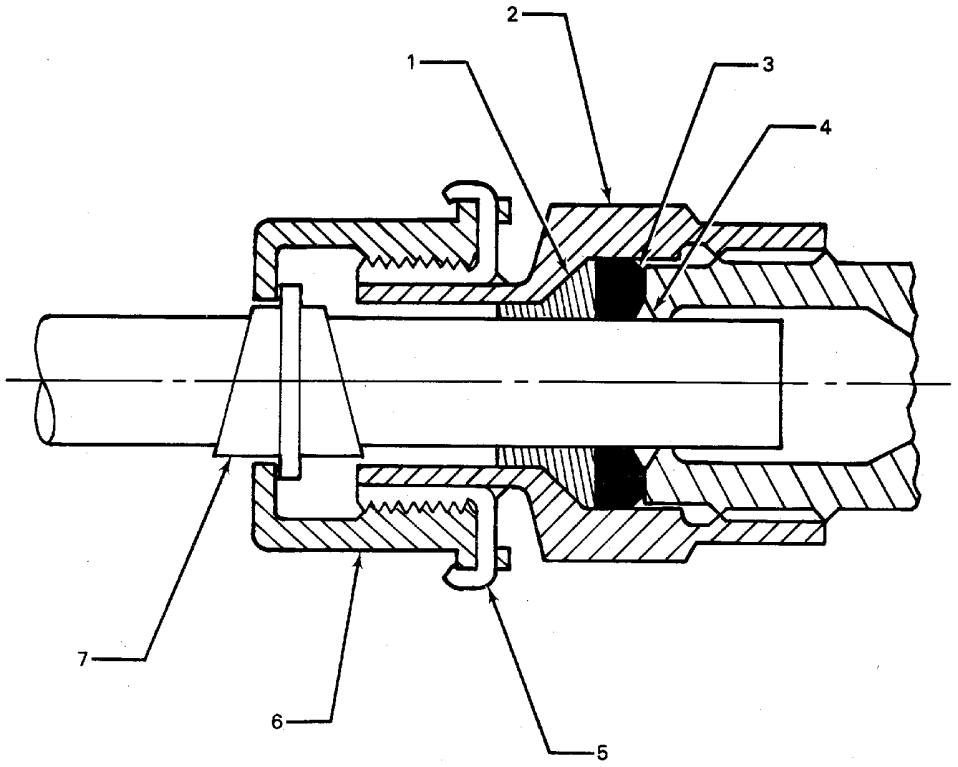
(d) Fuel fittings.



1. NUT
2. FERRULE
3. TUBE
4. PACKING OR SEAL
5. RETAINER
6. CONNECTOR

L-23237
6—75
BBB2-70-25

Assembly of Flexible Fitting, Packing, and Retainer
Figure 224/70-00-00-990-824



1. FERRULE
2. COUPLING NUT
3. PACKING
4. RETAINER
5. KEY WASHER (LOCK)
6. STOPNUT
7. TUBE FERRULE

L-25240
5—69
BBB2-70-26

Assembly of Flexible Fitting, Lock, and Stopnut
Figure 225/70-00-00-990-825

10. Gage Check

A. When a check procedure requires a very accurate measurement, a micrometer, vernier, or dial indicator must be used. If a micrometer is to be used, check it for accuracy before taking a measurement. Make sure that the contacting surfaces of the micrometer are clean and that the contacting surfaces of the part to be measured are clean and free from burrs. When using a depth micrometer, be sure to hold the anvil tightly and squarely against the contacting surface. If a dial indicator is used, make sure that the indicator support is firmly anchored and any swivel connections tightened securely.

B. When taking a measurement with a feeler gage, the final size of the feeler must be reasonably snug fit. Both the plug type and the flat type gages are used for measuring the amount of wear of liners and similar parts.

C. Except when otherwise stated, if the "no-go" end of a plug gage enters, the part is worn beyond the allowable limit. Because certain parts do not always wear evenly, the flat type gage must be tried at several different diameters. If the gage enters at any point, the part is worn beyond the allowable limit.

11. Periodic Check of Calibrated Tools

A. Suggested time intervals for monitoring the accuracy of the various types of tools used during engine check, repair and assembly. It is expected that individual departments or shop areas will adjust these time intervals to correspond more closely to actual tool usage. (Table 202)

Table 202/70-00-00-993-803 Periodic Tool Check

Tools	Time Intervals
Snap Gages (Special or Adjustable)	6 Weeks
Alignment Gages (Progressive Plug Type)	3 to 4 Weeks
Mounting Distance Gages	16 to 24 Weeks
Spacer Calculation Gages	16 to 24 Weeks
Flatness Checking Gages	3 to 4 Weeks
Stretch Gages	6 to 8 Weeks
Special Size Blocks Used as Width Gages	1 to 2 Weeks
Flushpin Gages or Depth Gages	6 to 8 Weeks
Reaming Fixtures	24 to 52 Weeks
Drilling Fixtures	24 to 52 Weeks
Spline Rings	12 to 16 Weeks
Runout Fixtures	24 to 52 Weeks
Oil Flow Target Fixtures	6 Months
Size Block Set	6 Months
Torque Wrenches - Set Type	1 Week
Torque Wrenches - Nonset Type	4 Weeks
Hydraulic Wrenches	4 Weeks
Cylinder Plugs	6 Weeks
Thread Plugs	2 Weeks

Table 202/70-00-00-993-803 Periodic Tool Check (Continued)

Tools	Time Intervals
Setting Rings	24 Weeks
Setting Disks	24 Weeks
Engine Weight and Flow Calibration Weight Scales	12 Weeks
"Last Word" Type Dial Indicators	3 Months
All Other Dial Indicators	6 Months
Horizontal Balancing Machines	1 Month
Vertical Balancing Machines	1 Month
Horizontal Balancing Fixtures, Hubs, Pulleys and Auxiliaries	3 Months
Vertical Balancing Fixtures and Auxiliaries Except Peg Plates	6 Months
Vertical Balancing Fixture Peg Plates	3 Months
Balancing Machine Test Weights	24 Weeks
Dowel or Stud Height Tools (Not Copper Flashed)	24 Weeks
Catalog Equipment Such as Micrometers, Verniers, Radius Gages, Steel Measuring Tapes, etc.	4 Weeks
All Final Dimension Tools, Fixtures, and Gages Which Are Not Listed Above	4 Weeks

12. Installation of Preformed Packings

NOTE: This task gives the general instructions for the lubrication and installation of preformed packings.

NOTE: Preformed rubber o-ring packings are referred to as packings.

A. Always obey the procedures and limits in the specific AMM maintenance tasks.

CAUTION: PREFORMED PACKINGS MUST BE COATED WITH THIN FILM OF LUBRICANT PRIOR TO ASSEMBLY. THIS LUBRICATION, PLUS PROPER ASSEMBLY, WILL PREVENT DAMAGE TO PACKINGS THAT COULD CAUSE ENGINE MALFUNCTION OR FAILURE.

CAUTION: DO NOT APPLY PETROLATUM TO PACKINGS USED IN FUEL OR OIL SYSTEMS. PETROLATUM DOES NOT DISSOLVE EASILY IN FUEL OR OIL AND CAN CAUSE BLOCKAGES IN SMALL PASSAGES AND CLOG FILTERS. CORRECT LUBRICATION AND ASSEMBLY WILL PREVENT DAMAGE TO THE PACKING THAT CAN CAUSE ENGINE DAMAGE OR A SHUTDOWN.

B. Apply the correct lubricant to each packing before engine assembly as follows:

(1) Find the material specification of the packing. This is often shown on the package.

(2) Determine the type of system (fuel, oil, or air) where the packing will be installed.

(3) Refer to Table 203 and select the necessary lubricant. Use only the lubricant specified for the packing material.

(4) Apply the necessary lubricant to each packing.

Table 203 Packing Lubricant Specification

Engine System	Packing Material and Specification	Lubrication Specification
Fuel	Fluorosilicone (AMS 7273)	(P03-001) Engine Oil (PWA 521) or (P06-053) Seal Ring Lubricant (PWA 36500)
Oil or Fuel	Fluorocarbon (AMS 7276, AMS 7278, AMS 7280)	(P03-001) Engine Oil (PWA 521) or (P06-053) Seal Ring Lubricant (PWA 36500)
Air or Water	Silicone (AMS 3301, AMS 3302, AMS 3303, AMS 3304, AMS 3305, AMS 3315, AMS 3320, AMS 3332, AMS 3334, AMS 3335, AMS 3336, AMS 3338, AMS 3345, AMS 3346, AMS 3356, AMS 3357, AMS 7267)	(P06-002) White Petrolatum (PMC 9609) See Note 1.
NOTE: Use only a small amount of (P06-002) White Petrolatum (PMC 9609) on silicone packings used in air systems. Hot air can move this lubricant into downstream components and cause contamination. Never use (P03-001) Engine Oil (PWA 521) on silicone packings.		

C. Instructions for the installation of preformed packings are as follows:

(1) Always use new packings at each assembly.

(2) Check the package for a date. This date is called the shelf life.

(a) Do not use packings that have gone past the shelf life date.

(b) If there is no date on the package, there is no shelf life.

(3) Apply a layer of specified lubricant to the O-ring before assembly.

(a) Use only the lubricants specified for the O-ring preformed packing material. Make sure that the O-ring has the lubricant material fully on it.

(4) Do a visual inspection of the O-ring mating surfaces and all other surfaces that the O-ring will touch during the installation. Make sure that there is no damage or sharp edges that could cause damage to the seal or a leak when it is installed.

(5) Make sure that the grooves and mating faces of engine parts are clean, smooth, and not damaged before you install packings.

(6) Push or slide the packing into position. Do not twist the packing when it is installed.

(7) Do not install packings on engine parts which are hot (hot parts will cause damage to a packing).

(8) Use an approved tool to install the packings on a part which has more than one packing groove (this is to prevent damage to the packing).

(9) Correctly align the mating parts when you assemble them to be sure not to accidently cut the packing. Always push parts with packings on to the mating part when they are installed. This will make sure that the part does not twist as it is installed and will prevent subsequent damage to the packing.

13. Installation and Handling of Ball and Roller Bearings

CAUTION: DO NOT TOUCH ENGINE BEARINGS WITH YOUR BARE HANDS. USE GLOVES TO PROTECT ENGINE BEARINGS. IF YOU DO NOT OBEY THIS CAUTION, DAMAGE TO BEARING CAN OCCUR.

A. Always obey specific procedures and limits in specific AMM maintenance tasks.

B. Wear a clean pair of gloves, made of an approved lint-free material, when handling bearings.

C. When assembling inner races of bearings on their mating shafts, it will be necessary to expand inner race by using controlled heating.

(1) You can heat the inner race of demountable bearings and complete bearing assembly of nondemountable bearings to necessary temperature by immersion in a controlled hot oil bath, or with an oven or induction heater.

(2) Check shafts and bearing races for size and trueness before heating to prevent abnormal fits.

D. It is important to keep area clean regardless of whether you use a hot oil bath, an oven, or induction heater.

E. Hot Oil Bath

(1) This use to be the typical heating method for bearings and other parts because of the anti-corrosion characteristics of oil. there are now environmental and safety concerns which make other methods a better choice.

(2) Be sure to put a cover on the oil tank to minimize contamination of the oil by airborne dirt and abrasives. It is important to change the oil and clean the tank regularly, as necessary.

(3) Do not permit bearings to rest on bottom of the tank because the settlings can cause contamination and the bearing temperature will be much greater than the indicated oil temperature. A heavy screen or series of rods extending at least 3 inches (76.2 mm) above the tank bottom will keep bearings surrounded by oil at a equal temperature and will permit any dirt to settle at bottom of tank.

(4) Use clean Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No. P03-019) in the hot oil bath with a temperature not exceeding 250°F (121°C) unless specified differently in the specific AMM maintenance task.

F. Oven

(1) An oven may not increase the temperature of the part as fast as an induction heater, but there is less potential to increase the temperature of the part too much. An oven gives an equal amount of heat to large or complex parts and thus minimizes distortion and thermal stress.

(2) A film of Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No. P03-019) must be on each part before it goes into the oven. Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No. P03-019) prevents corrosion before, during, and after assembly.

(3) The oven temperature must not be more than 250°F (121°C) unless specified differently in the specific AMM maintenance task.

G. Induction Heater

(1) A film of Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No. P03-019) must be on each part before the induction heater is used to increase the temperature of the part. Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No. P03-019) prevents corrosion before, during, and after assembly.

(2) An induction heater increases the temperature of a part quickly and does not have the environmental concerns of the hot oil bath, but to know how to get the correct temperature takes experience. Be sure to follow the manufacturers instructions, warnings, and cautions.

(a) PW has induction heater experience with units (Models TIH 020, TIH 050, TIH 100, and TIH 120) supplied by SKF Industries, units (Models 1x and 4x) supplied by Eddytherm and units (Foucault 22 ESD Swing Arm (PWA 89127)) by Foucault International Corporation.

(3) Magnetism can be induced by induction heaters. Therefore, after induction heating, be sure to examine bearings for any remaining magnetism as follows:

(a) Ball and roller bearings are at all times susceptible to magnetic adherence of small unwanted particles.

(b) Limits for remaining magnetism are ñ2 gauss.

(c) Demagnetize nonseparable bearings as assemblies. Slowly turn the inner and outer races in opposite directions when the bearing goes through the demagnetizer.

(d) Demagnetize separable bearings one component at a time.

(e) The components of disassembled bearing must be kept together.

(f) Remove bearing from the demagnetizer.

(4) There frequently is a degaussing feature built into the induction heater, but it may be inoperative (no indicating device to define if or when the degausser is functional or if there is a degausser feature).

(5) Bearing temperature must not be more than 250°F (121°C) unless specified differently in the Engine Manual. Be sure to wear insulated, clean, lint-free gloves when you touch heated bearings.

H. Handle the bearing as follows:

CAUTION: DO NOT TOUCH ENGINE BEARINGS WITH YOUR BARE HANDS. USE GLOVES TO PROTECT ENGINE BEARINGS. IF YOU DO NOT OBEY THIS CAUTION, DAMAGE TO BEARING CAN OCCUR.

(1) Do not touch the bearing with your bare hands.

(2) Put clean gloves on your hands.

(3) Put the bearing on a piece of clean bearing paper.

(4) Separate the outer race from the inner race.

(5) For separable bearings, verify that the serial numbers on the inner and outer races are the same.

I. Before you install the main bearings, wipe excess oil from the journals of the shaft, hub, or gear with a clean Lint Free Cotton Cloth (Material No. P05-005) and apply a lubricant, as specified in the AMM maintenance task. Force must not be used in the assembly of parts. If there is any difficulty, disassemble parts and examine them for burrs or other interference.

J. When a roller bearing is installed, turn the rollers with respect to the outer race. This will reduce the possibility of hang up of the rollers and will also increase the sensitivity of detection of the hang up.

K. Manufacturers number on bearing races must face the operator, as bearing is installed, unless specified differently in the specific AMM maintenance task.

L. Large spannernuts used to secure main bearings or seals to shafts and housings frequently have small burrs at spanner slots. These burrs can cause damage to the bearing surfaces and cause incorrect torques. Deburr spannernuts with this condition.

14. Installation of Key Washers

A. General

NOTE: This task gives the general instructions for the installation of the tab-type key washers and the installation of the cup-type key washers.

B. Key Washers (Tab-Type) Procedure

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Some key washers are pre-bent at manufacture.

(3) Use key washers only one time. Use a new key washer for each installation.

(4) Use the correct key washers as specified by the specific AMM maintenance task.

(5) Install key washers. (Figure 226)

(a) Install the key washer so the unbent keys are as far as possible from the axis of the part to be locked.

(b) The pre-bent key (Key B) must be tight to the overhanging surface as shown, or put against the side of the hole to prevent possible movement of the locked part.

(c) When you torque the fastener and bend the key washer, you must keep the key washer in the same position.

(d) If necessary, use a Marker or Pencil, as specified by MARKING PARTS (TEMPORARY AND PERMANENT) - MAINTENANCE PRACTICE, TASK 70-10-00, Page 201, to mark the position of the key washer so that you can see any movement out of position.

(e) Hold the key washer against the ant rotation surface in the loosen direction while you torque the fastener to the torque specified by the AMM maintenance tasks.

(f) Examine the pre-bent key (Key B) to make sure that it is not damaged.

(g) Bend external locking tabs of washer against nut. At least one tab shall be bent full against one flat of nut. Key washers not having external tabs, crimp side into mating nut slot 180 degrees apart.

1) You can bend the pre-bent key (Key B) at installation to meet the gap limits.

(h) Carefully bend all keys (Keys A) on the key washer so that it cannot be used again and that you do not cause cracks, gouges, or other damage.

(i) Bend at least one key (Key A) so that 75 percent or more of its width (as measured at the base of the key) engages the flat of the fastener (Dimension A).

(j) Bend all the keys (Keys A) so that the gap is within the limits which follow.

1) For fastener threads 0.3125 inch (7.938 mm) or less, Gap A is 0.010 in. (0.254 mm) or less.

2) For fastener threads more than 0.3125 in. (7.938 mm), Gap A is 0.020 in. (0.508 mm) or less.

(6) Install elliptical key washers as follows:

(a) After you torque the fasteners, bend the washer up across one whole face of the hexagon.

1) For fastener threads 0.3125 in (7.938 mm) or less, Gap A is 0.010 in (0.254 mm) or less.

2) For fastener threads more than 0.3125 in (7.938 mm), Gap A is 0.020 in (0.508 mm) or less.

(b) The previous requirements for key washers and elliptical key washers are applicable to the keys for each hole in a multiple-hole key washer.

(c) Key washers used with fuel nozzle nuts must not have the keys bent by impact.

(d) Examine the installed key washer as follows:

1) Make sure that a new key washer was installed.

2) Make sure that the keys are bent as previously specified.

3) Make sure that the keys are bent so that the key washer and fastener cannot move or turn to loosen.

4) Scoring, gouging, and smearing of the key washer or adjacent parts are not permitted.

5) Small tool marks from usual forming and bending procedures are permitted.

C. Key Washers (Cup-Type) Procedure (Figure 227)(Figure 228)

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Some key washers are pre-bent at manufacture

(3) Use key washers only one time. Use a new key washer for each installation.

(4) Use the correct key washers as specified by the specific AMM maintenance task.

(5) Crimping Tools

(a) Tool Requirements

1) The portion of the tool that forms the indentations must be spherically shaped and have a spherical radius of not less than 0.050 in (1.270 mm).

(b) Squeeze Action Tool

1) This tool forms indentations by pressing the cup-type key washer into slots in the nut or bolt. This type of tool is recommended and must be used where possible.

(c) Drift Type Tool

1) This tool consists of a ring with prongs on the inside diameter. This tool, when put over the cup-type key washer and moved in an axial direction, will form indentations on the outside diameter of the cup-type key washer.

(d) Punch

CAUTION: CUP TYPE KEYWASHERS USED WITH FUEL NOZZLE NUTS MUST NOT BE CRIMPED (DENTED) BY THIS PROCEDURE.

1) This tool will form indentations on the outside diameter of the cup-type key washer by the impact of the tool with a hammer.

(e) Position Control To Prevent Broken Or Bent Tabs

CAUTION: USE THE CORRECT MARKING PEN OR PENCIL. IF YOU DO NOT, THE MARK CAN HAVE A HARMFUL EFFECT ON THE MATERIALS.

1) To prevent broken or bent key washer tabs, you must mark the position of the cup-type key washer to the adjacent surface before you tighten and torque the nut.

2) Use an approved Marker or Pencil as specified in MARKING PARTS (TEMPORARY AND PERMANENT) - MAINTENANCE PRACTICE, TASK 70-10-00, Page 201. Mark the parts so that you can detect any turn of the key washer during the torque of the nut.

(f) Required Number Of Indentations

1) For cup-type key washers, you must bend the key washer in two or more places to give sufficient interference with the nut so that the nut will not turn. Refer to (Figure 227) and (Figure 228) for requirements.

2) After you tighten and torque the nut, you must indent the cup-type key washer in the correct number of places. Refer to Table 204 unless specified differently.

3) If the number of rounded slots in the nut or bolt is less than the necessary amount of indentations, the requirements of Table 204 do not apply.

4) If the key washer is the type shown in (Figure 228), the requirements of Table 204 do not apply.

Table 204. Required Number Of Indentations and Spacing

Thread Size	Number of Indentations	Spacing Between Indentations
Less Than 1.500 in. (38.100 mm)	2	See Figure 227 .
1.500 in. (38.100 mm) To Less Than 2.500 in. (63.500 mm)	4	60 deg - 120 deg
2.500 in. (63.500 mm) To Less Than 4.000 in. (101.600 mm)	6	6 Slot Nut 45 deg - 75 deg
	6	8 Slot Nut 45 deg - 90 deg*
4.000 in. (101.600 mm)And Larger	8	30 deg - 60 deg
* See Figure 227 for indentation spacing.		

5) For the cup-type key washers shown in (Figure 227) and (Figure 228), you must make the indentations as shown.

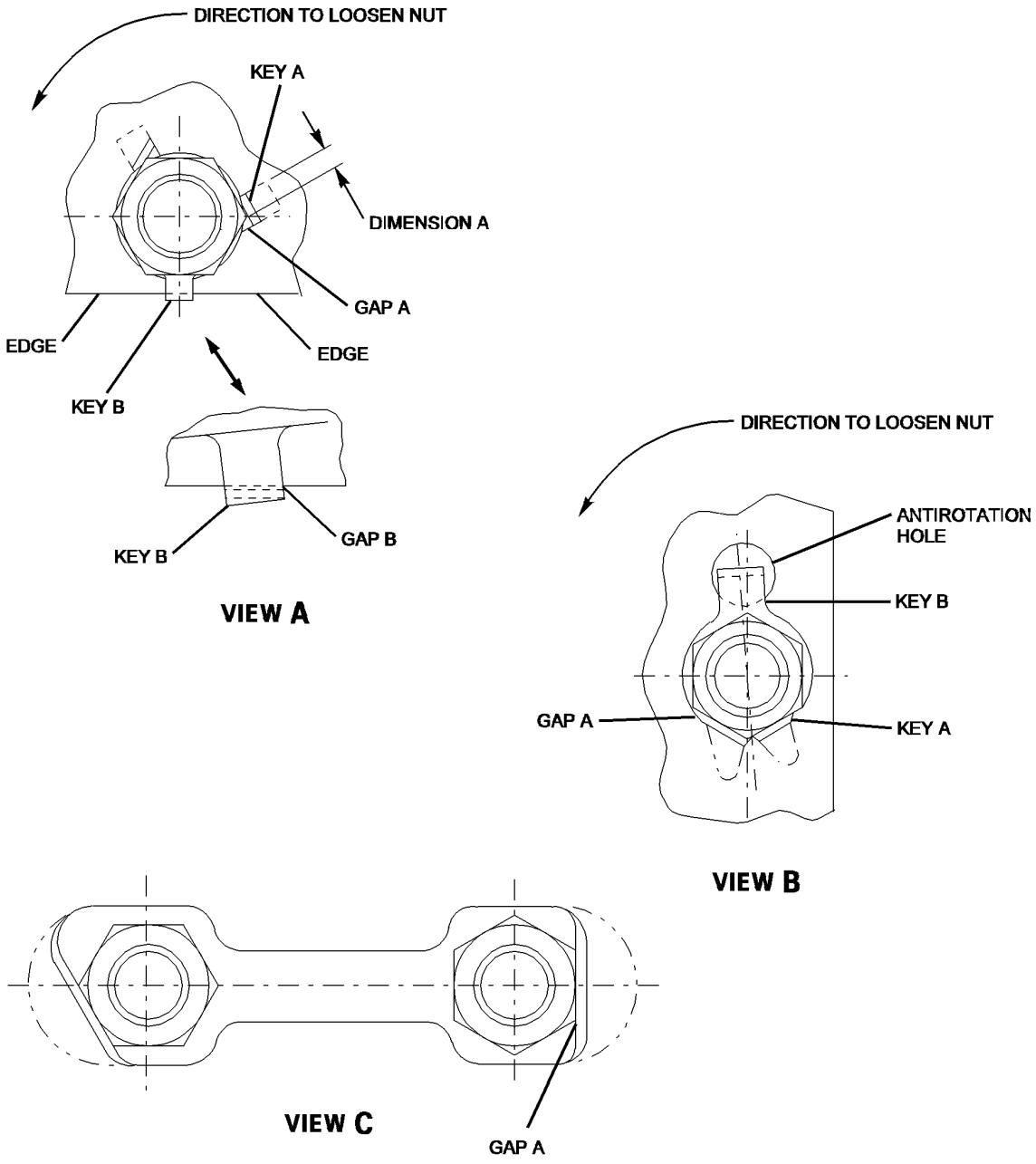
(g) Key Washer Engagement

Table 205 Required Engagement Measurements For Cup-type Key Washers

Thread Size	B Reference	C Minimum * Engagement
0.190 in. (4.826 mm)	0.043 in. (1.092 mm)	0.026 in. (0.660 mm)
0.250 in. (6.350 mm)	0.042 in. (1.067 mm)	0.025 in. (0.635 mm)
0.3125 in. (7.9375 mm)	0.040 in. (1.016 mm)	0.024 in. (0.610 mm)
0.375 in. (9.525 mm)	0.039 in. (0.991 mm)	0.023 in. (0.584 mm)
*C Minimum = 0.6 B		

(h) Examine the installed key washer as follows.

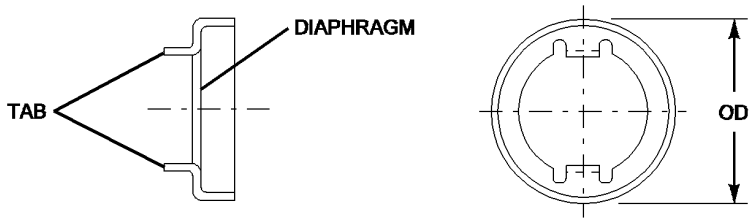
1) Make sure that a new key washer was installed.
2) Make sure the key washer is not loose and cannot shake or rattle.
3) Make sure the cup is bent as previously specified.
4) Make sure the key washer did not move during the assembly.
5) If there is no axial pinch on the diaphragm portion of the key washer, you can move the washer by hand through the limits of the tab clearance.
6) Cracking, tearing, scoring, gouging, and smearing of the key washer or adjacent parts are not permitted.
7) Small tool marks from usual forming and bending procedures are permitted.
8) Indentations in one key washer must be of similar size and shape.
9) Indentations in the key washer must be formed into the rounded slots in the nut where the nut has such slots.



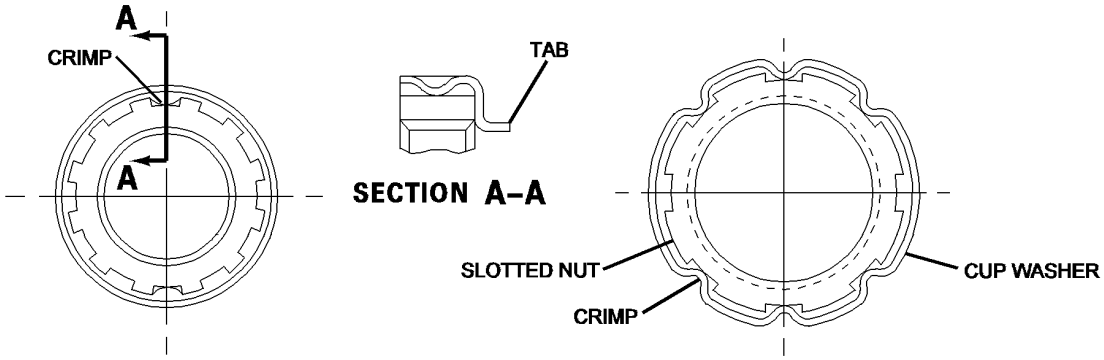
G-11810 (1002)
PW V

BBB2-70-28A
S0006553899V2

Installation of Key Washers (Cup-Type)
Figure 226/70-00-00-990-827

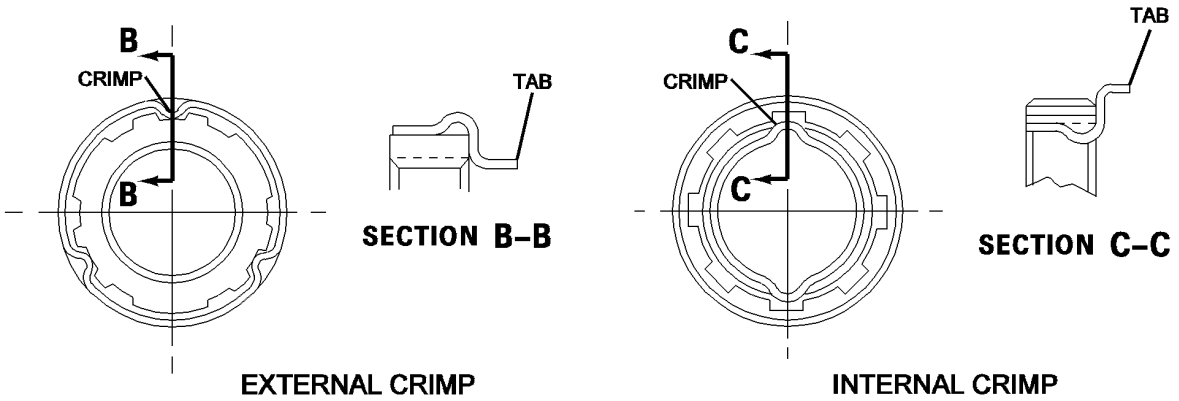


TYPICAL CUT-TYPE
KEYWASHER



SIX-INDENTATION
FOR NUTS WITH
EIGHT SLOTS

CRIMPING



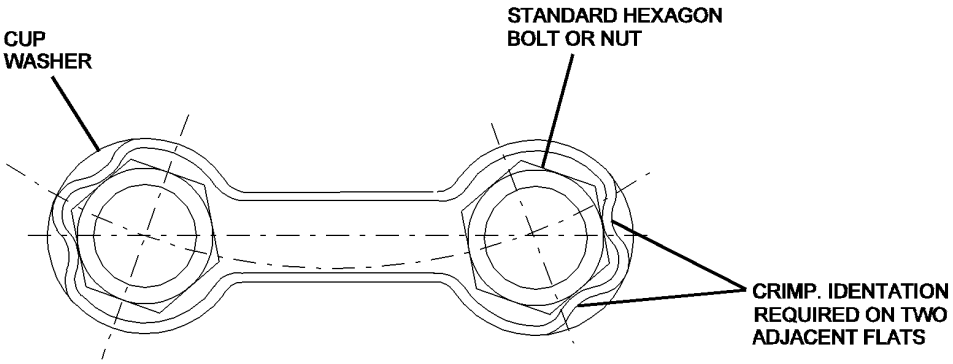
EXTERNAL CRIMP

INTERNAL CRIMP

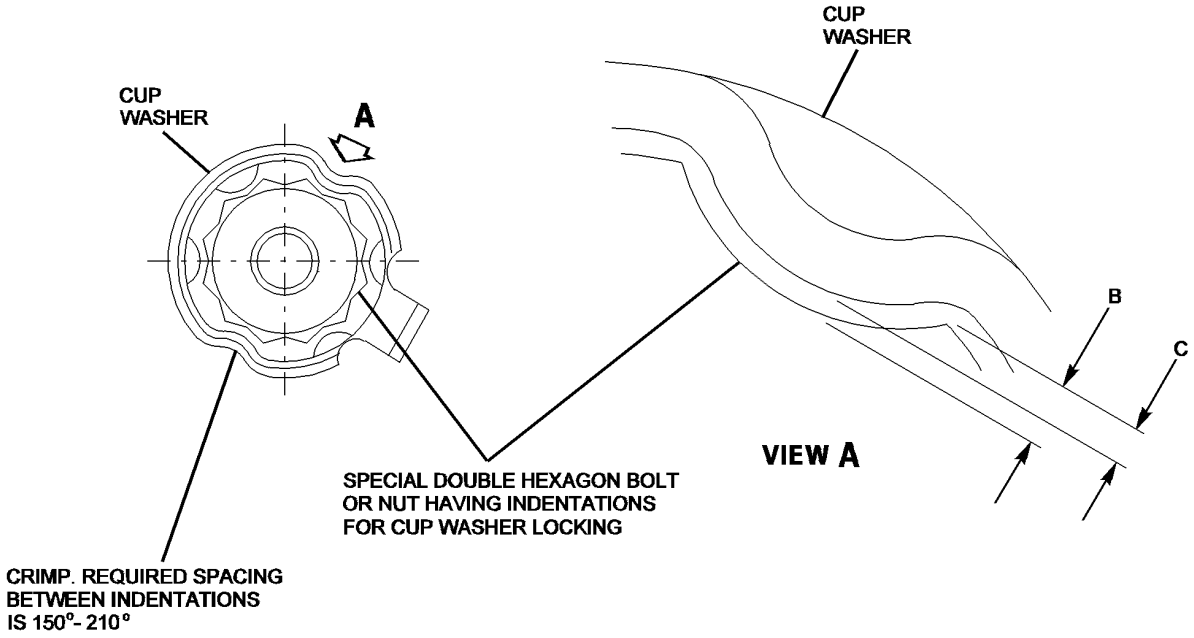
G-11808 (1002)
PW V

BBB2-70-27A
S0006553898V2

Installation of Key Washers (Tab-Type)
Figure 227/70-00-00-990-826



MULTI-HOLE CUP-TYPE CRIMP



SINGLE TAB CUP-TYPE
DIMPLE ENGAGEMENT

G-11809 (1002)
PW V

BBB2-70-29A
S0006553900V2

Installation of Key Washers (Cup-Type)
Figure 228/70-00-00-990-828

15. Lockwiring Procedures

A. Always obey the specific procedures and limits in the specific AMM maintenance tasks.

B. The term safety wire and lockwire are interchangeable.

C. The following are the different types of safety wire used:

(1) MS9226 (AMS 5687) and MS20995N (NASM20995) safety wires are Inconel 600 nickel safety wires, which are stiff and difficult to work with.

(2) AS3214 (AMS 5689, AISI 321) safety wire is a stabilized stainless steel safety wire that is not as stiff as the Inconel 600 wires and thus is easier to work with.

(3) MS20995C (NASM20995) and AMS 5697 are 304-series stainless steel safety wires that are used in applications where the temperatures are below 700°F (371°C).

D. Use the correct safety wire as specified in the specific AMM maintenance task.

E. Obey the maximum safety wire length limits which follow.

(1) The maximum length (span) of safety wire between two tension points is 6 in. (152 mm)) maximum, unless specified differently by the specific AMM maintenance task.

(2) The maximum length of safety wire used to safety multiple fasteners together in a series (3 or 4) is 24 in. (610 mm) maximum, unless specified differently by the specific AMM maintenance task.

F. Obey the maximum number of fasteners in a series limits which follow.

(1) Do not safety more than four fasteners in a series with one continuous length of wire, unless specified differently by the specific AMM maintenance task.

(2) If there are more than four fasteners in a series and the text or illustration specifies "Safety Wire Together", do the steps which follow.

(a) Divide this group into smaller groups of two, three, or four fasteners.

(b) Safety each of the smaller groups separately with safety wire.

(c) Safety the smaller groups in series with each other with safety wire.

G. Torque the parts before you install the safety wire as follows.

(1) All fasteners must be correctly torqued before you install the safety wire.

(2) For two or more fasteners safetied together, you must also put the wire holes in a correct position in relation to each other.

(3) To get the correct hole alignment, torque the fasteners to the limits for fasteners with wire holes. Refer to the specific AMM maintenance task or the Standard Torques (STANDARD PRACTICES - ENGINE - MAINTENANCE PRACTICES, 70-00-00/201)

(4) Do not decrease the torque less than the specified limit to correctly align the wire holes.

(5) Do not increase the torque more than the specified limit to correctly align the wire holes.

(6) If necessary, use another fastener or part to correctly align the wire holes within the specified torque limits.

H. Select the number of strands of the safety wire as follows.

(1) Use two strands of safety wire twisted together (double-twisted), unless specified differently by the specific AMM maintenance task.

(2) Use a single strand safety wire only where specified by the specific AMM maintenance task.

I. Examine the safety wire holes as follows.

CAUTION: DO NOT INSTALL THE SAFETY WIRE IN HOLES WITH BURRS OR SHARP EDGES. IF YOU DO, THE SAFETY WIRE CAN BREAK DURING ENGINE OPERATION.

(1) Examine the safety wire holes for burrs or sharp edges.

(2) Remove the burrs or sharp edges from the safety wire holes.

(3) If necessary replace the parts with burrs or sharp safety wire holes.

J. Examine the safety wire pliers as follows.

(1) Examine the jaws of the safety wire pliers for sharp edges or corners.

(2) If necessary, round off the sharp pliers jaws and make smooth.

NOTE: This will prevent nicks and damage to the safety wire.

K. Determine the direction and pattern of the safety wire for the parts that must be safetied. (Figure 229)

(1) Install safety wire for a group of three bolts or screws.(Figure 230)

(2) Install safety wire for a group of two bolts or nuts with the wire wrapped over the top of a bolt or nut. (Figure 230)

(a) Use this method if there is little or no clearance around the bolt or nut. (Figure 230)

(3) Install safety wire for a square plug to a lug with a safety wire hole. (Figure 230)

(4) Install safety wire for a single screw to a lug with a safety wire hole. (Figure 230)

(5) Install safety wire for two bolts that are on a different plane. (Figure 230)

(6) Install safety wire for hollow head plugs. (Figure 230)

(7) Install a single strand of safety wire for multiple screws. (Figure 230)

(8) Install a single strand of safety wire for multiple screws. (Figure 230)

(9) Install safety wire wrapped around an adjacent bracket for a bolt. (Figure 230)

(a) Use this method to safety any part if there is no lug with a safety wire hole.

(10) Install safety wire for tube and hose nuts or electrical connectors. (Figure 230)

(11) Install safety wire for tube and hose nuts or electrical connectors with a lug with a safety wire hole. (Figure 230)

(12) Install safety wire for tube and hose nuts or electrical connectors without a lug with a safety wire hole. (Figure 230)

(13) Install safety wire for small tube nuts or nuts made of soft material. (Figure 230)

(a) Use this method for all nuts with a thin wall thickness at the safety wire holes.

(b) Wrap the wire around the nut as shown to prevent a break through the thin wall section.

(14) Install safety wire for two adjacent tube and hose nuts or electrical connectors. (Figure 230)

(15) Install safety wire for tube and hose nuts or electrical connectors to a lug with a safety wire hole. (Figure 230)

(16) Install safety wire for a tube nuts on a tee. (Figure 230)

(17) Install safety wire for a straight bulkhead tube nut to a bolt. (Figure 230)

(18) Install safety wire for a tube nuts and jam nuts.(Figure 230)

(19) Install a lead seal to the end of the safety wire. (Figure 230)

(a) Attach the seal at the end of the safety wire after the last item is safetied.

(b) Wrap the loose end of the wire to the safety wire in front of the seal or to an empty safety wire hole.

L. Install the safety wire as follows. (Figure 229)

(1) Install the safety wire so that it always applies tension to tighten the parts.

(2) Make sure that there is no additional tension on the wire other than the original tension.

(3) If the torque on the threaded part becomes reduced, do the steps which follow.

(a) Remove the safety wire.

(b) Tighten the fastener again to the specified torque limits.

(c) Install the safety wire again.

(4) Obey all the assembly instructions if any slack is necessary between tension points.

(5) Pull the safety wire tight as you twist it and make the recommended number of twists.

Table 204 Recommended Safety Wire Twists

Wire Diameter Inch (mm)	Twists/Inch (25.4 mm)
0.015 - 0.017 Inch (0.381 - 0.432 mm)	11 - 14
0.019 - 0.021 Inch (0.483 - 0.533 mm)	9 - 13
0.024 - 0.026 Inch (0.610 - 0.660 mm)	9 - 12
0.030 - 0.034 Inch (0.762 - 0.864 mm)	7 - 10
0.038 - 0.042 Inch (0.965 - 0.067 mm	7 - 10
0.049 - 0.053 Inch (1.245 - 1.346 mm)	5 - 8
0.061 - 0.065 Inch (1.549 - 1.651 mm	5 - 8

NOTE: One twist is a twist of the wires through an arc of 180 degrees, equal to half of a complete turn.

(6) Twist the wire to 0.125 in. (3.175 mm)) distance from the safety wire hole.

M. Trim off the unwanted safety wire as follows.

CAUTION: BE SURE THAT THE CUT WIRE ENDS DO NOT FALL INTO THE ENGINE.

(1) Cut off the unwanted wire at the end of the last fastener and keep at least three full twists.

(a) Do not twist off the end of the safety wire with the wire twist pliers.

(b) You must use wire cutting pliers to cut off the end of the wire.

(2) Make sure that the safety wire does not have loose or non-twisted ends.

(3) Make sure that the safety wire does not have sharp ends.

(4) Bend the end of the wire in towards the part so that it does not point out.

NOTE: If the ends point out they could be a safety hazard to persons who work on the engine. They could also vibrate in the airstream during engine operation and break off.

N. Examine the safety wire after installation as follows.

(1) Examine the safety wire for flex limits as follows.

(a) Push on the safety wire at mid-span with light finger pressure, approximately 2 lb (1 kg).

(b) The total flex for the safety wire must not be more than the limits.

Table 205 Installation of Safety Wire (Flex)

Index A Safety Wire Length (Span) Inch (mm)	Index B Full Flex Limit Inch (mm)	Index C Half Flex Limit Inch (mm)
0.5 (12.700 mm)	0.125 (3.175 mm)	0.063 (1.600 mm)
1.0 (25.400 mm)	0.250 (6.350 mm)	0.125 (3.175 mm)
2.0 (50.800 mm)	0.375 (9.525 mm)	0.188 (4.775 mm)
3.0 (76.200 mm)	0.500 (12.700 mm)	0.250 (6.350 mm)
4.0 (101.600 mm)	0.500 (12.700 mm)	0.250 (6.350 mm)
5.0 (127.000 mm)	0.625 (15.875 mm)	0.313 (7.950 mm)
6.0 (152.400 mm)	0.625 (15.875 mm)	0.313 (7.950 mm)

(2) Examine the safety wire for damage as follows.

CAUTION: BE SURE THAT THERE ARE NO CRACKS IN THE WIRE.

(a) Examine the wire for cracks or broken strands. Cracks or broken strands are not permitted.

(b) Examine the wire for nicks, kinks or damage. Nicks, kinks or damage are not permitted.

(c) Remove and replace the safety wire if you find any cracks, broken strands, nicks, kinks or damage.

(d) Examine the safety wire for abrasions. Light abrasions from the safety wire pliers are permitted.

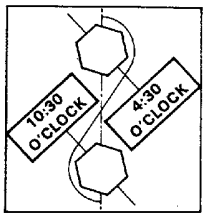
(3) Examine the safety wire for clearance as follows.

(a) Examine the safety wire for clearance between all adjacent parts.

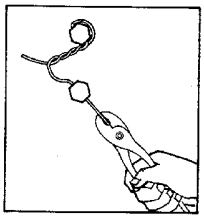
(b) The wire must not touch, chafe or rub on adjacent parts during engine operation.

(c) The wire must not stretch or get too much tension during engine operation.

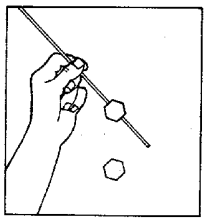
(d) The above limits apply for all parts that move during engine operation, (examples are variable stator rings, bleed valves, actuators, control cables, and linkage).



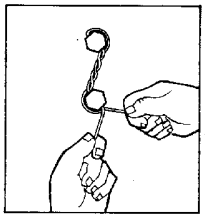
POSITION THE HOLES.



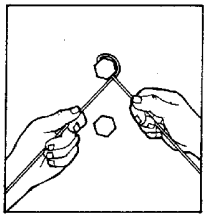
INSERT THE UPPERMOST WIRE, WHICH POINTS TOWARDS THE SECOND BOLT, THROUGH THE HOLE WHICH LIES BETWEEN THE NINE AND TWELVE O'CLOCK POSITIONS. GRASP THE END OF THE WIRE WITH A PAIR OF PLIERS AND PULL THE WIRE TIGHT.



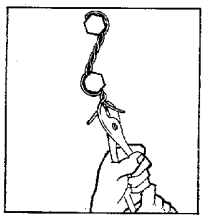
INSERT PROPER GAGE WIRE. TO DETERMINE THE PROPER WIRE TO BE USED IN CONJUNCTION WITH A PARTICULAR TIGHTENING OPERATION REFER TO THE CORRESPONDINGLY DESIGNATED ENGINE PARTS CATALOG OR ILLUSTRATED PARTS BREAKDOWN. LOCKWIRE WHICH IS SPECIALLY TREATED FOR 1800°F (982°C) APPLICATIONS HAS A DARK GRAY TO BLACK COLOR.



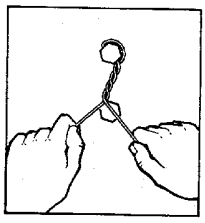
BRING THE FREE END OF THE WIRE AROUND THE BOLTHEAD IN A COUNTERCLOCKWISE DIRECTION AND UNDER THE END PROTRUDING FROM THE BOLT HOLE. TWIST THE WIRE IN A COUNTERCLOCKWISE DIRECTION.



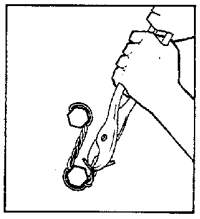
GRASP UPPER END OF THE WIRE AND BEND IT AROUND THE HEAD OF THE BOLT, THEN UNDER THE OTHER END OF THE WIRE. BE SURE WIRE IS TIGHT AROUND HEAD.



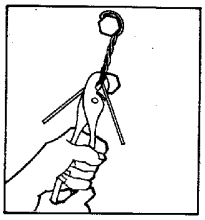
GRASP THE WIRE BEYOND THE TWISTED PORTION AND TWIST THE WIRE ENDS COUNTERCLOCKWISE UNTIL TIGHT.



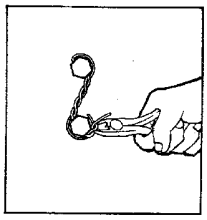
TWIST WIRE UNTIL WIRE IS JUST SHORT OF HOLE IN THE SECOND BOLT.



DURING THE FINAL TWISTING MOTION OF THE PLIERS, BEND THE WIRE DOWN AND UNDER THE HEAD OF THE BOLT.



KEEPING WIRE UNDER TENSION, TWIST IN A CLOCKWISE DIRECTION UNTIL THE WIRE IS TIGHT. WHEN TIGHTENED THE WIRE SHALL HAVE APPROXIMATELY 7—10 TWISTS PER INCH.

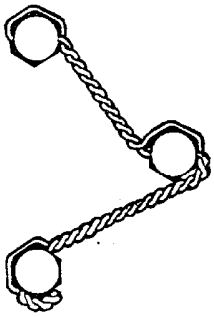


CUT OFF EXCESS WIRE WITH DIAGONAL CUTTERS.

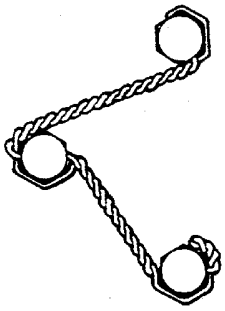
L-5254
11—75
BBB2-70-30

Lockwiring Technique
Figure 229/70-00-00-990-829

EXAMPLE 1



EXAMPLE 2

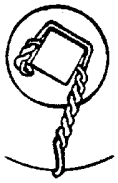


EXAMPLE 3

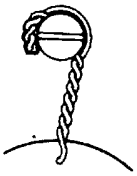
EXAMPLE 4

EXAMPLE 5

EXAMPLE 6

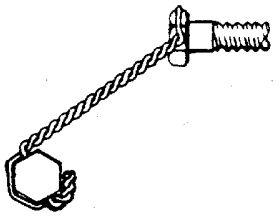


EXAMPLE 7



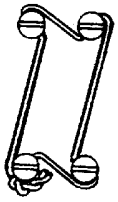
EXAMPLE 8

EXAMPLES 5, 6, 7, AND 8 SHOW METHODS FOR WIRING VARIOUS STANDARD ITEMS. WIRE MAY BE WRAPPED OVER THE UNIT RATHER THAN AROUND IT WHEN WIRING CASTELLATED NUTS OR ON OTHER ITEMS WHERE THERE IS A CLEARANCE PROBLEM.



EXAMPLE 9

EXAMPLE 10



EXAMPLE 11

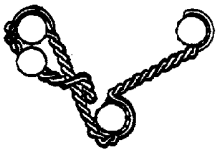
EXAMPLE 9 SHOWS THE METHOD FOR WIRING BOLTS IN DIFFERENT PLANES. NOTE THAT WIRE SHOULD ALWAYS BE APPLIED SO THAT TENSION IS IN THE TIGHTENING DIRECTION.

HOLLOW HEAD PLUGS SHALL BE WIRED AS SHOWN WITH THE TAB BENT INSIDE THE HOLE TO AVOID SNAGS AND POSSIBLE INJURY TO PERSONNEL WORKING ON THE ENGINE.

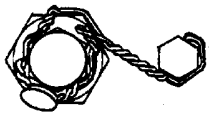
CORRECT APPLICATION OF SINGLE WIRE TO CLOSELY SPACED MULTIPLE GROUP.

L-61082
BBB2-70-31

Examples of Proper Lockwiring
Figure 230/70-00-00-990-830 (Sheet 1 of 3)



EXAMPLE 12



EXAMPLE 13

EXAMPLES 12 AND 13 SHOW METHODS FOR ATTACHING LEAD SEAL TO PROTECT CRITICAL ADJUSTMENTS.

EXAMPLE 14

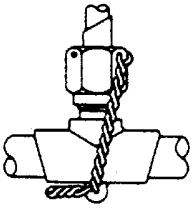
EXAMPLE 14 SHOWS BOLT WIRED TO A RIGHT ANGLE BRACKET WITH THE WIRE WRAPPED AROUND THE BRACKET.

EXAMPLE15

EXAMPLE 15 SHOWS CORRECT METHOD FOR WIRING ADJUSTABLE CONNECTING ROD.

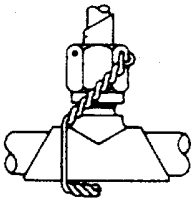
EXAMPLE 16

EXAMPLE 16 SHOWS CORRECT METHOD FOR WIRING THE COUPLING NUT ON FLEXIBLE LINE TO THE STRAIGHT CONNECTOR BRAZED ON RIGIDTUBE.



EXAMPLE 17

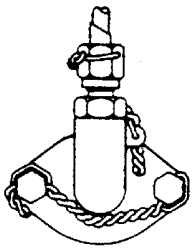
EXAMPLE 18



EXAMPLE 19

EXAMPLE 20

FITTINGS INCORPORATING WIRE LUGS SHALL BE WIRED AS SHOWN IN EXAMPLES 17 AND 18. WHERE NO LOCKWIRE LUG IS PROVIDED, WIRE SHOULD BE APPLIED AS SHOWN IN EXAMPLES 19 AND 20, ENSURING THAT WIRE IS WRAPPED TIGHTLY AROUND THE FITTING.

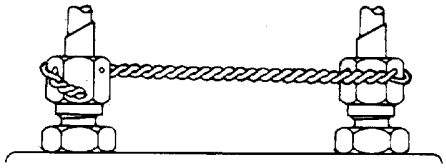


EXAMPLE 21

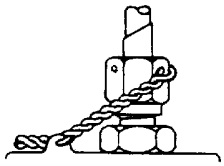
SMALL SIZE COUPLING NUTS SHALL BE WIRED BY WRAPPING THE WIRE AROUND THE NUT AND INSERTING IT THROUGH THE HOLES AS SHOWN.

L—51366
11—75
BBB2-70-32

Examples of Proper Lockwiring
Figure 230/70-00-00-990-830 (Sheet 2 of 3)

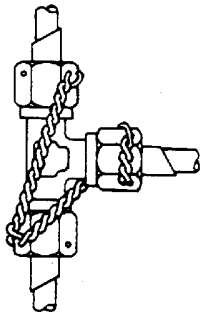


EXAMPLE 22



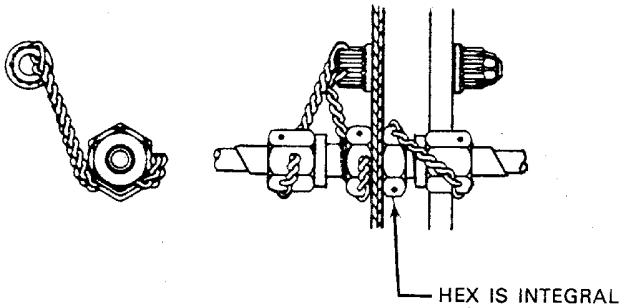
EXAMPLE 23

COUPLING NUTS ATTACHED TO STRAIGHT CONNECTORS SHALL BE WIRED AS SHOWN WHEN HEX IS AN INTEGRAL PART OF THE CONNECTOR.



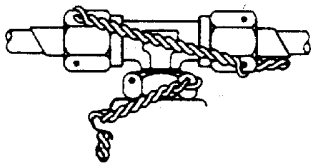
EXAMPLE 24

COUPLING NUTS ON A TEE SHALL BE WIRED AS SHOWN ABOVE SO THAT TENSION IS ALWAYS IN THE TIGHTENING DIRECTION.

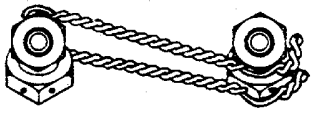


EXAMPLE 25

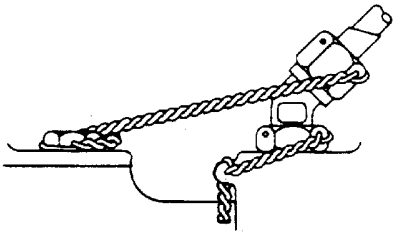
STRAIGHT CONNECTOR
(BULKHEAD—TYPE)



EXAMPLE 26



EXAMPLE 27



EXAMPLE 28

EXAMPLES 26, 27, AND 28 SHOW THE PROPER METHOD FOR WIRING VARIOUS STANDARD FITTINGS WITH LOCKNUT WIRED INDEPENDENTLY SO THAT IT NEED NOT BE DISTURBED WHEN REMOVING THE COUPLING NUT.

L-51368
11—75
BBB2-70-33

Examples of Proper Lockwiring
Figure 230/70-00-00-990-830 (Sheet 3 of 3)

16. Cotter Pinning

A. General

(1) Cotter pins are not reusable. New cotter pins must be used for each application.

B. Locking Nuts With Cotter Pins (Figure 231)

(1) Before installing cotter pin, tighten nut to low side of torque range, unless otherwise specified, then continue tightening until slot aligns with hole in bolt. If slot in nut does not line up with hole before maximum allowable torque is reached, back off nut, then retighten. If slot still does not line up, select new nut and repeat assembly procedure.

(2) While preferred installation would locate centerline of hole in bolt midway into nut slot, any installation wherein more than 50 percent of cotter pin diameter is located below nut castellation is acceptable. In event 50 percent or more of cotter pin diameter is located above nut castellation, new nut must be selected and installed.

(3) Install each cotter pin with head seated firmly in slot of nut with axis of eye at right angles to bolt. Bend prongs so that head and upper prong are firmly seated against bolt, and lower prong is firmly seated against corresponding nut flat. Upper prong may be cut off even with top of bolt to provide necessary clearance. Lower prong may also be cut off to provide necessary clearance and/or a snug fit against corresponding nut flat.

C. Retaining Pins and Rod Ends With Cotter Pins (Figure 232)

(1) Install cotter pin with axis of eye parallel to shank of clevis pin or rod end. Bend prongs around shank of pin or rod end. Prongs may be cut to obtain normal end position.

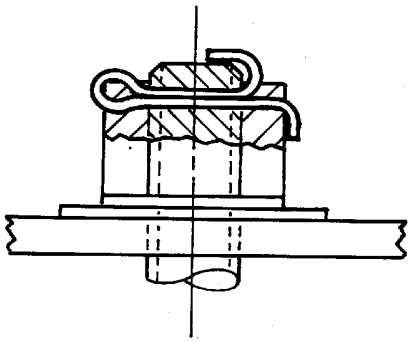
17. Installation of Retaining Rings

A. General. Retaining rings must be installed using approved retaining ring pliers. Internal type rings must not be compressed beyond point where ends of rings meet. External type rings must be expanded only enough to allow installation without becoming bent. After installation, ensure that each retaining ring is completely seated, without looseness or distortion, in its groove. Distorted or loose retaining rings must be replaced.

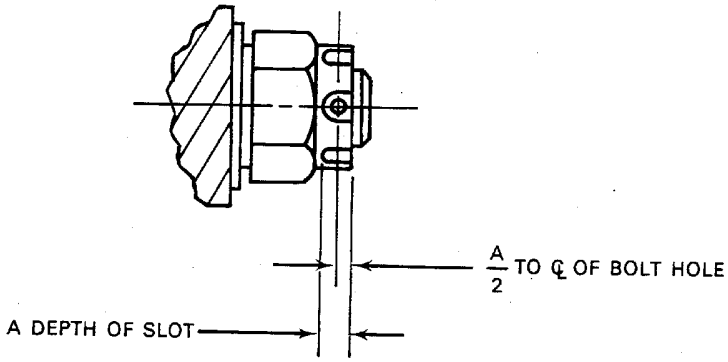
B. Plain Retaining Rings

(1) Plain retaining rings may contain slightly rounded edges on one side and sharp edges on opposite side. Slight rounding, caused by stamping die, is not a bevel and ring must not be classified as a beveled ring.

(2) Plain retaining rings must be installed only in square sided grooves. When one side of a plain ring has visibly sharper corners, this side must be installed away from detail part(s) being retained, so that sharp-edged side thrusts against groove.



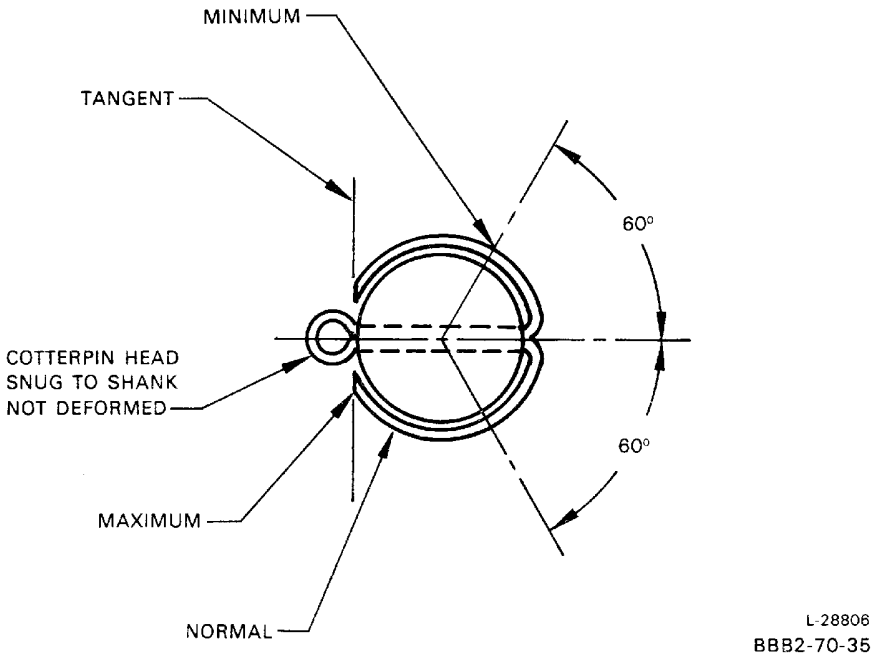
PREFERRED INSTALLATION



LOCATION OF LOCKING
HOLE IN SLOT OF NUT

L-28805
BBB2-70-34

Locking Nuts With Cotter Pins
Figure 231/70-00-00-990-831



Installing Cotter Pin on End of Retaining Pin/Rod
Figure 232/70-00-00-990-832

18. Guidelines For Reuse Of Damaged Engines And Engine Parts

A. General

(1) The following guidelines are provided to assist owners, operators and maintenance facilities in the disposition of engines and engine parts involved in Abnormal Operational Circumstances. Abnormal Operational Circumstances are defined as accidents or other events which fall outside of the operating envelope for the engine, aircraft and/or the engine/aircraft combination as originally certified and where inspection, refurbishment, and repair data are not addressed by FAA approved publications, i.e., engine manuals, service bulletins, etc. The data contained in these FAA approved publications normally address engine and engine parts which experience wear, deterioration, or damage through exposure to the normal day-to-day operating environment. The guidelines apply to the following engine associated abnormal operation circumstances:

(a) Engine And Engine Parts Unacceptable For Continued Aircraft Usage. (Paragraph 18.B.)

(b) Engines And Engine Parts Potentially Acceptable For Continued Aircraft Usage. (Paragraph 18.C.)

(2) For Abnormal Operational Circumstances not addressed by these guidelines, Pratt & Whitney considers engines and engine parts unacceptable for continued aircraft usage unless reviewed and approved on a case-by-case basis.

(3) The guidelines are based upon Pratt & Whitney's general experience in this area and therefore are to be used as general guidelines. In any particular incident, however, more complete information or inspection results may require alternate action. The engine or engine part owner should not rely upon the information in these guidelines without a thorough understanding of the damage to the engine or engine parts and its effect on engine operation.

NOTE: IT SHOULD BE UNDERSTOOD THAT THE FOLLOWING ARE ONLY GUIDELINES AND THAT ANY AND ALL RESPONSIBILITY FOR RETURNING ANY ENGINE OR ENGINE PART TO SERVICE REMAINS WITH THE ENGINE OR PART OWNER.

(4) The following are definitions of technical terms used in these guidelines:

(a) Definitions from ATA World Airlines Technical Operations Glossary (WATOG).

Accident:

1) An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight, until such time as all such persons have disembarked, in which:

a) Any person suffers death or serious injury as a result of being in or upon the aircraft, or by direct contact with the aircraft or anything attached thereto; or

b) The aircraft receives substantial damage; or

c) Any damage is caused to the property of a third party.

Damage, Accidental:

2) Physical deterioration of an item caused by contact or impact with an object or influence which is not a part of the aircraft, or by improper manufacturing or maintenance practices.

(b) Non-WATOG definitions used in the guidelines

Engine:

1) Engines manufactured by Pratt & Whitney Division of United Technologies Corporation.

Engine parts:

2) Parts sold by Pratt & Whitney and delivered as original equipment in an engine installed on an aircraft or in a spare engine or parts sold by Pratt & Whitney as new spare parts in support of an engine. Engine parts include Pratt & Whitney authorized vendor supplied accessories and components.

Abnormal operational circumstances:

3) Accidents or other events which fall outside the operating envelope for the engine, aircraft, and/or the engine aircraft combination as originally certified and where inspection, refurbishment, and repair data are not addressed by FAA approved publications, i.e., engine manuals, service bulletins, etc.

B. Abnormal Operational Circumstances - Engines And Engine Parts Unacceptable For Continued Aircraft Usage

(1) Pratt & Whitney considers engines and engine parts involved in the following types of circumstances unacceptable for continued aircraft usage:

NOTE: It is recognized that an aircraft could be damaged beyond economical repair without any resulting engine involvement. In such cases the engine and engine parts can be considered "not involved" in an abnormal operational circumstance.

(a) Engines and engine parts installed in an aircraft totally destroyed by fire.

(b) Engines and engine parts totally engulfed in fire to the extent that outer cases have been heat discolored and/or distorted or the engine is otherwise damaged by heat over a significant area of the engine, either external or internal.

(c) Engine and engine parts installed in an aircraft totally destroyed by impact damage.

C. Abnormal Operational Circumstances - Engines And Engine Parts Potentially Acceptable For Continued Aircraft Usage

(1) Accidents

(a) Pratt & Whitney considers engines and engine parts involved in the following types of accidents potentially acceptable for continued aircraft usage:

1) Engines and engine parts involved in an accident in which the nacelles and engines remain undamaged.

2) Engines or engine parts involved in a fire wherein a portion of the aircraft was destroyed but the engines were not subjected to fire damage.

3) Engines and engine parts involved in an accident wherein engines rotate freely, although impact damage to cases or other engine parts is evident.

4) Partially damaged engines which will not rotate freely as a result of superficial damage to cases, etc.

5) Engines subjected to partial or full immersion in fresh or salt water for a brief period of time.

(b) Acceptance criteria for Paragraph 18.C.(1)(a) engines or engine parts:

1) Engines and engine parts involved in accidents described in Paragraph 18.C.(1)(a)1) and Paragraph 18.C.(1)(a)2) can be considered "not involved" in an abnormal operational circumstance.

2) Engines and engine parts involved in accidents described in Paragraph 18.C.(1)(a)3), Paragraph 18.C.(1)(a)4), and Paragraph 18.C.(1)(a)5) should be 100 percent disassembled and inspected.

NOTE: Owners who are unable to perform the necessary tests or who are in doubt whether to accept or reject a part should contact Pratt & Whitney for assistance.

D. Serious Operational Events

(1) Pratt & Whitney considers engines and engine parts involved in the following types of serious operational events as potentially acceptable for continued aircraft usage provided the criteria defined are observed.

(a) Single fan blade fractures outboard of mid span shroud.

NOTE: A single fan blade fracture occurring outboard of the mid span shroud can cause varying degrees of engine damage. Refer to ENGINE GENERAL, SUBJECT 72-00-00, Inspection/Check-01 for bird or object ingestion inspections and damage limits. In general, the following inspection guidelines can be applied to events where a single blade has fractured outboard of the mid span shroud.

1) Check for evidence of core ingestion.

2) Inspect fan blade shrouds for evidence of shingling.

3) Inspect fan rubstrip for damage beyond limits.

4) Check fan exit guide vanes for damage.

5) Inspect engine externals for broken or cracked brackets and case flanges.

6) Borescope inspect compressor gaspath for excessive blade tip rub and blade-to-vane clash.

(b) Single blade fracture inboard of mid span shroud or multiple fan blade fractures.

NOTE: A fan blade fracture inboard of the mid span shroud or multiple fractures generate a significant amount of rotor vibration. More extensive inspections with disassembly of the N1 rotor modules is required as a minimum. Further disassembly is required as inspection findings dictate.

(c) Engines experiencing sudden stoppage.

1) Engines experiencing sudden stoppage usually as a result of significant ingestion or distress. In every instance of sudden stoppage a complete engine disassembly and 100 percent engine part inspection should be accomplished.

(d) Engines involved in an operational fire (burn-through, bearing compartment, etc.).

1) Engines involved in an operational fire should be completely disassembled and all engine parts inspected.

2) If extinguishing agents have been applied to the engine, gaspath cleaning is to be accomplished per ENGINE GENERAL - CLEANING-01, PAGEBLOCK 72-00-00/701 as quickly as practical to prevent corrosion.

E. "Impacted" And "Dropped" Engines

(1) The damage or circumstances which can result in an "Impacted" engine include impact with the ground, a collision with a service vehicle, etc. An engine dragged on the ground or against another object is considered an impacted engine. "Dropped" engines refer to engines which are dropped entirely or on either end.

Inspection requirements for impacted and dropped engines are similar and progressive in scope; that is, proceeding with further disassembly is dependent on the degree of damage found at each level of inspection.

(a) For engine mounted on aircraft where pylon or nacelle damage has occurred, inspect engine mount flanges, cases, external components and plumbing, and gearbox housing and mounts. If the impact was such that debris may have entered the engine inlet, inspect engine for ingestion, and check bleed system filters and valves for debris.

1) If no damage is noted, no further action is required.

2) If damage is noted to external components and plumbing, replace damaged items.

3) If damage is noted to mount flanges, gearbox or gearbox mounts or cases, remove engine.

4) Monitor chip detectors and oil filter on a more frequent basis during the initial return of the engine to service.

(b) For dropped engines removal and disassembly are required.

F. Tailpipe Fires

(1) In general tailpipe fires of short duration and extinguished by "motoring" the engine will probably have little detrimental effect on exhaust area engine parts. (Refer to PWA Operating Instructions 190).

(a) Inspect exhaust area for signs of scorching. Any parts which exhibit scorching including fan duct acoustic liners if so equipped, should be replaced.

(2) Engines which experience a more persistent tailpipe fire or when starting over temperature limits are exceeded during a tailpipe fire present a greater potential for thermal stress. Engine removal is required.

G. Engine Contamination - Fire Extinguishing Agents

NOTE: The following general information is provided to assist operators in determining appropriate actions for engines subjected to fire extinguishing agents. This information is applicable in instances where fires have been confined to burner and turbine gaspath areas, and over temperature limits have not been exceeded.

It should be noted that detailed gaspath cleaning procedures for engines exposed to fire extinguishing agents, as well as instructions for subsequent disassembly, cleaning and inspection, are provided in ENGINE GENERAL - CLEANING-01, PAGEBLOCK 72-00-00/701.

(1) There has been considerable effort expended to determine the effects of commonly used fire extinguishing agents (sodium bicarbonate, potassium bicarbonate and bromotrifluoreomethane (CBrF3) on turbine engine parts.

(2) The major concern with introducing dry powder chemicals into the engine is corrosion during subsequent engine operation. This material can be extremely detrimental to hot section parts, as exposure to the engine operating environment converts the bicarbonate compounds to carbonates, which then form a highly corrosive liquid flux.

(3) Test results reveal stainless steels, nickel base alloys, (coated or uncoated), and cobalt base alloys, show a high degree of susceptibility to chemical corrosion, even at temperatures considerable below the engine operating range of approximately 1200°F (649°C). Titanium, aluminum, magnesium, cadmium plated and nickel-cadmium plated low alloy steels evidenced no corrosion from bicarbonate compounds at engine operating temperatures.

(4) Regarding the use of CBrF3, used primarily as an inflight fire extinguishing agent, one manufacturer of the compound stated that the products of decomposition will include certain acids which may have a slight corrosive effect on metals when exposed to high temperatures. PWA 45, PWA 47, PWA 73, PWA 273, and PWA 275 coatings degrade completely from CBrF3 contact at 1800°F for short periods of time.

(5) Although no specific testing has been done relative to the effects these agents have on the oil system, the oil system should also be considered because agents could enter the oil system through labyrinth seals.

(6) Cleaning methods specified in ENGINE GENERAL - CLEANING-01, PAGEBLOCK 72-00-00/701 for engines subjected to fire extinguishing agents should be carefully adhered to in order to minimize damage.

19. Potable Water Quality Specifications (for Use In Compressor Wash Or Detergent Cleaning Procedures On-wing)

A. General

(1) This task gives the general instructions to determine if water is potable for use during engine gaspath cleaning.

NOTE: Maintenance Manuals use potable water for rinsing after detergent washing.

NOTE: SPS 87 gaspath/compressor solution uses potable water in its make-up. Refer to (Paragraph 20.) for the make-up of this solution.

B. Procedure - Potable Water Quality Specifications

(1) The quality specifications for potable water suitable for engine gaspath cleaning are as follows:

(a) Water used for engine gaspath cleaning must agree with local quality specifications for potable water and with the quality specifications that follow.

NOTE: When the local quality specifications for potable water and the quality specifications that follow do not agree, the quality specifications that follow are applicable.

Physical	Permitted Levels (Analysis at 75°F (24°C))
pH	6.0 - 10.0
Total Dissolved Solids	500 mg/l maximum
Specific Resistance or Conductivity	1800 ohms-cm minimum
Turbidity	5 units

Table 206 Potable Water Specifications

Inorganic	Milligrams/Liter
Chlorides	250 maximum
Fluoride	2.0 maximum

20. PREPARATION OF GASPATH/COMPRESSOR CLEANER SOLUTION (SPS 87)

A. Consumable Materials

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

NOTE: Equivalent replacements are permitted for the items that follow.

REFERENCE	DESIGNATION
P11-021	Gaspath Solvent Cleaner (SPMC 87-4)
P11-021	Gaspath Solvent Cleaner (SPMC 87-5)
P11-021	Gaspath Solvent Cleaner (SPMC 87-6)
P11-021	Gaspath Solvent Cleaner (SPMC 87-7)
NOTE: SPMC 87-1 thru -3 and 87-8 are not available; there are no replacements.	
P11-021	Gaspath Solvent Cleaner (SPMC 87-9A)
P11-021	Gaspath Solvent Cleaner (SPMC 87-9B)
P11-021	Gaspath Solvent Cleaner (SPMC 87-10A)
P11-021	Gaspath Solvent Cleaner (SPMC 87-10B)
P11-021	Gaspath Solvent Cleaner (SPMC 87-11A)
P11-021	Gaspath Solvent Cleaner (SPMC 87-11B)
P11-021	Gaspath Solvent Cleaner (SPMC 87-11C)
P11-021	Gaspath Solvent Cleaner (SPMC 87-12)
P11-021	Gaspath Solvent Cleaner (SPMC 87-13)

(Continued)

REFERENCE	DESIGNATION
P11-021	Gaspath Solvent Cleaner (SPMC 87-14)

B. Procedure - General Instructions

(1) Always obey the specified procedures and limits in the applicable AMM maintenance tasks.

(2) For the potable water quality specifications for cleaning, refer to Potable Water Quality Specifications. (Paragraph 19.)

(3) Mix as specified in the applicable gaspath/compressor cleaning cart.

NOTE: SPMC 87-1 thru -3 and 87-8 are not available; there are no replacements.

(a) SPMC 87-4, -6, -7, -10A, -11C, -12, -13, or -14 at 20 percent by volume with potable water.

(b) SPMC 87-5, -9A, -10B, -11B, 100 percent by volume.

(c) SPMC 87-9B at 15 percent by volume with potable water.

(d) SPMC 87-11A at 10 percent by volume with potable water.

(4) Use the solution at ambient temperature unless the manufacturers instructions specify differently.

21. Service Process Operation Procedures

A. General

(1) Some procedures are referred to in the maintenance text with the abbreviation "SPOP" and a number. These procedures are under P&W Engineering control.

(2) A SPOP is a Service Process Operation Procedure. If a process has this designation, it will be necessary to use approved procedures and materials.

22. Cleaning the Exterior of the Engine (SPOP 1)

A. General

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) This task gives the general instructions for the cleaning of the exterior of the engine.

(2) This procedure removes oils, grease, hydraulic fluid, and loose soil from engine exterior surfaces (that is, the outer surfaces of the engine) or external parts, which decreases the time necessary to clean disassembled Q. E. C. (Quick Engine Change) parts.

(3) This procedure does not remove hard, baked-on carbon.

B. Consumable Materials

(1) For Assembled Engines

(a) METHOD A

1) Spray, Steam, or Foam Cleaners

REFERENCE	DESIGNATION
(P11-031) Alkali Cleaner (PMC 1284)	

(Continued)

REFERENCE	DESIGNATION
(P11-040) Alkali Cleaner (SPMC 106)	
(P11-044) Alkali Cleaner (SPMC 104)	
(P11-045) Alkali Cleaner (SPMC 105)	
(P11-071) Aqueous Cleaner (SPMC 113)	
(P11-072) Aqueous Degreaser (SPMC 151)	
(P11-073) Aqueous Degreaser (SPMC 195)	
(P11-079) Aqueous Degreaser (SPMC 170)	
(P11-080) Aqueous Degreaser (SPMC 181)	
(P11-081) Aqueous Cleaner (SPMC 207)	
(P11-082) Aqueous Degreaser (SPMC 173)	
(P11-083) Aqueous Cleaner (SPMC 233)	

2) GEL-TYPE CLEANERS

REFERENCE	DESIGNATION
(P11-047) Alkaline Gel Cleaner (SPMC 109)	
(P11-048) Alkaline Gel Cleaner (SPMC 110)	
(P11-069) Alkaline Gel Cleaner (SPMC 112)	
(P11-070) Alkaline Gel Cleaner (SPMC 159)	

(b) METHOD B

1) (P05-421) Scrub Pad (PMC 4095)

2) (P05-422) Scrub Pad (PMC 4435)

3) Spray or Wipe Cleaners:

REFERENCE	DESIGNATION
(P11-049) Aqueous Cleaner (SPMC 148-1 thru SPMC 148-4)	

(2) For Disassembled Engines

NOTE: Refer to METHOD A or METHOD B above or use the subsequent consumable material.

(a) Cleaner Applied by Brush

REFERENCE	DESIGNATION
(P11-027) Stoddard Solvent (PMC 9001)	

C. Procedure to Degrease the Exterior of the Engine by METHOD A or METHOD B

(1) METHOD A

(a) Install covers on all openings into the engine (this includes the inlet, exhaust, all bleed openings, open fuel lines, open oil lines, breather tubes, and open electrical connectors).

(b) Clean by one of the subsequent procedures:

NOTE: Service experience shows that the gel-type cleaners are more effective than the spray, steam, and foam solutions on very dirty engines because the gel cleaners stay on the engine better than the spray, steam, and foam solutions, which drain off the engine during the soak time.

1) Mix one of these materials with water to make a cleaner solution at a concentration that is equal to or less than the maximum specified concentration, then apply this solution as a spray, steam, or foam:

Specification	Name	Maximum Concentration (Mixed with Water)
(P11-031)	Alkali Cleaner (PMC 1284)	30% by volume
(P11-040)	Alkali Cleaner (SPMC 106)	30% by volume
(P11-044)	Alkali Cleaner (SPMC 104)	25% by volume
(P11-045)	Alkali Cleaner (SPMC 105)	25% by volume
(P11-071)	Aqueous Cleaner (SPMC 113)	20% by volume
(P11-072)	Aqueous Degreaser (SPMC 151)	25% by volume
(P11-073)	Aqueous Degreaser (SPMC 195)	50% by volume
(P11-079)	Aqueous Degreaser (SPMC 170)	20% by volume
(P11-080)	Aqueous Degreaser (SPMC 181)	25% by volume
(P11-081)	Aqueous Cleaner (SPMC 207)	30% by volume
(P11-082)	Aqueous Degreaser (SPMC 173)	25% by volume
(P11-083)	Aqueous Cleaner	20% by volume

2) Spray on one of the subsequent gel-type cleaners. Do not use a steam machine to apply the gel-type cleaner.

NOTE: It is necessary to use a special applicator to apply the gel-type cleaners. Refer to the gel manufacture's instructions for the correct applicator.

Specification	Name	Concentration
(P11-047)	Alkaline Gel Cleaner (SPMC 109)	As received
(P11-048)	Alkaline Gel Cleaner (SPMC 110)	As received
(P11-069)	Alkaline Gel Cleaner (SPMC 112)	As received
(P11-070)	Alkaline Gel Cleaner (SPMC 159)	As received

(c) Let the cleaner solution or gel-type cleaner stay on the engine for 10 - 20 minutes.

(d) Flush the engine fully with warm or hot water, or with steam.

(e) Remove the covers from all the openings on the engine.

(2) METHOD B (Local Application Only). us one of these procedures:

(a) Apply (P11-049) aqueous cleaner (SPMC 148-1 thru SPMC 148-4), as received. If necessary, scrub with a soft brush (not made of metal), a (P05-421) scrub pad (PMC 4095), or a (P05-422) scrub pad (PMC 4435) to clean engine.

WARNING: CLEANING SOLVENTS ARE HIGHLY FLAMMABLE, VOLATILE AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTIALTION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH THE SKIN.

(b) Use a brush (not made of metal), a (P05-421) scrub pad (PMC 4095), (P05-422) scrub pad (PMC 4435), or a clean cloth to apply a solvent from SPOP 208. (Paragraph 26.)

1) If engine parts are hot, let the temperature of the parts decrease to a temperature at which you can touch the parts without gloves, and then apply the SPOP 208 solvent. (Paragraph 26.)

D. Procedure to Clean the Engine External Components Parts After Removal of the Parts From the Engine

(1) When it is necessary to clean engine external component parts after removal of the parts from the engine, do one of the subsequent procedures to clean the parts:

(a) Do METHOD A above. (Paragraph 22.C.(1))

(b) Do METHOD B above. (Paragraph 22.C.(2))

(c) Do the subsequent procedure:

1) Apply (P11-027) Stoddard Solvent (PMC 9001) to the parts with a brush in a solvent-recirculating parts washer or washer/soak tank that uses a recirculating pump to supply filtered solvent to the brush through a flexible supply hose.

2) Wipe the parts dry with a clean cloth.

23. Fluorescent Penetrant Check (Local Application) Normal or High or Ultra High Sensitivity (SPOP 70)

A. General

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) This task gives the general instructions and the approved materials for fluorescent penetrant inspection (local application) normal or high or ultra high sensitivity.

NOTE: SPOP 70 is for the inspection of the small areas of a part (such as, bosses, weld repaired areas, rout outs or grind outs, and blended areas). It is not for full circumference (360 degree) inspections (for example, on flanges, seals, knife-edges) or to replace a 100 percent inspection.

B. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items.

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 207

Name and Number	Manufacturer
UV Light (No specific)	
UV Light Meter (No specific)	
White Light Meter (No specific)	
Fluorescent Penetrant (Post-Emulsified) (P05-032) (PMC 4353)	
Masking Tape (P05-145) (PMC 4188)	
Fluorescent Penetrant (Post-Emulsified) (P05-234) (PMC 4352)	
Fluorescent Penetrant (Post-Emulsified) (P05-235) (PMC 4354)	
Fluorescent Penetrant (Water Washable) (P05-236) (PMC 4360)	
Fluorescent Penetrant Developer Nonaqueous (P05-237) (PMC 4357)	
Fluorescent Penetrant (Water Washable) (P05-424) (PMC 4351)	
Dry Developer (P05-469) (PMC 4356)	

C. Procedure - General Instructions

CAUTION: DO NOT USE A VISIBLE DYE PENETRANT ON AN ENGINE PART BEFORE YOU CHECK THE PART WITH FLUORESCENT PENETRANT. FLUORESCENT PENETRANTS AND VISIBLE DYE PENETRANTS ARE NOT COMPATIBLE WITH EACH OTHER. THE ABSORPTION OF VISIBLE DYE PENETRANT WILL MASK INDICATIONS AND DECREASE THE SENSITIVITY OF THE FLUORESCENT PENETRANT CHECK. DURING CHECK, DO NOT WEAR EYE GLASSES THAT HAVE LENSES WHICH DARKEN WHEN THEY ARE IN UV LIGHT.

(1) Always obey the specific procedures and limits in the AMM maintenance task.

(2) Always use “ultra” high sensitivity (Level 4) penetrant when you do SPOP 70 on major rotating parts (fan blades; compressor blades, drums, disks, airseals, and hubs; and turbine disks, airseals, hubs, seal plates (full rings and segments), and shafts). In some tasks the “ultra” high sensitivity penetrant is not specified on these major rotating parts. Service experience shows that “ultra” high sensitivity penetrant must be used (instead of high) on all major rotating parts.

D. Procedure - Cleaning Instructions

(1) To remove all unwanted material, wipe the inspection area with a clean cloth, wet with solvent from SPOP 208 (Paragraph 26.).

(2) Do not let the solvent run over or flood any surface.

E. Procedure - Inspection Instructions

(1) Mask the adjacent area with masking tape (P05-145) (PMC 4188), as necessary, to prevent penetrant contamination where it is not wanted.

(2) Apply the applicable penetrant (normal, high, or ultra high), as specified by the specific AMM maintenance task, with a brush, cloth, or cotton swab. Let the penetrant stay on the surface of the part for 20 - 60 minutes.

(a) Do not mix different types or brands of penetrant.

(b) Normal Penetrants

1) (P05-234) Fluorescent Penetrant (Post-Emulsified) (PMC 4352).

2) (P05-424) Fluorescent Penetrant (Water Washable) (PMC 4351).

(c) High Penetrants

1) (P05-032) Fluorescent Penetrant (Post-Emulsified) (PMC 4353).

2) (P05-236) Fluorescent Penetrant (Water Washable) (PMC 4360).

(d) Ultra High Penetrants

1) (P05-235) Fluorescent Penetrant (Post-Emulsified) (PMC 4354).

(3) To remove surface penetrant, wipe surfaces area with a clean cloth or paper towel, moisten with solvent from SPOP 208 (Paragraph 26.). Use the solvent only to moisten the wiper, if necessary. Do not let the solvent run over or flood any surface.

NOTE: It is very important to prevent too much solvent wiping, which can remove too much penetrant from the part.

(4) Use the UVL to make sure that there is no more penetrant on the surface.

(5) Very lightly apply one of the developers that follow.

(a) (P05-237) Fluorescent Penetrant Developer (Nonaqueous) (PMC 4357).

1) If this nonaqueous developer is used, apply a constant thickness of the nonaqueous developer such that you can see the developer and the color of the part.

(b) (P05-034) Dry Developer (PMC 4356).

(6) Let the developer absorb the penetrant for 10 minutes, minimum.

CAUTION: YOU MUST DO THIS CHECK IN A DARK AREA. WHITE LIGHT MUST NOT BE MORE THAN 2 FOOTCANDLES AT THE CHECK SURFACE. TO MAKE THE AREA DARK, YOU CAN COVER IT WITH A BLACK SHEET.

(7) Examine the part under UVL for indications.

(8) If any area shows moderate fluorescent background or any marginally unacceptable or questionable indication, continue as follows.

(a) Lightly rub the area with a soft brush or cotton swab wet with solvent from SPOP 208 (Paragraph 26.).

(b) Do not let the solvent run over or flood any surface.

(c) Let the solvent evaporated from the surface, and then examine the area again under UVL.

(d) If the indication shows again immediately, then examine the indication.

(e) If the indication does not show again immediately, then apply the (P05-469) Dry Developer (PMC 4356) or the (P05-237) Fluorescent Penetrant Developer (PMC 4356) or the (P05-237) Fluorescent Penetrant Developer (Nonaqueous) (PMC 4357) to the area. If you use the nonaqueous developer, apply a constant thickness such that you can see the developer and the color of the part. Let the developer absorb the penetrant for 10 minutes, minimum, and then examine the questionable area again under UVL.

NOTE: No cracks are permitted unless specified differently by an AMM task.

(f) Use this evaluation procedure only once on an indication.

(9) Remove the developer.

NOTE: Removal of the developer is necessary only if it interferes with a subsequent process or part function.

(a) For parts with no areas that can cause entrapment that are to go to visual/dimensional inspection, blow off any remaining developer, if necessary.

(b) For parts that can cause entrapment of dry developer, flush with hot water to clean.

(c) If a nonaqueous developer was used, remove developer by using SPOP 208 (Paragraph 26.).

24. Anodize Touch-Up Application (SPOP 42)

A. PS 607 Anodize Touch-Up Solution

(1) Fill a container one-half full with PMC 1737 demineralized water with chloride content of 10 PPM maximum (you can use tap water if the chloride content is less than 10 PPM).

WARNING: REFER TO MANUFACTURER'S SAFETY DATA SHEETS FOR INFORMATION SUCH AS HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, AND USE AND CONTROL MEASURES.

(2) Add PMC 1631 salts, four ounces to a gallon of water (30 g/liter) of the total water volume.

NOTE: It is possible to get PMC 1631 chromate conversion salts as Iridite #14-2 compound from Witco Allied-Kelite, Division of Witco Chemical Corp. PMC 1632 wetting agent is ARP No. 2 from Witco Chemical Corp.

(3) Add PMC 1632 wetting agent, two ml/gallon (0.53 g/liter) of the total water volume.

(4) Mix the solution fully.

(5) Fill the container with PMC 1737 demineralized water (chloride content of 10 PPM maximum).

NOTE: Discard the solution if not used after 14 days. It is possible to weigh the PMC 1631 salts and put them in storage until it is necessary to use them, then to add the water and PMC 1632 wetting agent.

B. Procedure

(1) Use a clean cloth, wet with PMC 9015 perchlorethylene and/or crocus cloth and/or No. 400 emery cloth, to clean the bare surface.

(2) Use a swab or brush to apply the PS 607 anodize touch-up solution.

NOTE: If the solution does not make the surface wet, remove with a clean cloth and clean the area again. See Paragraph 24.B.(1).

(3) Let the solution become dry, or use a cloth wet with clean water to remove the remaining solution.

(4) Examine the surface for a brown color (this will show that the solution is fully applied on the surface).

(5) Use a cloth to make all the coating as much the same color as possible.

25. Application of Epoxy Primer and Aluminized Epoxy Enamel (SPOP 148)

A. This task gives the general instructions and the approved materials for touch up application of epoxy primer and aluminized epoxy enamel.

B. Equipment

REFERENCE	DESIGNATION
Not specified	Mixing Container (Graduated)
Not specified	Mixing Sticks
Not specified	Paint Gun
Not specified	Heat Gun

C. Consumable Materials

REFERENCE	DESIGNATION
(P05-037)	Aluminized Epoxy Enamel (PWA 569)
(P05-063)	Solvent Reducer (PWA 36050)
(P05-076)	400 Grit Abrasive Paper (PWA 569)
(P05-255)	Masking Tape
(P05-482)	Solvent Reducer (PWA 36106)
(P05-483)	Aluminized Epoxy Enamel (PWA 36569)
(P11-065)	Acetone (PMC 1914)
(P18-020)	Epoxy Primer (PWA 36519-1) or (PWA 36569)
(P18-024)	Epoxy Primer (PWA 36568)

D. Procedure

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Clean the repair area. (Paragraph 26.)

(3) Use (P05-076) 400 Grit Abrasive Paper to lightly sand the surface.

(4) Clean the repair area again. (Paragraph 26.)

(5) Apply (P05-255) Masking Tape to the areas not to be painted.

(6) Prepare the applicable (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA 36568) as follows:

NOTE: The working life of the (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA 36568) mixture is approximately four hours at 60° - 80°F (16° - 27°C). Be sure to identify the time and date of the mixture.

CAUTION: DO NOT INTERMIX THE BASE-CURING SOLUTION-SOLVENT SYSTEMS.

(a) Mix the applicable (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA 36568) as follows:

1) For (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2):

NOTE: The (P18-020) Epoxy Primer comes in green (PWA 36519-1) or black (PWA 36519-2). You can use either suffix when no suffix is specified, but PWA 36519-2 is preferred because it does not contain MEK and is less hazardous than PWA 36519-1.

a) Stir the primer base until there is no solid material remaining on the bottom of the container.

b) Mix three parts by volume of the primer base with one part by volume of the curing solution.

c) If necessary, dilute the green (P18-020) Epoxy Primer mixture (PWA 36519-1) with (P11-065) Acetone (PMC 1914) in a ratio of four parts by volume of acetone. It is not necessary to dilute the black Epoxy Primary (PWA 36510-2). Stir fully.

NOTE: For (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2), it is permitted to decrease the volume of solvent for applications by brush.

2) For (P18-024) Epoxy Primer (PWA 36568):

NOTE: The (P18-024) Epoxy Primer (PWA 36568) is a dark gray primer. This primer does not contain MEK and is less hazardous than the green (PWA 36519-1).

a) Stir the primer base until there is no solid material remaining on the bottom of the container.

b) Mix seven parts by volume of the primer base with one part by volume of the curing solution. No dilution is necessary.

(7) Apply a thin coat of the (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA 36568) to the repair area with a standard Paint Gun and filtered air supply. Air dry between coats for 5 - 10 minutes.

NOTE: To get sufficient coverage of the repair area, multiple coats of the (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA 36568) can be necessary.

(8) Let the (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA 36568) cure for a minimum of one hour.

(9) Prepare the applicable (P05-037) Aluminized Epoxy Enamel (PWA 569) or (P05-483) Aluminized Epoxy Enamel (PWA 36569) as follows:

(a) For (P05-037) Aluminized Epoxy Enamel (PWA 569):

NOTE: The working life of the (P05-037) Aluminized Epoxy Enamel (PWA 569) mixture is approximately eight hours at 60° - 80°F (16° - 27°C). Be sure to record the time and date of mixing.

1) Stir the enamel base until there is no solid material remaining on the bottom of the container.

2) Mix one part by volume of the enamel base with one part by volume of the curing solution.

3) If necessary, add (P05-063) Solvent Reducer (PWA 36050) to the (P05-037) Aluminized Epoxy Enamel (PWA 569) mixture.

4) Let the (P05-037) Aluminized Epoxy Enamel (PWA 569) mixture become stable for one hour before you use the mixture.

(b) For (P05-483) Aluminize Epoxy Enamel (PWA 36569):

NOTE: The working life of the (P05-483) Aluminized Epoxy Enamel (PWA 36569) mixture is approximately four hours at 60° - 80°F (16° - 27°C). Be sure to record the time and date of mixing.

1) Stir the enamel base until there is no solid material remaining on the bottom of the container.

2) Mix three parts by volume of the enamel base with one part by volume of the curing solution.

3) If necessary, add (P05-482) Solvent Reducer (PWA 36106) to the (P05-483) Aluminized Epoxy Enamel (PWA 36569) mixture.

4) Let the (P05-483) Aluminized Epoxy Enamel (PWA 36569) mixture become stable for 15 minutes before you use the mixture.

(10) Apply one coat of the (P05-037) Aluminized Epoxy Enamel (PWA 569) or (P05-483) Aluminized Epoxy Enamel (PWA 36569) to the repair area with a Paint Gun and filtered air supply.

(11) Cure the (P05-037) Aluminized Epoxy Enamel (PWA 569) or (P05-483) Aluminized Epoxy Enamel (PWA 36569) with a Heat Gun as follows:

(a) For (P05-037) Aluminized Epoxy Enamel (PWA 569):

1) Cure (P05-037) Aluminized Epoxy Enamel (PWA 569) with a Heat Gun at 140° - 180°F (60° - 82°C) for one hour.

(b) For (P05-483) Aluminized Epoxy Enamel (PWA 36569):

1) Air dry the (P05-483) Aluminized Epoxy Enamel (PWA 36569) for a minimum of 24 hours at room temperature to cure the coating sufficiently for handling purposes only.

2) Air dry the (P05-483) Aluminized Epoxy Enamel (PWA 36569) for seven days for full chemical resistance.

(12) Carefully remove the Masking Tape.

(13) Examine the repair area for full coverage of the Aluminized Epoxy Enamel.

26. Degrease Engine Parts by Solvent Wipe (SPOP 208)

A. General

(1) This task gives the general instructions and the approved materials for degreasing of the engine parts by wiping.

B. Consumable Materials

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey the applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

NOTE: Equivalent replacements are permitted for the items that follow.

Name and Number	Manufacturer
Lint Free Cotton Cloth (P05-005)	
Solvent, Methyl Ethyl Ketone (Technical Grade) (P11-005) (PMC 9076)	
Solvent, Methyl Ethyl Ketone (Reagent Grade) (P11-005A) (PMC 1820)	
Isopropyl Alcohol (Technical Grade) (P11-014) (PMC 9094)	
Acetone (P11-032) (PMC 9008)	
Solvent, Cleaner (P11-039) (PMC 9060)	
Remover, Cleaner (P11-042) (PMC 4366)	
Solvent, Cleaner (P11-055) (PMC 8914)	
Solvent, Cleaner (P11-056) (SPMC 156)	
Solvent, Cleaner (P11-057) (SPMC 168)	
Solvent, Cleaner (P11-058) (SPMC 175)	
Solvent, Cleaner (P11-059) (SPMC 176)	
Solvent, Dielectric (P11-062) (PMC 8920)	
Solvent, Hand-Wiping (P11-063) (PMC 8917)	
Solvent, Cleaner (P11-064) (SPMC 185)	

(Continued)

Name and Number	Manufacturer
Acetone (Reagent Grade) (P11-065) (PMC 1914)	
Solvent, Hand-Wiping (P11-066) (PMC 8929)	
Solvent, Cleaner (P11-067) (SPMC 169)	
Solvent, Cleaner (P11-074) (SPMC 213-1)	
Solvent, Cleaner (P11-075) (SPMC 213-2)	
Solvent, Cleaner (P11-076) (SPMC 216-1)	
Solvent, Cleaner Wipe (P11-077) (SPMC 216-2)	
Alcohol, Isopropyl (P11-078) (PMC-9016)	

C. General Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

CAUTION: DO NOT IMMERSE THOSE PART ASSEMBLIES THAT CONTAIN NON-METALLIC MATERIALS IN SOLVENTS. SIZED CHEESECLOTH CONTAINS RESIN BINDERS THAT CAN DISSOLVE IN SOLVENTS AND CAUSE CONTAMINATION OF BOND SURFACES. USE SOLVENT DISPENSERS THAT SQUIRT OR POUR TO PREVENT REPEATED DIPPING AND CONTAMINATION BY WORK CLOTHS.

(2) This SPOP 208 procedure is for use on titanium and non-titanium parts.

(3) Do not use sized cheesecloth with solvents.

(4) Methanol or halogenated hydrocarbon solvents are not permitted in SPOP 208.

D. Procedure - Degrease Engine Parts by Solvent Wipe

WARNING: THE SOLVENTS IN THIS PROCEDURE ARE FLAMMABLE. BE CAREFUL WHEN USING THESE SOLVENTS. THIS WILL PREVENT DEATH OR INJURY TO PERSONNEL.

CAUTION: DO NOT PUT PART ASSEMBLIES THAT CONTAIN MATERIALS THAT ARE NOT METALLIC IN SOLVENTS. THIS WILL NOT CONTAMINATE THE SOLVENTS AND DAMAGE THE METAL SURFACES THE SOLVENT IS APPLIED TO.

CAUTION: DO NOT DIP (PUT MOMENTARILY) THE WIPING CLOTH IN THE SOLVENT OR THE SOLVENT CONTAINER; THIS CAN CAUSE CONTAMINATION OF THE SOLVENT, WHICH CAN CAUSE CONTAMINATION OF THE PART SURFACES AND PREVENT A GOOD BOND WITH ADHESIVES OR PAINTS.

(1) Wipe the part with an unsized, clean, white (P05-005) lint free cotton cloth wet with one of the solvents that follow.

NOTE: Make sure that you wear clean cotton gloves to touch clean parts before adhesive bonding.

(a) For description and letter codes of solvents approved to use on metallic or non-metallic parts, refer to (Figure 233).

(b) For the solvents that are approved to degrease metallic parts for general wiping, and for local Fluorescent Penetrant Inspection (FPI) or before adhesive bonding or painting, refer to (Figure 234).

(c) For the solvents that are approved to degrease non-metallic parts for general wipe cleaning, or before painting or adhesive bonding, refer to (Figure 235).

(d) To maintain the cleanliness of the wiping solvent, pour the solvent onto the cloth.

(e) Do not dip the cloth into the solvent container.

(f) The cloth must be clean, lint free, plastic free, white cotton.

(g) Wear clean cotton gloves to touch clean parts to be bonded.

(2) Air dry the parts.

(a) Do not use compressed air to dry parts before adhesive bonding or painting. Compressed air can contain oil vapors.

LETTER CODE	MATERIAL No.	DESCRIPTION	FLASHPOINT	VAPOR PRESSURE
A	P11-005A	METHYL ETHYL KETONE (REAGENT GRADE)	<140°F (60°C)	>45mm Hg
B	P11-065	ACETONE (REAGENT GRADE)	<140°F (60°C)	>45mm Hg
C	P11-042	FLUORESCENT PENETRANT CLEANER/REMOVER	<140°F (60°C)	>45mm Hg
D	P11-055	SOLVENT CLEANER	≥ 140°F (60°C)	≤ 45mm Hg
E	P11-063	HAND-WIPING SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
F	P11-062	DIELECTRIC SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
G	P11-066	HAND-WIPING SOLVENT	<140°F (60°C)	≤ 45mm Hg
H	P11-032	ACETONE (TECHNICAL GRADE)	<140°F (60°C)	>45mm Hg
I	P11-014A	ISOPROPYL ALCOHOL (REAGENT GRADE)	<140°F (60°C)	≤ 45mm Hg
J	P11-039	SOLVENT CLEANER	<140°F (60°C)	>45mm Hg
K	P11-005	METHYL ETHYL KEYTONE (TECHNICAL GRADE)	<140°F (60°C)	>45mm Hg
L	P11-014	ISOPROPYL ALCOHOL (TECHNICAL GRADE)	<140°F (60°C)	≤ 45mm Hg
M	P11-056	CLEANER SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
N	P11-057	CLEANER SOLVENT	≥ 140°F (60°C)	≤45mm Hg
O	P11-067	CLEANER SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
P	P11-058	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
Q	P11-059	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
R	P11-064	CLEANER SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
S	P11-074	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
T	P11-075	CLEANER SOLVENT WIPES	<140°F (60°C)	≤ 45mm Hg
U	P11-076	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
V	P11-077	CLEANER SOLVENT WIPES	<140°F (60°C)	≤ 45mm Hg

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Description and Letter Codes of Solvents Approved To Use On Metallic Or Non-Metallic Parts
Figure 233/70-00-00-990-837

APPLICATION	SOLVENTS APPROVED TO DEGREASE METALLIC PARTS*
FPI (LOCAL)	A B C G H I J K L P Q S T
GENERAL WIPE	A B C D E F G H I J K L M N O P Q R S T U V
PRE-ADHESIVE BONDING	A B C G I J P Q S T
PRE-PAINTING	A B C G I J P Q S T U V

*SEE FIGURE 70-00-00-990-837 FOR SOLVENT LETTER CODES.

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Solvents Approved to Degrease Metallic Parts
Figure 234/70-00-00-990-838

SPEC. No.	NON-METALLIC PART DESCRIPTION OF MATERIAL	SOLVENTS APPROVED TO DEGREASE NON-METALLIC PARTS*
PWA 410	FIBERGLASS STRUCTURES, LAMINATED MOLDINGS	A B C G H I J K L P Q
PWA 411	CLOTH, GLASS, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 446	POLYURETHAN RESIN, FOAMING	I
PWA 459	FABRIC, AROMATIC POLYAMIDE, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 460	LAMINATED STRUCTURES, AROMATIC POLYAMIDE FABRIC - EPOXY RESIN MATRIX	A B C G H I J K L P Q
PWA 479	MOLDING COMPOUND, POLYAMIDE, COMPOSITE	B I
PWA 628	FOAM, MOLDED POLYURETHANE	I
PWA 36013	POLYURETHANE COATING, CONDUCTIVE, BLACK	I
PWA 36014	POLYURETHANE SURFACER, WHITE	I
PWA 36151	COMPOSITE AIRFOILS, CARBON FIBER REINFORCED	A B C G H I J K L P Q
PWA 36408	FABRIC, CARBON FIBER AND FIBERGLASS, POLYIMIDE RESIN IMPREGNATED	B I
PWA 36414	FABRIC, ALUMINUM BOROSILICATE GLASS FIBER, EPOXY RESIN IMPREGNATED	B I
PWA 36422	FABRIC, FIBERGLASS, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 36426	MOLDING COMPOUND, POLYETHERIMIDE COMPOSITE	B
PWA 36442	FLUOROELASTOMER SHEET	I
PWA 36509	PRIMER, POLYURETHANE	I
PWA 36510	COATING, POLYURETHANE, EROSION RESISTANT	I
PWA 36516	FLUOROELASTOMER COATING	I
*SEE FIGURE 70-00-00-990-837 FOR THE SOLVENT LETTER CODES.		

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S0000301637V1

Solvents To Degrease Non-Metallic Parts
Figure 235/70-00-00-990-839

27. Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)

A. General

(1) This task gives the general instructions and the approved materials for cleaning of the engine after chemical contact with fire extinguishing agents, hydraulic fluid, oil, or fuel.

B. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items.

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 208

Name and Number	Manufacturer
Aqueous Cleaner P11-049 (SPMC 148-1)	

C. Procedure - General Instructions (Figure 236)

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) SPOP 425 gives operators the cleaning and disassembly requirements for engines that come in contact with (touch) fire extinguishing agents during a fire in the burner (combustor) and/or gaspath areas of the engine, or that come in contact with hydraulic fluid, oils, or fuel. Contact (speak or write to) the local Pratt & Whitney representative for the applicable requirements and procedures when the subsequent conditions occur:

(a) The engine comes in contact with a fire extinguisher agent when there is no fire (for example, during accidental operation of the fire extinguisher system).

(b) The fire temperature was higher than the engine over-temperature limits.

(c) The fire occurred in areas other than the burner and gaspath areas of the engine.

(3) After a fire extinguisher agent goes into the engine, do not operate the engine if (Figure 236) shows that the fire extinguisher agent makes it necessary to disassemble the engine. Some fire extinguisher agents can cause damage to engine parts at engine operation temperatures.

(4) If you used carbon dioxide, nitrogen, Ansul Inergen, water, or water fog to extinguish a tail pipe fire, and the post fire-fire inspection finds no fire damage or mechanical damage, then it will not be necessary to disassemble the engine to clean the engine parts. See (Figure 236 (Sheet 1)). For many other fire extinguisher agents, it is necessary to disassemble the engine to satisfactorily clean the parts that came in contact with the fire extinguisher agent. (Figure 236 (Sheet 2))

(5) Before you do maintenance work on a hanger fire extinguisher system that uses foam, remove engines from the hanger or put covers on the engines to make sure that accidental operation of the system does not cause foam to go into engine.

(6) Necessary detailed procedures for gaspath cleaning (internal wash), and instructions for subsequent disassembly, cleaning, and inspection, are in the applicable AMM Maintenance Manuals.

(7) If operators who know of airports, test cells, or hangers that use fire extinguisher agents that are not in the list in (Figure 236), then they must give instructions to their local Pratt & Whitney representative to send the Technical Data Sheets and Material Safety Data Sheets for these fire extinguisher agents to Pratt & Whitney Customer Service in East Hartford, Connecticut.

(8) The primary concern when foam or dry chemical fire extinguisher agents go into an engine is corrosion during subsequent engine operation. The engine operating environment can cause chemical reactions of the fire extinguishing agents, which then can cause corrosion on cold-section and/or hot-section parts.

(9) Tests show these results:

(a) Stainless steels alloys, nickel base alloys, (coated or uncoated), and cobalt base alloys, show a high risk of chemical corrosion from some types of fire extinguisher agents, (for example, protein foams and dry chemical agents), at temperatures much below the engine operating range.

(b) Titanium, aluminum, magnesium, cadmium plated and nickel-cadmium plated low alloy steels show no signs of corrosion from bicarbonate compounds (dry powders) at engine operating temperatures.

(c) Many of the foam fire extinguisher agents in the list in (Figure 236 (Sheet 1)) causes stress corrosion cracks in titanium at the service operation temperatures in the high pressure compressor, but not at the service operation temperatures of the fan. Thus, it is permitted to hand wipe clean with (P11-49) Aqueous Cleaner (SPMC 148) to remove overspray of foam fire extinguisher agents from fan blades.

(d) Some of the aqueous film-forming foam (AFFF) and high-expansion foam chemical fire extinguisher agents in the list in (Figure 236 (Sheet 2)) do not cause corrosion on engine material test panels at engine operation temperatures. (Figure 236 (Sheet 2)) shows which AFFF and high-expansion foam agents have test results that show they are compatible with engine alloys and coatings. For other AFFF and high-expansion foam agents, it is necessary to disassemble the engine to remove the parts that came in contact with the foam.

(10) Halon 1301 fire extinguishing agent decomposes in fires and at engine operation temperatures to make acids that can cause corrosion of, or stress corrosion cracks in, gaspath materials at high temperatures. Tests show that Halon 1301 can degrade turbine airfoil coatings at 1800°F (982°C) in a short period of time.

(a) Fire extinguisher systems that release Halon 1301 directly into the core of the engine (for example, ground units) can cause the turbofan airfoils to come in contact with the Halon 1301.

(b) Onboard nacelle Halon 1301 fire extinguisher systems usually do not cause the turbine airfoils to come in contact with the Halon 1301 because these systems release the Halon 1301 into the nacelle compartment and not directly into the engine core. Thus, it is usually not necessary to clean engine gaspath parts to remove Halon 1301 decomposition materials after an onboard nacelle fire extinguisher system releases Halon 1301.

(11) The aqueous film-forming foams (AFFF) in (Figure 236 (Sheet 2)) are NFPA Class B foam fire extinguisher agents that use synthetic surfactants, which are usually fluorinated. These foams do not contain protein foaming agents.

(12) The high-expansion foams in (Figure 236 (Sheet 2)) are NFPA Class B foam fire extinguisher agents that expand quickly to fill closed spaces (for example, hangars). These foams usually use synthetic surfactants that are different from the synthetic surfactants in aqueous film-forming foams.

(13) The protein (P), fluoroprotein (FP), and film-forming fluoroprotein (FFFP) foams in (Figure 236 (Sheet 2)) are NFPA Class B foam fire extinguisher agents that use protein foaming agents.

D. Cleaning After Chemical Contact with Fire Extinguisher Agents

(1) After a fire, or after you use an onboard nacelle fire extinguisher system because of a cockpit fire warning, do an inspection of the engine for fire damage:

(a) Turn the rotor manually to do a check to make sure that the rotor turns freely:

1) The rotor must turn freely. A rotor that does not turn freely is a sign of damage.

2) While the rotor turns, listen for parts that rub against or hit other parts that they usually do not touch. Such noises are signs of damage.

(b) Do a visual inspection of the external surfaces of the engine to look for fire damage.

(c) Do a borescope inspection of the engine to see which parts have fire damage.

(d) If the check for free movement finds one or more signs of damage, the visual inspection finds fire damage, and/or the borescope inspection finds fire damage, then it is necessary to remove the engine from the airframe and to disassemble the engine to remove the parts that have damage.

(2) In engine models that use labyrinth seals, do a check for contamination of the oil systems because the materials in the list in (Figure 236) could enter the oil system through the labyrinth seals.

(3) See (Figure 236)(Figure 701 (Sheet 1 & 2) for the inspection, cleaning, and disassembly requirements for engines that come in contact with fire extinguisher agents during a fire. The procedures for the requirement in each column of (Figure 701 Sheet 1 & 2) are in the subsequent list:

(a) Visual/Borescope Inspection - (Figure 236), Column 2

1) If Column 2 says "YES" for the material in (Figure 236), then do the subsequent procedure:

a) Do a visual inspection of the external surfaces of the engine to see which parts have contamination from the material.

b) Do an internal borescope inspection to see which parts have contamination from the material.

NOTE: This inspection will show how much of the engine you must disassemble to remove the parts that have contamination from the material.

NOTE: This inspection does not show contamination from gaseous fire extinguisher agents or vaporizing liquid fire extinguisher agents.

2) If Column 2 says "N/R" for the material in (Figure 236), then it is not required (that is, it is permitted, but not necessary) to do a borescope inspection of the engine to look for contamination.

(b) External Wash - (Figure 236), Column 3

1) If Column 3 says "YES" for the material in (Figure 236), then do an external wash to remove the material from the external surfaces of the engine that had chemical contact with the material. Use this procedure:

a) Use Paragraph 30. to clean electrical harnesses and contact points.

b) Use Paragraph 22. to clean other external surfaces.

2) If Column 3 says "NO" for the material in (Figure 236) then do not do an external wash.

3) If Column 3 says "N/R" for the material in (Figure 236)(Figure 701 Sheet 1 or 2), then it is not required (that is, it is permitted, but not necessary) to do an external wash to remove the material from the external surfaces.

(c) Internal Wash - (Figure 236), Column 4

1) If Column 4 says "YES" for the material in (Figure 236), then do an internal (gaspath) wash of the engine to remove the material from the engine gaspath surfaces. Refer to the applicable AMM maintenance task for the gaspath wash procedures.

CAUTION: IF YOU OPERATE THE ENGINE AFTER ENGINE GASPATH PARTS COME IN CONTACT WITH THE MATERIAL, THE MATERIAL COULD CAUSE DAMAGE TO THESE PARTS AT ENGINE OPERATION TEMPERATURES.

2) If Column 4 says "NO" for the material in (Figure 236), then it is not permitted to do an internal (gaspath) wash. Do not operate the engine after engine gaspath parts come in contact with the material.

NOTE: It is not possible to fully remove foam fire extinguisher agents from the engine gaspath by an internal wash (with plain water or with detergent).

NOTE: Dry chemical fire extinguisher agents are not water soluble. Thus, an internal wash will cause these materials to cake, bond to engine parts, and/or cause air holes and cavities to become clogged.

a) If you or some other operator does an internal wash after engine gaspath parts come in contact with the material, then it will be necessary to remove and clean all parts in the engine gaspath.

3) If Column 4 says "N/R" for the material in (Figure 236), then it is not required (that is, it is permitted, but not necessary) to do an internal (gaspath) wash to remove the material from engine gaspath surfaces.

(d) Disassemble/Clean By Engine Manual - (Figure 236), Column 5

1) 1 If Column 5 says "YES" for the material in (Figure 236), then disassemble the engine to clean the parts that have contamination. Use the subsequent procedure:

CAUTION: IF YOU OPERATE THE ENGINE AFTER ENGINE GASPATH PARTS COME IN CONTACT WITH THE MATERIAL, THE MATERIAL COULD CAUSE DAMAGE TO THESE PARTS AT ENGINE OPERATION TEMPERATURES.

a) Do not operate the engine after the engine has chemical contact with the material.

b) Complete this procedure as soon as possible after the parts have chemical contact with the material.

c) For gaseous fire extinguisher agents or vaporizing liquid fire extinguisher agents, disassemble the engine to remove all parts in the engine gaspath.

d) For foam fire extinguisher agents or dry chemical fire extinguisher agents, disassemble the engine to remove those parts on which the visual/borescope inspection found contamination.

<1> If you or some other operator did a gaspath wash after the material went into the engine, then it is necessary to remove and clean all parts in the engine gaspath.

e) Use the applicable AMM maintenance task for instructions to clean the parts.

f) After the parts are clean, do a visual inspection of all parts that had chemical contact. Use the applicable AMM maintenance task for inspection limits.

2) If Column 5 says "N/R" for the material in (Figure 236), then it is not required (that is, it is permitted, but not necessary) to disassemble the engine to clean the parts.

E. Cleaning After a Hydraulic Fluid Leak

(1) After a hydraulic fluid leak, do the subsequent procedure:

(a) Complete this procedure as soon as possible after contamination from hydraulic fluid occurs.

(b) Do a visual inspection of the external surfaces of the engine to see which parts have contamination from hydraulic fluid.

1) If external surfaces show baked-on or burned hydraulic fluid, contact the local Pratt & Whitney representative for the applicable requirements and procedures.

2) 2 If external surfaces show wet hydraulic fluid with no indication of baked-on or burned hydraulic fluid, then do the subsequent steps in this procedure.

(c) If the visual inspection of the external surfaces of the engine finds indications that hydraulic fluid went into the engine through bleed valves, the inlet, or the exhaust, then do an internal borescope inspection to see which parts have contamination from the hydraulic fluid.

NOTE: This inspection will show how much of the engine you must disassemble to remove the parts that have contamination from the hydraulic fluid.

1) If gaspath surfaces show contamination from hydraulic fluid, then it is necessary to remove the parts that have contamination from the hydraulic fluid for better cleaning.

2) It is not permitted to do an internal wash to remove hydraulic fluid from the gaspath surfaces.

(d)) If the visual inspection of the external surfaces of the engine found wet hydraulic fluid with no indication of baked-on or burned hydraulic fluid, then do an external wash to remove the hydraulic fluid from the external surfaces of the engine. Use the subsequent procedure:

1) Use Paragraph 30. to clean electrical harnesses and contact points.

2) Use one of the procedures in the subsequent list to clean other external surfaces:

a) Use Paragraph 22. to clean other external surfaces.

b) Use Paragraph 26. to remove grease from other external surfaces.

3) After the above steps, do a visual inspection to look for remaining hydraulic fluid varnish or baked-on hydraulic fluid.

(e)) If the visual inspection after the external wash finds remaining hydraulic fluid varnish or baked-on hydraulic fluid, then do the subsequent procedure:

1) Disassemble the engine to remove those parts that show remaining hydraulic fluid varnish or baked-on hydraulic fluid.

2) Use the applicable AMM maintenance task instructions to clean the parts that show remaining hydraulic fluid varnish or baked-on hydraulic fluid.

3) After the parts are clean, do a visual inspection of the parts. Use the applicable AMM maintenance task for the inspection limits.

(f) If inspection finds part surfaces with baked-on or burned hydraulic fluid and/or engine gaspath surfaces with contamination from hydraulic fluid, then do the subsequent procedure:

1) Do not operate the engine if engine gaspath surfaces have contamination from hydraulic fluid.

2) Disassemble the engine to remove those gaspath parts on which the visual/borescope inspection found contamination from hydraulic fluid.

a) If you or some other operator did a gaspath wash after the contamination of engine gaspath surfaces from hydraulic fluid occurred, then it is necessary to remove and clean all parts in the engine gaspath.

3) Use the applicable AMM maintenance task instructions to clean the parts.

4) After the parts are clean, do a visual inspection of all parts that had contamination from hydraulic fluid. Use the applicable AMM maintenance task for the inspection limits.

F. Cleaning After an Oil or Fuel Leak

(1) After an oil or fuel leak, do the subsequent procedure:

(a) Do an external wash to remove the oil or fuel from the external surfaces of the engine. Do the subsequent steps:

1) Use Paragraph 30. to clean electrical harnesses and contact points.

a) Use one of the procedures in the subsequent list to clean other external surfaces:

<1> Use Paragraph 22. to clean other external surfaces.

<2> Use Paragraph 26. to remove grease from other external surfaces.

(b) Do an internal (gaspath) wash of the engine to remove the oil or fuel from the engine gaspath surfaces. Refer to the applicable AMM maintenance task for the gaspath wash procedure.

FIRE EXTINGUISHER AGENT TYPE	VISUAL/ BORESCOPE INSPECTION	EXTERNAL WASH	INTERNAL WASH	DISASSEMBLE/ CLEAN BY ENGINE MANUAL
WATER				
WATER	N/R	N/R	N/R	N/R
WATER FOG	N/R	N/R	N/R	N/R
GASEOUS				
ANSUL INERGEN® (N2 + Ar + CO2)	N/R	N/R	N/R	N/R
CARBON DIOXIDE	N/R	N/R	N/R	N/R
NITROGEN	N/R	N/R	N/R	N/R
SULFUR HEXAFLUORIDE (SF6)	N/R	NO	NO	YES
VAPORIZING LIQUID				
DUPONT FE-232™ (HCFC-123)	N/R	NO	NO	YES
DUPONT FE-36™ (HFC-236fa)	N/R	NO	NO	YES
DUPONT FE-227™/FM-200® (HFC-227 ea)	N/R	NO	NO	YES
GREAT LAKES FM-100 (HBFC-22B1)	N/R	N/R	N/R	N/R
HALON 1011 (HBCC-30B1)	N/R	NO	NO	YES
HALON 1202 (BFC-12B2)	N/R	NO	NO	YES
HALON 1211 (BCFC-12B1)	N/R	NO	NO	YES
HALON 1301 (BFC-13B1) - NACELLE DISCHARGE/RELEASE	N/R	N/R	N/R	N/R
HALON 1301 (BFC-13B1) - IN PRIMARY GASPATH	N/R	NO	NO	YES
HALON 2402 (BFC-114B2)	N/R	NO	NO	YES
HALOTRON® I (HCFC-123 BLEND)	N/R	NO	NO	YES
HALOTRON® II (HFC-134a + HFC-125 + CO_2)	N/R	NO	NO	YES
DRY CHEMICAL				
NFPA ABC MULTI-CLASS:				
AMMONIUM PHOSPHATE	YES	NO	NO	YES
NFPA BC MULTI-CLASS:				
PURPLE K	YES	NO	NO	YES
SODIUM BICARBONATE	YES	NO	NO	YES
NFPA CLASS D:				
FOUNDRY FLUX	YES	NO	NO	YES
ANSUL MET-L-X®	YES	NO	NO	YES
FYR-FYTER METAL FYR	YES	NO	NO	YES
M-1	YES	NO	NO	YES
PYRO-CHEM® G-1	YES	NO	NO	YES
REFER TO THE TEXT FOR THE FULL REQUIREMENTS.				

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Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)
Figure 236/70-00-00-990-836 (Sheet 1 of 2)

FIRE EXTINGUISHER AGENT TYPE	VISUAL/ BORESCOPE INSPECTION	EXTERNAL WASH	INTERNAL WASH	DISASSEMBLE/ CLEAN BY ENGINE MANUAL
FOAM				
AQUEOUS FILM-FORMING FOAMS (AFFF):				
ANSULITE® 1%	N/R	N/R	N/R	N/R
ANSULITE® 3% (AFC-3A)	N/R	N/R	N/R	N/R
ANSULITE® PREMIUM 3% (AFC-5-A)	N/R	N/R	N/R	N/R
CHEMGUARD 3% AFFF C-303	N/R	N/R	N/R	N/R
ALL OTHER AQUEOUS FILM-FORMING FOAMS	YES	NO	NO	YES
HIGH EXPANSION FOAMS:				
ANSUL JET-X® 2 3/4%	N/R	N/R	N/R	N/R
NATIONAL FOAM HI-EX® 2%	N/R	N/R	N/R	N/R
ALL OTHER HIGH EXPANSION FOAMS	YES	NO	NO	YES
OTHER FOAM TYPES:				
PROTEIN (P, FP, OR FFFP)	YES	NO	NO	YES
SODA-ACID	YES	NO	NO	YES
TRIMETHOXYBOROXINE (TMB)	YES	NO	NO	YES
WATER-GLYCOL	YES	NO	NO	YES
REFER TO THE TEXT FOR THE FULL REQUIREMENTS.				

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Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)
Figure 236/70-00-00-990-836 (Sheet 2 of 2)

28. DENICKING (BLENDING) AND BUFFING/POLISHING TITANIUM PARTS (SPOP 532)

A. General

(1) This procedure gives the instructions for blending and buffing titanium parts.

B. Fixtures, Tools, Test and Support Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

REFERENCE	DESIGNATION
Not specified	Pneumatic Hand Tool
Not specified	Tampico Brush
Not specified	Files
Not specified	Abrasive Stone
Not specified	Abrasive Paper
Not specified	Crocus Cloth
Not specified	Abrasive Pads
Not specified	Emery Cloth
Not specified	Silicon Carbide or Aluminum Oxide Grit (80, 120, or 180 mesh)

C. Consumable Materials

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart can not be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local and provincial laws and regulations when it is necessary to work with these materials.

REFERENCE	DESIGNATION
P05-066	Buffing Polishing Compound PMC 3061
P05-353	Cloth Wheel, Non-Coated
P05-354	Polishing Compound PMC 3017
P05-384	Silicon Carbide Deburring Compound PMC 3088
P05-421	Scrub Pad PMC 4095
P05-422	Scrub Pad PMC 4435
P05-426	Polishing Compound PMC 3022

D. Procedure - General Denicking (Blending) and Buffing Instructions

WARNING: TITANIUM DUST CAN BE A FIRE HAZARD. REMOVE BLEND DUST FREQUENTLY DURING REPAIR.

CAUTION: LIMITS SPECIFIED IN THIS SECTION ARE FOR GENERAL USE ONLY. ALL PART-SPECIFIC LIMITS TAKE PRECEDENCE OVER THE LIMITS THAT FOLLOW. POST-BLEND SURFACE TREATMENT REQUIREMENTS WILL BE DETAILED WITHIN THE SPECIFIC BLEND REPAIR.

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.

CAUTION: TO CONTROL DUST AND NOISE CAUSED BY BLENDING, AND TO REDUCE THE RISK OF FIRE HAZARD FROM BLENDING DUST OF CERTAIN MATERIALS, WHENEVER POSSIBLE, DO THE BLENDING OPERATION IN A VENTILATED BOOTH. CONTACT YOUR LOCAL ENVIRONMENT HEALTH AND SAFETY PERSONNEL FOR SPECIFIC REQUIREMENTS.

CAUTION: USE ONLY MINIMUM PRESSURE WHEN YOU APPLY BLENDING TOOLS TO PARTS.

CAUTION: CHECK THE PART FREQUENTLY FOR HEAT BUILD-UP. IF THE PART IS TOO HOT TO TOUCH WITH YOUR HAND, LET THE PART COOL DOWN BEFORE YOU CONTINUE WITH THE REPAIR. IF THE PARTS CONTAIN TOO MUCH HEAT DURING BLENDING IT CAN CAUSE EMBRITTLEMENT.

CAUTION: DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

CAUTION: BE SURE TO DRESS THE ABRASIVE TOOL BEFORE BLENDING TO GET BEST TOOL PERFORMANCE AND TO PREVENT MATERIAL CROSS-CONTAMINATION.

CAUTION: USE A SHIELD OR MASKING TO PROTECT OTHER SURFACES FROM DAMAGE BY ACCIDENTAL TOOL CONTACT DURING THE REPAIR.

(1) General blending guidelines are as follows:

(2) Blending is an operation to remove nicks, scratches, high metal, and other surface defects by the removal of the base metal.

  (a) Use manual or mechanical procedures to make shallow and smooth surface depressions.

    NOTE: This will decrease the stress concentration from the damaged area by the distribution of the stress concentration on larger areas.

(3) Examine the part for cracks, before the blend repair. (Paragraph 23.)

(4) Enclosed areas will have a tolerance of 0.125 in. (3.175 mm) or more in all directions unless adjacent areas are specified as areas where blending is not permitted.

  (a) Non-toleranced enclosed areas specified in blend repairs are to corners, points of tangency between surfaces, or at points opposite one of these locations.

(5) It is better to blend sharp impact damage that is in serviceable limits than it is to accept that damage.

  (a) The sharper the impact, the better it is to blend the damaged area.

(6) Make one blend when the adjacent damage is to near together, that the minimum length-to-depth blend ratio cannot be done.

(7) The depth of the blend must be sufficient to remove the damage with the repair limits.

(8) The approved repair criteria for blending is as follows:

(a) The best blends are smooth, continuous, and circular at the bottom.

(b) The blends must extend outboard from the damage area.

(c) For rotating parts, the length of the blend must be a minimum of 15 times the maximum depth of the blend in all directions.

(d) For non-rotating parts, the length of the blend must be a minimum of 10 times the maximum depth of the blend in all directions.

(e) Blend in the circumferential direction, on a cylindrical surface.

(f) Blend engine radial members in a radial direction.

(9) The approved repair criteria for manual blending by hand is as follows:

(a) Manual blending is done with abrasive stones, abrasive paper, abrasive pads, files, emery cloth, or crocus cloth.

(b) Blend with more than one grade of the abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish.

(c) Use manual blending for local damage in the form of raised material.

(d) Use manual blending for parts that are smaller than 1.75 in. (44.45 mm).

CAUTION: DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

(10) The approved repair criteria for mechanical blending is as follows:

(a) Mechanical blending is done with a power tool (electrical or air) with abrasive impregnated wheels, stones, or pads.

(b) Blend with more than one grade of the abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish.

(c) Use minimum pressure when the blending tool is applied to the part. This will prevent heat build-up.

(d) Do not let particles from blending build-up on the abrasive wheels.

(11) Do the visual inspection of the blends as follows:

(a) Compare the surface finish with the adjacent non-blended surface.

(b) The surface finish of the blended area must be as smooth as, or smoother than, the initial surface.

(c) Transitions from blended to non-blended areas must be smooth and continuous.

(d) Repair the initial radius contour, if the blended area intersects adjacent radii.

(e) Break the sharp edges from 0.003 in. (0.076 mm) to 0.015 in. (0.381 mm), if the blended area intersects a corner.

(12) Do the buffing as follows:

NOTE: Buffing is an optional procedure to use to get the necessary surface finish while blending.

(a) Buff the area(s) with a power tool, a tampico brush, and (P05-066) buffing polishing compound (PMC 3061) or (P05-384) silicon carbide deburring compound (PMC 3088).

(b) Use minimum pressure when the blending tool is applied to the part. This will prevent heat build-up.

(c) Buff engine radial members in a radial direction.

(d) Buff cylindrical surfaces in a circumferential direction.

(13) Do the polishing as follows:

NOTE: Polishing is an optional operation that can be used to smooth minor scratches and burrs.

(a) Polish the area(s) with fine grain abrasive paper, abrasive cloth, crocus cloth, emery cloth, (P05-421) scrub pad (PMC 4095), or (P05-422) scrub pad (PMC 4435).

CAUTION: WHEN YOU BLEND ROTATING COMPONENTS, DO THE PROCEDURE IN THE ORDER GIVEN IN THE PROCEDURE TO PREVENT DAMAGE TO THE PART.

(14) Special instructions for the blending of rotating parts, are as follows:

(a) Make sure to follow all the requirements in the blending and buffing procedures.

(b) Do not do on-wing blending in areas where shotpeening is necessary.

(c) Blend only if necessary in the specified AMM maintenance task.

(d) Blend to a sufficient depth to remove all damage from 0.002 in. (0.051 mm) to 0.003 in. (0.076 mm) of material in the repair limits.

(e) Blending must start with the coarser grades of flexible abrasive impregnated wheels, brushes, or points for the initial removal of damage.

(f) Do not use a coarser grade of abrasive than is necessary to remove the damage.

(g) Finish blending the part with the finer grades of abrasives.

(h) The surface must be as smooth as, or smoother than, the adjacent surfaces.

(i) Use grades of abrasives in the order that follows:

(j) 80 mesh silicon carbide or aluminum oxide grit.

(k) 120 mesh silicon carbide or aluminum oxide grit.

(l) 180 mesh silicon carbide or aluminum oxide grit.

(m) Optional:

1) Use (P05-354) Polishing Compound (PMC 3017) or (P05-426) Polishing Compound (PMC 3022) with (P05-353) Cloth Wheel (Non-Coated) to get a surface finish, if necessary.

29. Denicking (Blending) and Buffing/Polishing of Steel, Nickel, Cobalt, Aluminum, and Magnesium Alloy Parts (SPOP 533)

A. General

(1) This task gives the general instructions for blending and buffing of steel, nickel, cobalt, aluminum, and magnesium alloy parts.

B. Fixtures, Tools, Test and Support Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

REFERENCE	DESIGNATION
Not specified	Pneumatic Hand Tool
Not specified	Tampico Brush
Not specified	Files
Not specified	Abrasive Stone
Not specified	Abrasive Paper
Not specified	Crocus Cloth

(Continued)

REFERENCE	DESIGNATION
Not specified	Abrasive Pads
Not specified	Emery Cloth
Not specified	Silicon Carbide or Aluminum Oxide Grit (80, 120, or 180 mesh)

C. Consumable Materials

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart can not be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local and provincial laws and regulations when it is necessary to work with these materials.

REFERENCE	DESIGNATION
P05-066	Buffing Polishing Compound PMC 3061
P05-353	Cloth Wheel, Non-Coated
P05-354	Polishing Compound PMC 3017
P05-384	Silicon Carbide Deburring Compound PMC 3088
P05-421	Scrub Pad PMC 4095
P05-422	Scrub Pad PMC 4435
P05-426	Polishing Compound PMC 3022

D. Procedure - General Denicking and Buffing/Polishing Instructions

WARNING: MAGNESIUM DUST IS EXTREMELY FLAMMABLE. FOLLOW THE PRECAUTIONS VERY CAREFULLY TO PREVENT FIRE. BE SURE TO FREQUENTLY REMOVE BLEND DUST FROM THE PART, BLENDING AREA, AND WEAR GLOVES DURING THE REPAIR.

CAUTION: LIMITS SPECIFIED IN THIS SECTION ARE FOR GENERAL USE ONLY. ALL PART-SPECIFIC LIMITS TAKE PRECEDENCE OVER THE LIMITS THAT FOLLOW. POST-BLEND SURFACE TREATMENT REQUIREMENTS WILL BE DETAILED WITHIN THE SPECIFIC BLEND REPAIR.

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.

CAUTION: TO CONTROL DUST AND NOISE CAUSED BY BLENDING, AND TO REDUCE THE RISK OF FIRE HAZARD FROM BLENDING DUST OF CERTAIN MATERIALS, WHENEVER POSSIBLE, DO THE BLENDING OPERATION IN A VENTILATED BOOTH. CONTACT YOUR LOCAL ENVIRONMENT HEALTH AND SAFETY PERSONNEL FOR SPECIFIC REQUIREMENTS.

CAUTION: USE ONLY MINIMUM PRESSURE WHEN YOU APPLY BLENDING TOOLS TO PARTS. EXCESSIVE PRESSURE AND SPEED WILL CAUSE SPARKS OR AN ORANGE PEEL EFFECT THAT CAN POSSIBLY BE HARMFUL TO THE PART. KEEP MATERIAL REMOVAL TO A MINIMUM. DO NOT EXCEED BLEND LIMITS.

CAUTION: CHECK THE PART FREQUENTLY FOR HEAT BUILD-UP. IF THE PART IS TOO HOT TO TOUCH WITH YOUR HAND, LET THE PART COOL DOWN BEFORE YOU CONTINUE WITH THE REPAIR. IF THE PARTS CONTAIN TOO MUCH HEAT DURING BLENDING IT CAN CAUSE EMBRITTLEMENT.

CAUTION: DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

CAUTION: BE SURE TO DRESS THE ABRASIVE TOOL BEFORE BLENDING TO GET BEST TOOL PERFORMANCE AND TO PREVENT MATERIAL CROSS-CONTAMINATION.

CAUTION: USE A SHIELD OR MASKING TO PROTECT OTHER SURFACES FROM DAMAGE BY ACCIDENTAL TOOL CONTACT DURING THE REPAIR.

(1) Blending General Guidelines

(a) Blending is an operation that is used to remove nicks, scratches, high metal, and other surface irregularities by intentional removal of base metal. Manual or mechanical methods are used to produce shallow and smooth surface depressions that reduce the stress concentration from the damaged area by the distribution of the stress concentration over larger, more tolerant areas.

(b) Before you start any blend repair, examine part for cracks. refer to Fluorescent Penetrant Inspection (SPOP 70) (Paragraph 23.).

(c) Non-toleranced enclosed areas defined in blend 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 in. (3.175 mm) in all directions unless adjacent areas are specified as areas where blending is not permitted.

(d) It is better to blend sharp impact damage that is within acceptable limits than it is to accept that damage. The sharper the impact, the better it is to blend the damaged area.

(e) It is recommended that you make one single blend when the adjacent damage is so close together that the minimum length-to-depth blend ratio cannot be done independently.

(f) The depth of the blend must be as deep as necessary to remove the damage within the repair limits specified.

(g) The best blends are the ones which are smooth, continuous, and round-bottomed that extend outboard from the damage area as much as necessary. Refer to the step that follows.

(h) For rotating parts, the length of the blend must be a minimum of 15 times the maximum depth of the blend in all directions. For non-rotating parts, the length of the blend must be a minimum of 10 times the maximum depth of the blend in all directions.

(i) For local damage in the form of raised material, manual blending (that is, blending by hand) is the preferred method.

(j) When blending on a cylindrical surface, blend in the circumferential direction.

(k) Blend engine radial numbers in a radial direction.

(l) For parts that are smaller than 1.75 in. (44.45 mm) in length, the manual blending procedure that follows is recommended.

(m) Manual Blending (Blending By Hand)

1) Manual blending is done with abrasive stones, abrasive paper, abrasive pads, files, emery cloth, and/or crocus cloth.

NOTE: Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive needed to remove the damage.

(n) Mechanical Blending (Power Blending)

CAUTION: DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

1) When blending, use a power tool (electric or air) with abrasive-impregnated wheels, stones, and/or pads.

NOTE: Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive needed to remove the damage.

2) Use minimum pressure when you apply the blending tool to the part to prevent heat build-up. Do not let abrasive wheels become loaded up with any particles remaining from blending.

(2) Visual Inspection of the Blends

(a) The surface finish of the blended area must be as smooth as, or smoother than, the initial surface. You can compare the surface finish with the adjacent non-blended surface.

(b) All transitions from blended to non-blended areas must be smooth and continuous.

(c) If the blended area intersects adjacent radii, the initial radius contour must be restored.

(d) If the blended area intersects a corner, break the sharp edges 0.003 in. (0.076 mm) - 0.015 in. (0.381 mm).

(3) Buffing/Polishing (Optional)

(a) Buffing is an optional operation that can be used to get the necessary surface finish while blending.

1) Buff reworked area(s) with a power tool, a tampico brush, and (P05-066) Buffing Polishing Compound (PMC 3061) or (P05-384) Silicone Carbide Deburring Compound (PMC 3088).

2) Use minimum pressure when you apply the buffing brush to the part to prevent heat build-up.

3) Buff engine radial members in a radial direction.

4) Buff cylindrical surfaces in a circumferential direction.

(b) Polishing is an optional operation that can be used to smooth minor scratches and burrs with fine grain abrasive paper, abrasive cloth, crocus cloth, emery cloth, (P05-421) Scrub Pad (PMC 4095), or (P05-422) Scrub Pad (PMC 4435).

(4) Local Touch-up After Blending

(a) Aluminum Anodized parts - To prevent corrosion damage on aluminum anodized parts after blending, do a local touch-up of the repair. Refer to Anodized Touch-Up (SPOP 42). (Paragraph 24.)

(b) Nickel - Cadium Plated or PWA 110 Coated Parts - Refer to the engine shop P & W Standard Practices Manual - SPOP 144 for disposition and repair.

NOTE: SPOP 144 is not a typical on-wing type repair. You must measure, mix, and apply chemicals and solutions that are not normally provisioned at line stations. Refer to the P & W Standard Practices Manual (PN 585005), 70-41-03.

(c) Magnesium Parts With PWA 547 Coating - Refer to the engine shop P & W Standard Practices Manual - SPOP 155 for disposition and repair.

NOTE: SPOP 155 is not a typical on-wing type repair. You must measure, mix, and apply chemicals and solutions that are not normally provisioned at line stations. Refer to the P & W Standard Practices Manual (PN 585005), 70-41-03.

CAUTION: WHEN YOU BLEND ROTATING COMPONENTS, DO THE PROCEDURE IN THE ORDER GIVEN IN THE PROCEDURE TO PREVENT DAMAGE TO THE PART.

(5) Special Instructions for the Blending of Rotating Parts.

NOTE: Be sure to follow all the instructions in the Blending and Buffing/Polishing procedures above.

(a) In areas where shotpeening is required, on-wing blending is not permitted. Blend only as specified in the specific AMM maintenance procedure.

(b) Blend to a sufficient depth to remove all the damage that you can see plus 0.002 in. (0.051 mm) - 0.003 in. (0.076 mm) of material within the repair limits specified.

(c) Blending must start with the coarser grades of resilient flexible abrasive-impregnated wheels, brushes, or points for the initial removal of damage, but not coarser than is needed to remove the damage.

(d) Finish blending the part with the finer grades of abrasive until the surface is as smooth as, or smoother than, the adjacent surfaces.

(e) Use grades of abrasives in the order that follows:

1) 80 mesh silicon carbide or aluminum oxide grit.

2) 120 mesh silicon carbide or aluminum oxide grit.

3) 180 mesh silicon carbide or aluminum oxide grit.

4) Optional: Use (P05-354) Polishing Compound (PMC 3017) or (P05-426) Polishing Compound (PMC 3022) with (P05-353) Cloth Wheel (Non -Coated) to get a surface finish, if necessary.

30. Cleaning of Electrical Wiring Harnesses and Contact Points (SPOP 6)

A. General

(1) This task gives the general instructions and the approved materials for cleaning of electrical wiring harnesses and contact points.

B. Consumable Materials

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart can not be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local and provincial laws and regulations when it is necessary to work with these materials.

REFERENCE	DESIGNATION
P05-005	Lint Free Cotton Cloth
P11-014A	Reagent Grade Isopropyl Alcohol PMC 9016
P11-055	Cleaner Solvent PMC 8914
P11-056	Cleaner Solvent SPMC 156
P11-057	Cleaner Solvent SPMC 168
P11-058	Cleaner Solvent SPMC 175
P11-059	Cleaner Solvent SPMC 176
P11-060	Cleaner Solvent SPMC 179
P11-062	Ultra High Purity Dielectric Solvent PMC 8920
P11-064	Cleaner Solvent SPMC 185

C. Procedure - Cleaning Instructions

(1) Always obey the specified procedures and limits in the applicable AMM maintenance tasks.

(2) Spray one of the materials on the harnesses and the connector contacts from the table that follows:

REFERENCE	DESIGNATION
P11-014A	Reagent Grade Isopropyl Alcohol PMC 9016
P11-055	Cleaner Solvent PMC 8914
P11-056	Cleaner Solvent SPMC 156
P11-057	Cleaner Solvent SPMC 168
P11-058	Cleaner Solvent SPMC 175
P11-059	Cleaner Solvent SPMC 176
P11-060	Cleaner Solvent SPMC 179

(Continued)

REFERENCE	DESIGNATION
P11-062	Ultra High Purity Dielectric Solvent PMC 8920
P11-064	Cleaner Solvent SPMC 185

(3) Wipe clean the area with a (P05-005) Lint Free Cotton Cloth.

(4) Let the connector dry or blow dry with clean air at 30 psi (207 kPa).

(5) If necessary, use a contact enhancer. (Paragraph 31.)

31. Enhancement of Electrical Connector Contacts (SPOP 430)

A. General

(1) This task gives the general instructions and the approved materials for enhancement of electrical wiring harness contact points.

(2) Electrical contact enhancer on connector contacts in connector interfaces decreases intermittent signals that you think are not correct, and/or nuisance messages.

(a) This electrical enhancer is not an alternative to the contact replacement. It is necessary to replace worn or damaged connectors as soon as the harness is at a location where it is possible to replace the connectors.

(3) For better reliability of connector contacts, it is permitted to apply electrical contact enhancer as part of the usual procedure at harness assembly.

(4) Do not apply (P11-068A) or (P11-068B) electrical contact enhancer (SPMC 205) to igniter high tension lead contacts, EGT harness connections or EGT junction box connections. During engine operation, the temperature of these connections can become more than the 425°F (218°C) decomposition temperature of (P11-068A) or the 550°F (288°C) decomposition temperature of (P11-068B).

B. Consumable Materials

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of their necessary applications. Before you use the materials, make sure that the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

NOTE: Equivalent replacements are permitted for the items that follow.

REFERENCE	DESIGNATION
P11-068	Contact Enhancer, Electrical SPMC 205
P11-078	Alcohol, Isopropyl PMC 9016

C. Procedures - Enhancement of Electrical Connector Contacts (SPOP 430)

(1) Always obey the procedures and limits in the applicable AMM maintenance tasks.

(2) Clean the applicable connectors and contact points. (Paragraph 30.)

(3) Apply electrical contact enhancer (SPMC 205) by the applicable procedure:

(a) For (P11-068A) electrical contact enhancer, do the procedure that follows:

1) Apply one drop of (P11-068A) electrical contact enhancer to the brush that the manufacturer supplies with the electrical contact enhancer and then use the brush to apply a thin layer of the electrical contact enhancer to the electrical contact pins on the male connector of the mating pair of electrical connectors.

a) If the ambient temperature is too cold for the electrical contact enhancer to flow sufficiently, add (P11-078) isopropyl alcohol to the (P11-068A) electrical contact enhancer in a proportion of 4:1 maximum (that is, four parts or less isopropyl alcohol, to one part electrical contact enhancer) to make the electrical contact enhancer more liquid.

2) If you added (P11-078) isopropyl alcohol to the electrical contact enhancer, let the applied electrical contact enhancer on the connector dry for one hour minimum before you connect the mating connectors.

CAUTION: IF YOU APPLY TOO MUCH (P11-068B) ELECTRICAL CONTACT ENHANCER, PIN-TO-PIN SHORT CIRCUITS CAN OCCUR.

(b) For (P11-068B) electrical contact enhancer, do the applicable procedure:

1) For (P11-068B) bulk liquid, use a brush to apply a thin layer of the electrical contact enhancer to the electrical contact pins on the male connector of the mating pair of electrical connectors.

2) For (P11-068B) aerosol spray, hold the spray can at distance of 10 - 12 inches (26 - 30 cm) from the connector. Lightly spray a thin layer of electrical contact enhancer to the electrical contact pins on the male connector of the mating pair of electrical connectors.

(c) Let the applied electrical contact enhancer dry before you connect the mating connectors.

(4) Connect the mating connectors.

32. Removal of Broken Bolts or Studs and Installation of Oversize Studs (SPOP 416)

A. General

(1) This task gives the general instructions and equipment necessary for the removal of broken bolts or studs and the installation of oversize studs.

B. Equipment and Materials

NOTE: Equivalent replacements are permitted for the items that follow.

REFERENCE	DESIGNATION
Not specified	Bolt/Stud Extraction Tool (commercially available)

C. Procedure to Remove Broken Bolts or Studs

(1) Always obey the specific procedures and limits in the specific AMM maintenance task.

(2) Remove broken bolts and/or studs by mechanical removal methods, unless specified differently by the AMM maintenance task.

(3) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size drill.

(4) Put the extraction tool into the drilled hole and lock into position.

(5) Turn the extraction tool in a counterclockwise direction to remove the broken bolt.

(6) Tap the threads, if necessary, to clean or chase the threads.

(7) Examine the threads for damage or an oversize condition. If there is thread damage or an oversize condition, do the subsequent procedure Paragraph 32.D..

D. Procedure for the Installation of Oversize Studs

(1) General

(a) Replace studs that are stretched, loose, or have thread damage with oversize studs.

(b) It is permitted to replace an oversize stud to the next oversize one time. If more than the second oversize replacement is necessary, get approval from:

1) Manager Of Customer Technical Service (CTS)

400 Main Street - Mail Stop 163-20

East Hartford, CT 06108 USA

Fax: 1-860-565-9825

(c) Where the threads of a stud hole have become damage or stripped, it is possible, if there is sufficient material around the hole, to drill and tap the hole again for a special stepped stud. (Figure 237)

(d) When you install a stud that incorporates a cotterpin or a safety wire hole, measure the projection length from the bottom of the stud hole.

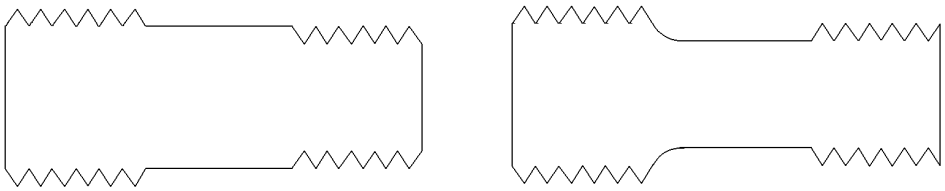
(e) See the specific repair chart applicable to the studs to be replaced.

(2) Stud Torques

(a) For standard torques, refer to Paragraph 3..

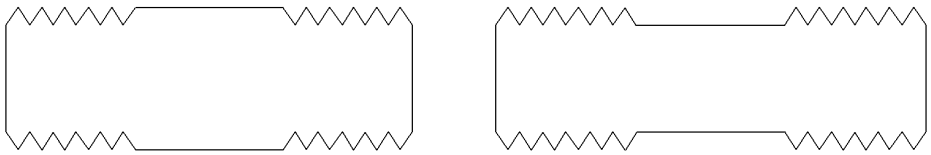
(3) Stud Lubrication

(a) For information on oil lubricated studs, antigallant lubricated studs, and studs in self-locking helical coil inserts, refer to Paragraph 3..



PLAIN NECKED

STEPPED STUDS



PLAIN NECKED

STANDARD STUDS

G-12749 (0409)
PWV

BBB2-70-46
S0000352564V1

Replacement Stud Types
Figure 237/70-00-00-990-840

33. Safety Cable Procedures

A. General

(1) Safety cable is permitted at limited locations as an alternate to lockwire. Install safety cable by PWA Specification 316 (Ref. Standard Practices Manual, Section 70-53-00). Safety cable is permitted at all external and fan stream locations where the lockwire hole is sufficiently large for the cable, except as specified below. Use safety cable PN AS3510-0218C (0.032 inch diameter) and safety cable ferrule PN AS3510-02F.

(2) Do not use safety cable at the following locations

(a) Locations where lockwire hole is more than 0.100 inch diameter (safety cable ferrule will pull through hole larger than this).

(b) Internal engine, gearbox, and accessory areas.

(c) Heat shields (as lacing).

(d) Vendor-controlled (Category 1) components.

NOTE: Where safety cable is permitted in the Engine Manual, use the procedure that follows to install the cable.

(3) Maximum span of safety cable between two end points is 6 inches (152.4 mm), unless specified differently by assembly illustrations.

(4) Any cable defect (such as, nick, fray, kink, or any damage to safety cable) found before, during, or subsequent to installation, at or between end points, is not permissible.

CAUTION: IF THE HOLES ARE MORE THAN 0.100 IN. (2.54 MM) IN DIAMETER, DO NOT USE A SAFETY CABLE. THE FERRULES ON THE END OF THE SAFETY CABLE ARE 0.106-0.108 IN. (2.692-2.743 MM) IN DIAMETER AND WILL GO THROUGH HOLES THAT ARE LARGER THAN THIS.

(5) Always install safety cable through safety cable holes given on part.

(6) Safety cable and its ferrule must be new for each application. It is not permissible to use safety cable and ferrule again.

(7) Installation

(a) Various examples of safety cable methods are shown in Figure 238. Other methods are possible.

(b) Unless specified differently in assembly procedure, install safety cable in two-or three-bolt patterns. Two-bolt pattern is preferred when you apply safety cable to an even number of fasteners.

(c) Although every possible combination is not shown in Figure 238, every combination must follow basic rules for safety cable.

(8) Pull-off load is force necessary to pull cable out of either ferrule or cable end fitting.

(9) Crimp ferrule to cable with crimper (such as, Bergen Mechanical Crimper Model M303, M305, or M307, or equivalent).

NOTE: This tooling (or use units with equivalent features and safeguards) is available from the source that follows by source code. Ref. Section 70-91-00 for the source name/address identified by this number.

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(10) Safety cable must meet minimum crimp requirements as follows:

Table 209

Nominal Cable Diameter	Minimum Pull-off Load
0.020 inch (0.508 mm)	30 in-lbs (3.390 N·m)
0.032 inch (0.813 mm)	70 in-lbs (7.909 N·m)

Safety Cable Minimum Crimp Requirements (Pull-off Load)

B. Installation

(1) Hole alignment

(a) Do not decrease or increase torque on parts to correctly align holes for cable.

(2) Adjacent units

(a) Install safety cable so that any tendency for fastener to loosen is counteracted by more tension on cable.

(b) P&W recommends that there be no sharp turns more than 90°, if possible, when cable goes through fasteners. Result is installation of safety cable with either a positive or neutral pull.

(3) Cable flex limits

(a) Cable installation tools (such as, Bergen Mechanical Crimper Model M303, M305, or M307, or equivalent) will give the flex limits specified in Figure 239. These values are the maximum flex limits between the end points when light finger pressure of approximately 2 pounds (8.9 N) is applied at midspan.

NOTE: This tooling (or use units with equivalent features and safeguards) is available from the source that follows by source code. Ref. Section 70-91-00 for the source name/address identified by this number.

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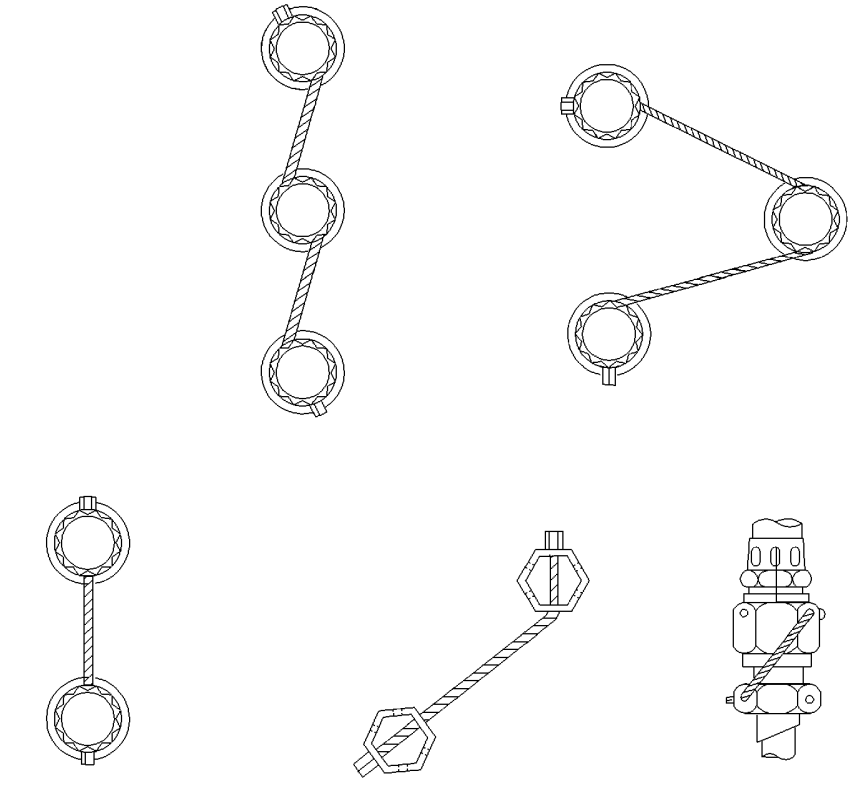
(4) Excess cable

(a) After installation of safety cable, cut off excess cable from crimped ferrule.

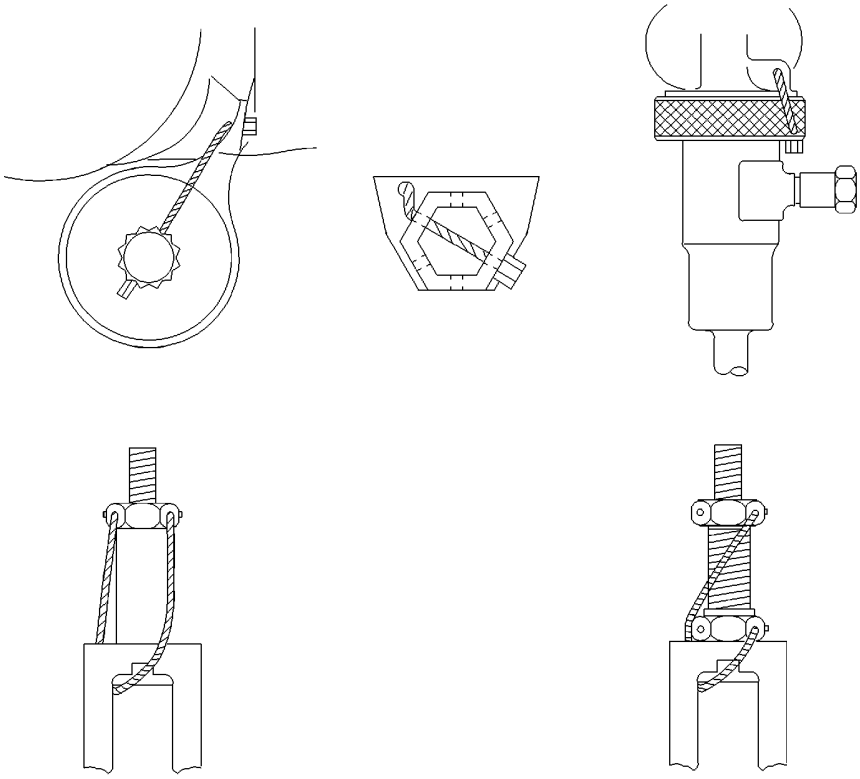
(b) Maximum length of unwanted cable that is permissible to extend past crimped ferrule is 0.031 inch (0.787 mm).

(5) Lead seals

(a) Where specified by assembly drawing, apply and crimp lead seals to safety cable.



Examples of Safety Cable Methods
Figure 238/70-00-00-990-833 (Sheet 1 of 2)



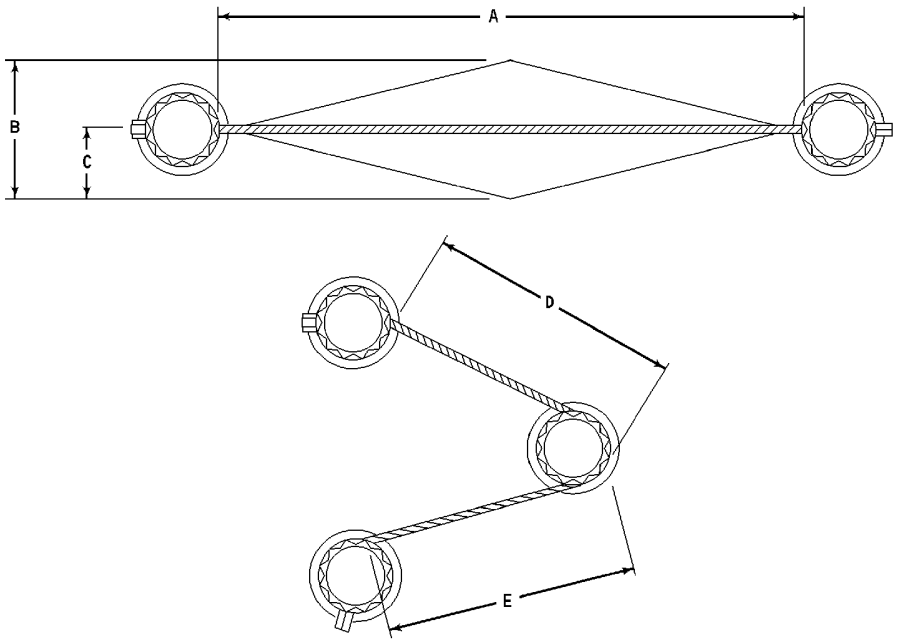
EXAMPLE 3
OTHER APPLICATIONS

L-S0007 (0000)

CAG(IGDS)

BBB2-70-38

Examples of Safety Cable Methods
Figure 238/70-00-00-990-833 (Sheet 2 of 2)



FOR THREE BOLT PATTERNS
A = D + E

FLEX LIMITS, DIMENSIONS		
A INCH	B INCH	C INCH
0.5	0.125	0.062
1.0	0.250	0.125
2.0	0.375	0.188
3.0	0.375	0.188
4.0	0.500	0.250
5.0	0.500	0.250
6.0	0.625	0.312

L-S000B (0000)

CAG(IGDS)

BBB2-70-39

Safety Cable Flex Limits
Figure 239/70-00-00-990-834

34. Preparation of Blue Dye Oil System Leak Check Solution (PS 197)

A. General

(1) This task provides the general instructions to make up the PS 197 Blue Dye Solution used in oil system leak checks.

B. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items.

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Name and Number	Manufacturer
Container, Mixing (No Specific)	
Oil, Engine Lubricating P03-001 (PWA 521, Type II)	
Dye, Blue P05-459 (PMC 4513)	

C. Procedure - General Instructions

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) Always obey the specific procedures and limits in the AMM maintenance task.

D. Procedure - Make-Up of PS 197 Blue Dye Solution

Materials	Make-up	Operating Limits
Dye, Blue (Material No. P05-459)	5 to 6 milliliters	150 ñ 40 ppm
Oil, Engine Lubricating (Material No. P03-001)	10 gallons (37.85 liters)	

NOTE: When the engine is first refilled with non-dyed oil, the non-dyed oil will mix with the remaining (that is, residual) dyed oil. The color of this mixture will likely be darker than the non-dyed oil that was just added. The color of various oil brands can be different. This color change is permitted and is not a negative indication of the condition of the lubrication system.

E. Procedure - Preparation Instructions

(1) Add the specified amount of Engine Lubricating Oil (Material No. P03-001) to the mixing container.

NOTE: The selection of base oil (Approved PWA 521, Type II) will make it easier for the operator to see the blue color of the dyed oil. Pratt & Whitney experience finds that light color PWA 521, Type II base oils are more easily detected with the Blue Dye (Material No. P05-459).

(2) Add the specified amount of Blue Dye (Material No. P05-459).

(a) It is necessary to put Blue Dye (Material No. P05-459) through a five-micron or less membrane filter six weeks or less before you mix it with Engine Lubricating Oil (Material No. P03-001) for PS 197.

(3) Stir to mix.

F. Procedure - Precaution Instructions

NOTE: This solution is organic.

(1) Do not permit the solution to touch the skin, eyes, nose or throat

(2) Do not take this solution internally.

(3) Be sure to wash fully after handling and before you drink or smoke.

(4) Keep this solution away from food.

(5) Do not breath the dust, vapors, mists, or gases.

(6) Use this solution with sufficient ventilation.

(7) Keep this solution away from heat or flames; toxic mixtures can occur.

(8) Be sure to wear the necessary safety equipment.

(9) Keep this solution away from oxidizers.

MARKING PARTS (TEMPORARY AND PERMANENT) - MAINTENANCE PRACTICE

1. General

A. This section provides general instructions and approved materials for marking of engine parts.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

REFERENCE	DESIGNATION
P05-018	Pencil (PMC 4059)
P05-022	Dye - Layout and Identification, LOX Compatible (Purple) (PMC 4062)
P05-026	Black Metal Marking Ink (PMC 4057-1)
P05-040	Varnish - Phenoic Resin, Corrosion-Preventive (AMS 3132)
P05-049	White Metal Marking Ink (PMC 4057-2)
P05-232	Metal Marking Crayon (Soft) (PMC 4058)
P05-366	Dye, Layout and Identification (PMC 4039)
P05-408	White Marker (Felt Tip) (SPMC 198-1)
P05-409	Black Marker (Metal Tip) (SPMC 198-2)
P05-410	Yellow Marker (Felt Tip) (SPMC 198-3)
P05-411	Black Stamping Ink (PMC4021)
P05-413	Black Marking Ink (PMC 4500)
P05-414	Black Marker (Extra Fine Point) (PMC 4557)
P05-415	Black, Trace Element Certified (TEC) Marking Pen (PMC 4556)
P05-416	White Chalk (Low Dust) (PMC 4552)
P05-417	Marking Pen (White or Yellow Paint) (PMC 4554)
P05-418	Dye, Layout and Identification Blue (PMC 4504)
P05-419	Dye, Layout and Identification (Red) (PMC 4503)
P05-423	Felt Tip Marker (PMC 4050)
P05-441	White Metal Marking Ink (PMC 4057-10)
P05-465	Green Metal Marking Ink (PMC 4057-5)
P05-470	High Purity Marker (Blue) (PMC 4563-1)
P05-472	High Purity, Black, Trace Element Certified marker (PMC 4564)
P05-477	High Temperature Marker (Blue) (PMC 4563-3)
P07-001	Lacquer (PMC 1641)

3. Marking of Parts

A. Marking of Parts - General

CAUTION: THE MARK MUST NOT CHANGE THE CONDITION OR THE OPERATION OF THE PART. ONLY USE THE APPLICABLE PROCEDURE TO MAKE THE MARKS. THIS WILL PREVENT DAMAGE TO THE PART.

(1) Always obey the specified procedures and limits in the specified AMM maintenance tasks.

(2) Marks made on engine parts and assemblies must be easily read and must not be easily removed.

(a) Characters must be easily and accurately read usually with no aid to the eye.

(b) Where there are unusual area or surface limits, a maximum of 3.5X magnification is permitted to get the necessary readability.

(3) The location of a mark must be as specified in the Service Bulletin or AMM maintenance task.

NOTE: Be sure to apply the mark only on a surface that will not move relative to a surface that touches it after you assemble the parts.

(4) Except where specified differently, reidentification of parts, reapplication and/or relocation of marks on a part must be done adjacent to, or in a location almost the same as that of the initial marking. Where reidentification or corrective marks are specified, removal of all or part of the old marking can be necessary. In these cases, using an approved marking method, draw a wavy line, loop, flat oval, or X's through the character (s) or symbol (s) to be removed.

(5) All the characters in a mark, unless specified differently, must be 0.060 - 0.160 inch (1.5 - 4.1 mm) high. In special cases, the mark is a function of the size or configuration of part, characters not less than 0.016 inch (0.406 mm) nor more than 0.500 inch (12.700 mm) in height are permitted.

(6) If the surface specified for a mark will get a surface treatment coating (for example, paint), you must apply the mark before you apply the coating. Use an approved permanent marking method that will show through the final surface treatment.

(a) If none of the specified marking methods will show through the coating, then it is permitted to use the applicable step to make the mark after you apply the coating:

1) On external surfaces, apply the mark with ink and a stamp, and then apply a full layer of (P07-001) Lacquer (PMC 1641) on the mark.

a) If permitted by the repair instructions, apply the mark by the vibration peen method.

b) Apply the mark with ink and a stamp, and then apply a full layer of transparent (P05-040) Varnish (AMS 3132) on the mark.

(7) In electric arc scribing, (for example, hand arc scribing), characters are made by action of an electric arc between surface and an electrode (scriber). Electric arc scribing is not a satisfactory marking method to use for jet engine parts and must not be used.

(8) In acid etching, the characters are made by the action of an acid on the surface of the part. Acid etching is not recommended because it can possibly cause corrosion.

(9) Soapstone must not be used to make a mark on engine parts.

(10) Wherever the vibration peen method is approved, identify offset holes in mating parts with a vibration peened “X” mark adjacent to the offset hole as long as the condition or operation of the part is not changed.

B. Permanent Marking Methods

(1) General

(a) Permanent methods of marking are those in which marking is legible during the normal service life of the part.

(b) Permanent markings must not extend onto any radius, chamfer, sharp edge, bead, or fillet adjacent to the specified marking surface.

(2) Applied Marking Methods

(a) Metal Stamping

1) Characters are produced by forcible displacement of materials.

a) Hammer - characters are made one at a time or in groups by a force applied mechanically or manually.

b) Press - characters are produced individually or in groups by a force applied as you steadily increase the controlled pressure.

c) Roll - characters are made as the part or the tool or both the part and the tool turn when they touch each other under a controlled force.

2) Stamps used for marking must make fillets and radii at all intersecting surfaces of the characters.

3) Parts marked by this method must have the marking area sufficiently back-supported to prevent dangerous stresses.

4) This method is not permitted if the hardness of the part at the time of marking is higher than Rockwell C45 or equivalent.

5) If the metal is raised more than 0.001 inch (0.025 mm) by this method of marking, it is necessary to carefully remove it.

NOTE: It is necessary to remove all raised metal around the characters on the surfaces of bearings that touch.

(b) Vibration Peen Method

1) Characters are made by vibrations from a radius-tipped, conical tool.

a) Manual - tool is manually guided and has one tip.

b) Mechanical - tool is mechanically guided and has one or more tips that can make one or more full characters at the same time.

2) This method is not usually permitted if the hardness of the part at the time of marking is higher than Rockwell C45 or equivalent. It can be used on parts harder than Rockwell C45 when specifically permitted.

NOTE: The vibration peen method can be an alternative to use on those parts that had drag impression or roll marking.

(c) Engraving

1) Characters are made by a manually or mechanically guided cutter or grinder that turns.

(d) Brand

1) Characters are made by burning or displacing non-metallic materials with a hot tool.

(e) Drag Impression

1) Characters are made when material is moved by force by a radius-tipped conical tool, which is drawn (dragged) across the surface of the part. This tool is mechanically guided and turns freely.

(f) Blast

1) Characters are made when an abrasive material hits the characters in the stencil area.

(3) Marking Depth

(a) The depth of the marks must be at these maximum limits, unless specified differently:

Metal Stamp, Hammer 0.010 inch (0.254 mm)

Metal Stamp, Press and Roll 0.006 inch (0.152 mm)

Vibration Peen, Manual and Mechanical 0.006 inch (0.152 mm)

Engrave, Manual and Mechanical 0.003 inch (0.076 mm)

Brand 0.010 inch (0.254 mm)

Drag Impression 0.003 inch (0.076 mm)

Blast 0.0005 inch (0.013 mm)

C. Temporary Marking Methods

(1) General

CAUTION: USE ONLY THE APPROVED MATERIALS SPECIFIED IN THE PMC'S FOR MARKING.

CAUTION: DO NOT USE LEAD AND/OR METALLIC PENCILS OR A TEMPORARY MARKING METHOD THAT CAN CAUSE DANGEROUS REMAINING CARBON, ZINC, COPPER, LEAD, OR SIMILAR MATERIAL TO OCCUR ON A PART. THIS REMAINING MATERIAL CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN HEAT OF HIGH INTENSITY IS APPLIED TO THE PART. IF A MARKING MATERIAL THAT IS NOT APPROVED IS USED, THE MARK MUST BE FULLY REMOVED BY THE SPOP 208 DEGREASE ENGINE PARTS BY SOLVENT WIPE PROCEDURE.

(a) Temporary methods of marking are those in which the marks will correctly identify a part during the usual handling, inspection, and storage of items before final assembly and use.

(b) When you use a marking pencil, do not apply marks to the surfaces of carbon seal plates or to mating surfaces of finished machined parts. Marking material remaining on these parts could cause incorrect results during dimensional inspection and assembly.

(c) These marking materials must be removed:

1) Chalk

a) After inspection is completed, remove chalk from parts. Use Degrease Engine Parts By Solvent Wipe (SPOP 208). (STANDARD PRACTICES - ENGINE - MAINTENANCE PRACTICES, PAGEBLOCK 70-00-00/201)

2) Dye, Layout and Identification

a) Remove layout and identification dye from parts before you assemble the parts in the engine. Use Degrease Engine Parts By Solvent Wipe (SPOP 208). (STANDARD PRACTICES - ENGINE - MAINTENANCE PRACTICES, PAGEBLOCK 70-00-00/201)

D. Marking Methods

(1) Ink Marking

(a) Characters are made by any type of ink application that does not change the surface as mechanical methods do.

NOTE: Usually, ink stampings, when used as a temporary marking method, can be applied to a surface which, after assembly, does not move in relation to a surface that it touches (that is, a contact surface).

E. Marking Materials

(1) This material is used to highlight stamped or vibration peened part numbers during inspection and is approved to use on all gas turbine engine alloys if you remove the material after the inspection is completed:

(a) Chalk

1) (P05-416) Low Dust White Chalk (PMC 4552).

(2) These materials are approved to use on steel, stainless steel, cobalt-base alloys, aluminum, magnesium, titanium, titanium alloys, and on nickel-base alloys other than nickel superalloys (for example, PAW 1422 or PAW 1480) unless specified differently below:

(a) Crayons

1) (P05-232) Metal Marking Crayon (Soft) (PMC 4058)

(b) Dyes, Layout and Identification

1) (P05-022) Dye - Layout and Identification, LOX Compatible (Purple) (PMC 4062).

2) (P05-366) Dye, Layout and Identification (PMC 4039)

3) (P05-418) Dye, Layout and Identification (Blue) (PMC 4504)

4) (P05-419) Dye, Layout and Identification (Red) (PMC 4503).

(c) Inks (Applied by a brush or stamp)

1) (P05-026) Black Metal Marking Ink (PMC 4057-1).

NOTE: The above ink is approved to use on aluminide coated or PAW 286 coated or ceramic coated parts and on nickel super alloys (for example, PAW 1422 and PAW 1480).

2) (P05-049) White Metal Marking Ink (PMC 4057-2).

NOTE: The above ink is approved to use on aluminide coated or PAW 286 coated parts and on nickel super alloys (for example, PAW 1442 and PAW 1480)

3) (P05-411) Black Stamping Ink (For Marking on Non-porous Surfaces with a Rubber Stamp) (PMC 4021)

NOTE: The above ink is also approved to use on PAW 73, overlay, aluminide, and ceramic coated parts.

4) (P05-413) Black Marking Ink (PMC 4500)

5) (P05-441) White Metal Marking Ink (PMC 4057-10).

NOTE: The above ink is approved to use on aluminide coated or PAW 286 coated parts.

6) (P05-465) Green Metal Marking Ink.

NOTE: The above ink is also approved to use on nickel superalloys (for example, PAW 1422 and PAW 1480).

(d) Markers

1) (P05-408) White Marker (Felt Tip) (SPMC 198-1)

2) (P05-409) Black Marker (Metal Tip) (SPMC 198-2)

3) (P05-410) Yellow Marker (Felt Tip) (SPMC-198-3)

4) (P05-414) Marker, Extra Fine Point (Black) (PMC 4557)

5) (P05-423) Felt Tip Marker (PMC 4050).

NOTE: The above marker is also approved for other applications (see Notes below). This does not always include all markers available for a given suffix.

NOTE: The Marks-A-Lot markers for PMC 4050-1 (black/chisel point) and PMC 4050-4 (black/fine point) are also approved to use on nickel superalloys and on ceramic coatings.

NOTE: The Sharpie markers for PMC 4050-4 (black/fine point) and all markers for PMC 4050-17 (black/bold fine point), PMC 4050-7 (red/fine point), PMC 4050-12 (red/extra fine point), PMC 4050-15 (red/ultra fine point) and PMC 4050-18 (red/bold fine point) are also approved to use on ceramic and overlay aluminide coatings.

NOTE: All PMC 4050-6 (blue/fine point) and all PMC 4050-16 (blue/ultra fine point) markers are approved to use on aluminide coatings.

6) (P05-470) Marker, High Purity (Blue) (PMC 4563-1)

7) (P05-471) Marker, High Temperature (Blue) (PMC 4563-2)

8) (P05-472) Marker, High Purity, Black, Trace Element Certified (PMC 4564)

9) (P05-477) Marker, High Temperature (Blue) (PMC 4563-3).

(e) Pencils

1) (P05-018) Metal Marking Pencil (Hard) (PMC 4059).

(f) Pens

1) (P05-415) Black, Trace Element Certified (TEC) Marking Pen (PMC 4556)

2) (P05-417) Marking Pen (White or Yellow Paint (PMC 4554).