

**CHAPTER 20****STANDARD PRACTICES**

<u>Section</u>	<u>Title</u>	<u>Page</u>
20-10	Cleaning . . . . .	20.1
20-20	Lubrication . . . . .	20.2
20-30	Torque Requirements. . . . .	20.3
20-31	Torque Seal . . . . .	20.5
20-32	Standard Torques . . . . .	20.6
20-33	Special Torques . . . . .	20.7
20-34	Push-Pull Tube Rod End Adjustment . . . . .	20.11A
20-35	D210-series Nuts on Critical Fasteners . . . . .	20.11B
20-40	Non-Destructive Testing . . . . .	20.12
20-41	Magnetic Particle Inspection . . . . .	20.12
20-42	Fluorescent Penetrant Inspection . . . . .	20.13
20-50	Corrosion Control . . . . .	20.13
20-60	Priming and Painting . . . . .	20.13
20-70	Approved Materials . . . . .	20.16
20-71	Paint Strippers . . . . .	20.16
20-72	Solvents and Cleaners . . . . .	20.16
20-73	Fillers and Putty . . . . .	20.17
20-74	Torque Stripe . . . . .	20.17
20-75	Primers . . . . .	20.17
20-76	Powder Coat . . . . .	20.18
20-77	Paints . . . . .	20.19
20-78	Lubricants . . . . .	20.22
20-79	Adhesives and Sealants . . . . .	20.23
20-80	Storage Limits . . . . .	20.24
20-90	Miscellaneous Practices . . . . .	20.25
20-91	Part Interchangeability . . . . .	20.25
20-92	Thermal Fitting Parts . . . . .	20.25
20-93	Replacement Component Identification (Data) Plates . . . . .	20.25
20-94	Crimp Inspection . . . . .	20.26

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CHAPTER 20  
STANDARD PRACTICES20-10 Cleaning**NOTE**

Remove turbine exhaust stains from engine cowling, tailcone, empennage, and tail rotor blades after every flight to prevent permanent discoloration.

**CAUTION**

Wash helicopter exterior surfaces, windshields, and windows with mild soap and water. Harsh abrasives, alkaline soaps, or detergents can scratch painted or plastic surfaces, or cause corrosion of metal. Protect areas where cleaning solution could cause damage.

**CAUTION**

Never use high-pressure spray to clean helicopter. Never blow compressed air into main or tail rotor blade tip drain holes, pitot tube, or static ports.

**WARNING**

**Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.**

**A. Cleaning Exterior Surfaces**

1. Rinse away loose dirt and debris from exterior surface with clean water.
2. Apply mild soap and clean warm water solution to exterior surface using a clean, soft cloth, sponge, or soft bristle brush. Use caution near antennas and sensitive equipment.
3. Remove oil and grease using a cloth wetted with aliphatic naphtha.
4. Rinse all surfaces thoroughly.
5. If desired, polish painted surfaces with a good quality automotive wax using soft cleaning cloths, or a chamois cloth, free of abrasive debris.

20-10 Cleaning (continued)**B. Cleaning Windshield and Windows****CAUTION**

Do not use gasoline, other alcohols, benzene, carbon tetrachloride, thinner, acetone, or window (glass) cleaning sprays.

1. Rinse away loose dirt and debris from windshield and windows with clean water.
2. Apply mild soap and clean warm water solution, or aircraft plastic cleaner, to windshield and windows using a clean, soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
3. Remove oil and grease using a cloth wetted with isopropyl alcohol (rubbing alcohol) or aliphatic naphtha.
4. After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
5. To remove scratches, rub windshield or windows with jeweler's rouge then hand polish with commercial plastic polish. Polish in figure eight motion.

**C. Cleaning Seat Assemblies and Back Rests**

1. Vacuum and brush, then wipe with damp cloth. Dry immediately.
2. Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Follow manufacturer's instructions. Avoid soaking or harsh rubbing.
3. Leather should be cleaned with saddle soap or a mild hard soap and water.

**D. Cleaning Carpet**

Remove loose dirt with a whisk broom or vacuum. For soiled spots and stains, use nonflammable dry cleaning liquid.

20-20 Lubrication**WARNING**

**Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.**

All R66 bearings are sealed or self-lubricating and do not require periodic lubrication.

The engine oil tank, the main and tail rotor gearboxes, and the hydraulic reservoir require servicing when indicated by sight gage level. Additionally, change engine, gearbox, or hydraulic oil and clean respective sight gage when oil becomes so dirty its level cannot be determined. Change hydraulic oil when notably odorous.

When installing a new or overhauled main rotor gearbox, replace filter at first 100-hour inspection after installation. Thereafter, replace filter at scheduled intervals per Section 5-20. When installing a new or overhauled tail rotor gearbox, drain and flush after first 4 hours of flight or first chip light, whichever occurs first. Thereafter, drain and flush gearbox at scheduled intervals per Section 5-20.

Servicing procedures are located in Chapter 12.

20-30 Torque Requirements

**A. Tool Calibration**

Dimensions and tolerances given in this manual are critical. Calibrate measuring tools per manufacturers recommendation at least once a year, when tool is dropped, misused, or calibration is suspect. This includes torque wrenches, micrometers, calipers, dial indicators, and spring scales.

**WARNING**

**Proper torque is critical. Always use calibrated wrenches and undamaged, properly lubricated (where applicable) hardware. Ensure clamping surfaces are clean, and clamp only bare metal or wet-primed surfaces. Improper torque or dirty or painted clamping surfaces may result in loss of clamp-up, hardware or part damage, and premature failure.**

**B. Torque Value**

Torque fasteners to standard dry values listed in Section 20-32 unless otherwise specified. If torque is applied by rotating bolt, increase torque value by 10% to account for higher friction at bolthead and shank.

For example, the torque wrench setting for an NAS1305 bolt used with a NAS1068 nutplate is determined as follows:

NAS1305 bolt (5 indicates 5/16 inch size) dry torque per Section 20-32	240 in.-lb
Add 10% because torque must be applied at bolt head	+ 24 in.-lb
Torque wrench setting	<u>264 in.-lb</u>

**C. Secondary Locking Mechanism**

A secondary locking mechanism is required on all critical fasteners. B330 stamped nuts (palnuts) serve as secondary locking mechanisms in most areas on the helicopter, and are torqued per Section 20-32. The R66 Illustrated Parts Catalog (IPC) lists secondary locking mechanisms for specific fasteners.

**D. Critical Fastener**

A critical fastener is one which, if removed or lost, would jeopardize safe operation of the helicopter. This includes joints in the primary control system, and non-fail-safe structural joints in the airframe, landing gear, and drive system.

**WARNING**

**Assembly of flight controls is critical and requires inspection by a qualified person. If a second person is not available, RHC recommends the installer take a 5-minute break prior to inspecting flight control connections he has assembled.**

**Given**

- Y = Unknown
- T = 135 in.-lb
- L = 10 in.
- A = 1.5 in.

**Symbols**

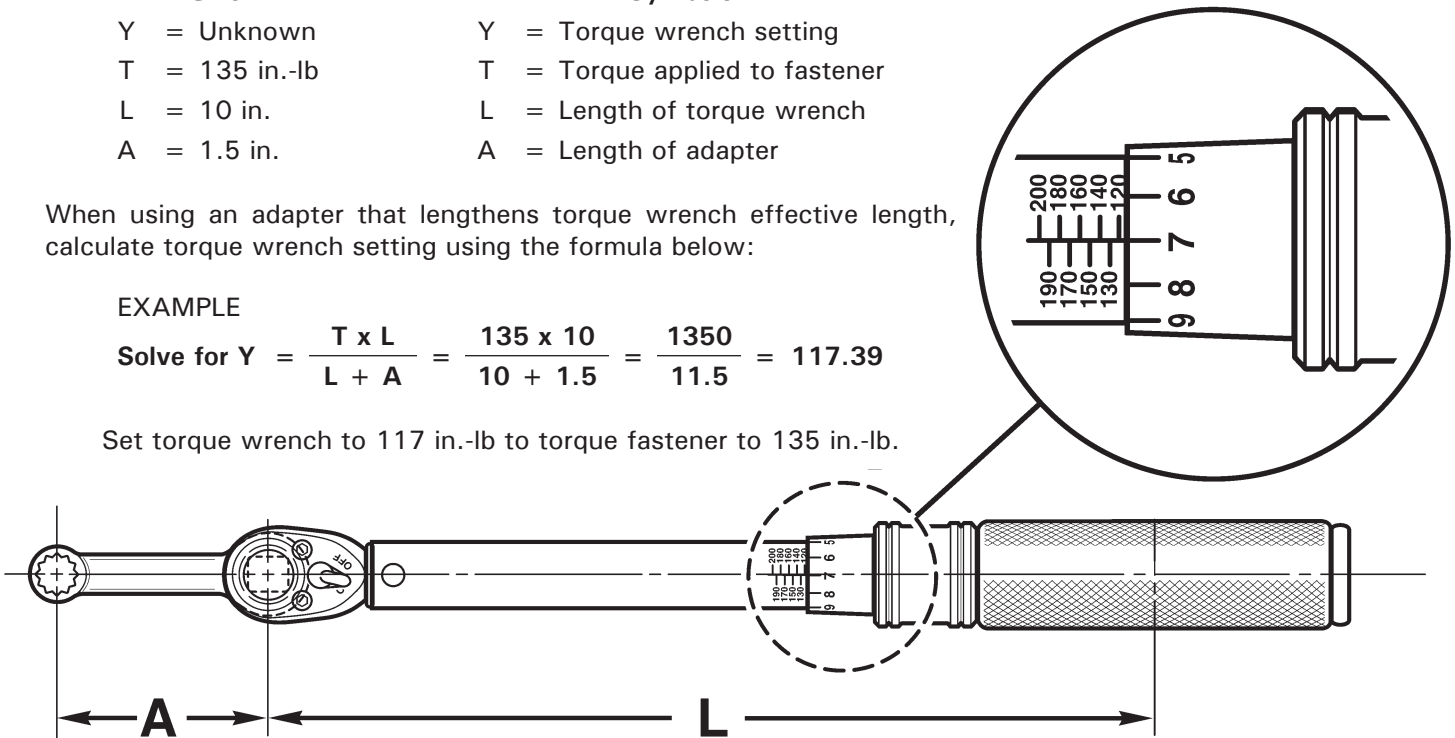
- Y = Torque wrench setting
- T = Torque applied to fastener
- L = Length of torque wrench
- A = Length of adapter

When using an adapter that lengthens torque wrench effective length, calculate torque wrench setting using the formula below:

**EXAMPLE**

$$\text{Solve for } Y = \frac{T \times L}{L + A} = \frac{135 \times 10}{10 + 1.5} = \frac{1350}{11.5} = 117.39$$

Set torque wrench to 117 in.-lb to torque fastener to 135 in.-lb.



**FIGURE 20-1 LENGTHENING TORQUE WRENCH EFFECTIVE LENGTH**

**Given**

- Y = Unknown
- T = 135 in.-lb
- L = 10 in.
- A = 1.5 in.

**Symbols**

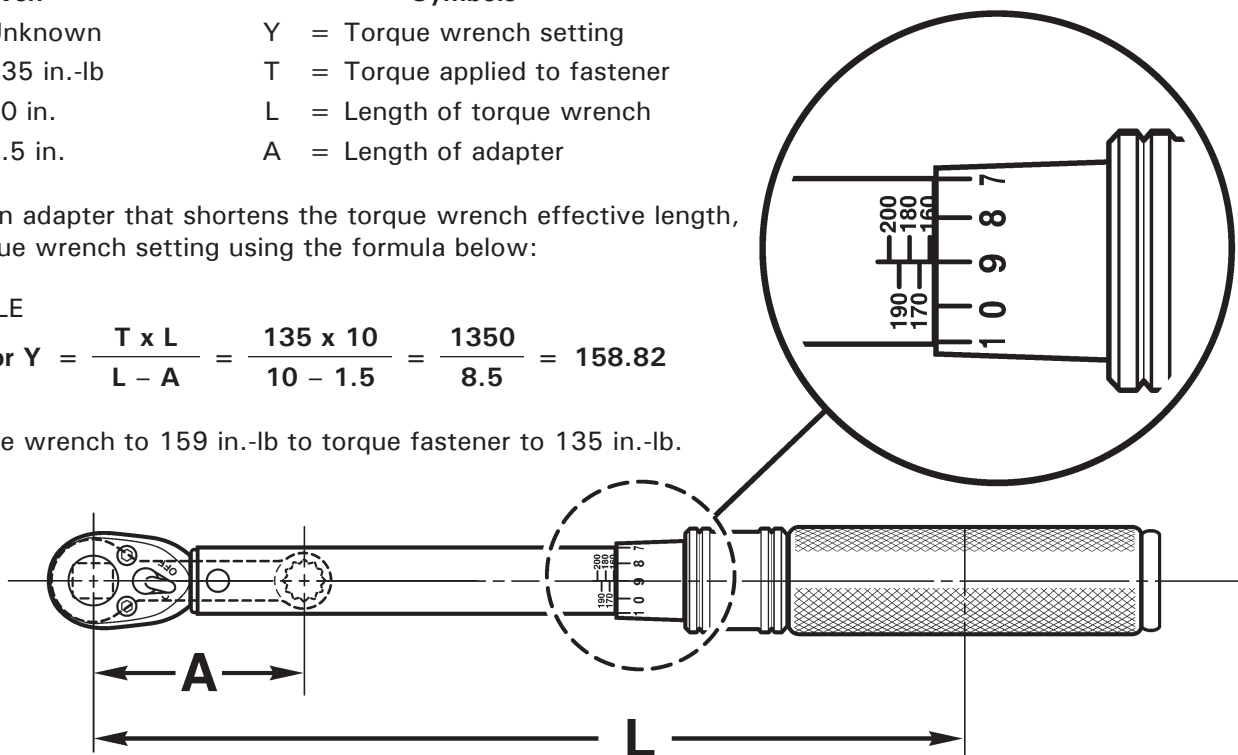
- Y = Torque wrench setting
- T = Torque applied to fastener
- L = Length of torque wrench
- A = Length of adapter

When using an adapter that shortens the torque wrench effective length, calculate torque wrench setting using the formula below:

**EXAMPLE**

$$\text{Solve for } Y = \frac{T \times L}{L - A} = \frac{135 \times 10}{10 - 1.5} = \frac{1350}{8.5} = 158.82$$

Set torque wrench to 159 in.-lb to torque fastener to 135 in.-lb.



**FIGURE 20-2 SHORTENING TORQUE WRENCH EFFECTIVE LENGTH**

20-30 Torque Requirements (continued)**WARNING**

Two threads minimum must be exposed beyond nut on any installation to insure proper locking of fastener. Four threads maximum may be exposed. More than four threads exposed may allow nut to seat against bolt shank, resulting in insufficient joint clamping.

**CAUTION**

Never substitute AN bolts for NAS bolts. NAS bolts have higher tensile strength.

**E. Torque Requirements**

1. Bolt and nut are to be clean and dry except when assembly procedure specifies anti-seize or thread-locking compound.
2. If chattering or jerking occurs, disassemble and re-torque fastener.
3. If special adapters which change effective length of torque wrench are used, final torque value must be calculated using formulas in Figures 20-1 and 20-2.
4. Proper thread engagement requires 2-4 threads beyond primary self-locking nut (palnuts excepted).
5. Torque wrenches must be calibrated annually, when dropped, or when a calibration error is suspected.

Any self-locking nut whose drag has deteriorated appreciably must be replaced. Damaged hardware must be replaced.

20-31 Torque Stripe**WARNING**

Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.

Refer to Figure 5-1. Lacquer-paint Torque Seal<sup>®</sup> is applied to all critical fasteners after palnut installation in a stripe ("torque stripe") extending from the fastener's exposed threads across both nuts and onto the component. Subsequent rotation of the nut or bolt can be detected visually. Position torque stripes for maximum visibility during preflight inspections. Approved Torque Seal<sup>®</sup> is listed in § 20-74.

20-32 Standard Torques

FASTENER SERIES	SIZE	EXAMPLE FASTENER	DRY TORQUE (IN.-LB)
NAS 1300 Bolts NAS 6600 Bolts NAS 600 THRU 606 Screws NAS 623 Screws NAS 1351 Screws NAS 1352 Screws	10-32	NAS6603	50
	1/4-28	NAS6604	120
	5/16-24	NAS6605	240
	3/8-24	NAS6606	350
	7/16-20	NAS6607	665
	1/2-20	NAS6608	995
AN3 Bolts AN4 Bolts AN6 Bolts AN8 Bolts AN502 Screws AN503 Screws AN509 Screws AN525 Screws MS24694 Screws MS27039 Screws	10-32	AN3	37
	1/4-28	AN4	90
	3/8-24	AN6	280
	1/2-20	AN8	795
STAMPED NUTS (PALNUTS)	10-32	B330-7 (MS27151-7)	6 to 15
	1/4-28	B330-13 (MS27151-13)	11 to 25
	5/16-24	B330-16 (MS27151-16)	20 to 40
	3/8-24	B330-19 (MS27151-19)	29 to 60
	7/16-20	B330-21 (MS27151-21)	42 to 85
	1/2-20	B330-24 (MS27151-24)	54 to 110
TAPERED PIPE THREADS	1/8-27	N/A	60
	1/4-18	N/A	85
	3/8-18	N/A	110
	1/2-14	N/A	160
	3/4-14	N/A	230
ROD END JAM NUTS (AN315 and AN316)	10-32	AN315-3	15
	1/4-28	AN316-4	40
	5/16-24	AN316-5	80
	3/8-24	AN316-6	110

1. Values include nut self-locking torque.
2. Increase values 10% if torqued at bolt head.
3. For elbow & tee fittings which require alignment, torque to indicated value then tighten to desired position.
4. Values ± 10% unless range is specified.
5. Unless otherwise noted, thread sizes 8-32 & smaller are not used for primary structure & do not require specific torque.



20-33 Special Torques

Special torques supersede standard torques listed in § 20-32.

AREA*	FASTENER*	TORQUE (IN.-LB)*
AIR CONDITIONING (OPTIONAL EQUIPMENT)	(1) D795-8 line assembly, B-nuts	150
	(1) D799-2 switch assembly	90
	(1) D799-3 switch assembly	90
	(1) D799-9 switch assembly	90
	(1) G783 condenser, dessicant cap	100
	(1) G784-1 evaporator assembly, inlet B-nut to TXV	210
	(1) G794-1 hose assembly, B-nuts	210
	(1) G794-2 hose assembly, B-nuts	210
	(1) G794-3 hose assembly, B-nuts	150
	(1) G810-1 line assembly, B-nuts	210
	(1) G811-1 line assembly, B-nuts	150
	(2) AN924-8D nuts	360
	(8) MS27039C1-07 screws at condenser fans	30
	(2) 91292A135 screws	70
CABIN	(1) D210-5 nut, ground handling ball	240
COOLING SYSTEM (ENGINE AND MAIN ROTOR GEARBOX OILS)	(1) B289-2 bolt, drain	70
	(1) B563-2 sight gage	150
	(1) D205-19 hose assembly, B-nuts	285
	(1) D205-20 hose assembly, B-nuts	285
	(1) F723-1 line assembly, B-nuts	675
	(1) F723-2 line assembly, B-nuts	245
	(1) F723-3 line assembly, B-nuts	245
	(1) F723-4 line assembly, B-nuts	245
	(1) F724-1 line assembly, B-nuts	120
	(1) F724-2 line assembly, B-nuts	285
	(1) F724-3 line assembly, B-nuts	285
	(2) AN815-8D unions, on F649-1 oil cooler	300
	(2) AN832-8D unions, at firewall	230-260
	(1) AN832-10D union, at firewall	330-360
	(2) AN924-8D nuts, at firewall	150
	(1) AN924-10D nut, at firewall	180
	(2) AN924-6D nuts, securing F823-1 thermostat assembly to firewall	120
(2) AS5169D04L fitting, on F649-1 oil cooler	58	
(1) MS28034-1 oil temperature sender, to tank	120	

20-33 Special Torques (continued)

AREA *	FASTENER*	TORQUE (IN.-LB)*
DOOR HINGES AND GAS SPRINGS	(16) MS51861-37C screws, securing door hinge assemblies	36
	(2) 94830A030 nuts, securing G904-1 gas spring ball studs at baggage compartment door	100
	(2) 94830A030 nuts, securing D575-1 gas spring ball studs at aft doors	100
	(2) C394-2 ball stud, at forward doors, to frame	150 wet
	(2) D575-2 and (2) D575-3 ball joints, at forward doors' D573-4 rods	37
DRIVE SYSTEM	(2) F650-1 bolt, forward main rotor gearbox and G201 frame mounts	65 FT-LB wet Bolt head or nut
	(2) F650-2 bolt, aft main rotor gearbox and G201 frame mounts	65 FT-LB wet Bolt head or nut
EMPENNAGE	(8) NAS6604-6 bolts, securing vertical stabilizers to upper horizontal stabilizer	185
	(1) NAS1352-3-14P screw, securing guard assembly blocks to lower vertical stabilizer	40
ENGINE CONTROLS	(1) Fuel control unit (FCU) lever nut	40-50
	(1) Power turbine governor (PTG) lever nut	40-60
	(4) MS21042L3 nut, securing control wires	25-30
ENGINE INDUCTION	(1) A457-16 and (1) A457-17 fittings, IBF filter FMA line	60
	(1) G738-1 nozzle, compressor service	30
	(1) AN316-7R nut, compressor service line	150
	(1) AN929-4 cap, compressor service line	60
FUEL SYSTEM	(1) B254-3 strainer, fuel bladder outlet	150
	(1) B283-12 hose assembly, fuel valve to fuel pump inlet, B-nuts	110-130
	(5) B289 bolts, fuel sender	37
	(1) F550 fuel sender center stud nut	11
	(1) F550 fuel sender ground stud nut	9
	(1) D205-21 hose assembly, fuel bladder outlet to fuel valve, B-nuts	110-130
	(1) G254-2 fitting, vent assembly	200
	(1) G254-6 retainer, vent assembly	200
	(1) AN924-5D nut, low fuel warning switch assembly	150
	(1) MS21042L3 nut, securing control wire	27
AUXILIARY FUEL SYSTEM	(5) B289-4 bolts, fuel sender	37
	(1) D205-35 hose assembly, B-nuts	120
	(2) D205-36 hose assembly, B-nuts	120
	(2) G764-5 fittings	200
	(1) AN815-6D fitting	200

20-33 Special Torques (continued)

AREA*	FASTENER*	TORQUE (IN.-LB)*
HEATER	(1) G391-1 line assembly B-nuts (apply A257-9 to upper nut threads)	245 wet
	(1) G391-2 line assembly B-nuts	100
	(1) G391-3 line assembly B-nuts	100
	(1) G391-4 line assembly B-nuts	100
	(1) G391-5 line assembly B-nuts	230-260
	(2) G392-3 diffuser assembly B-nuts	100
	(1) MS21042L3 nut, securing control wire	25-30
HYDRAULIC HOSES & FITTINGS	(2) AN815-3D union	95-105
	(2) AN815-4D union	135-150
	(1) AN820-4 cap, on reservoir AN804D4 T-fitting	60
	(1) AN820-6 cap, on reservoir AN834-6D T-fitting	120
	(2) D452-3 nuts, on aft and left hand servos	60
	(3) D452-4 nuts, on aft and left hand servos and on reservoir	90
	(1) D452-6 nut, on reservoir	150
	(2) B330-19 palnut, on aft and left hand servos	30
	(3) B330-21 palnut, on aft and left servos and on reservoir	45
	(1) B330-25 palnut, on reservoir	75
	(1) D205-14 line assembly B-nuts	95-105
	(1) D205-17 line assembly B-nuts	95-105
	(1) D205-18 line assembly B-nuts	135-150
	(1) D205-22 line assembly B-nuts	95-105
	(1) D205-23 line assembly B-nuts	135-150
	(1) D205-24 line assembly B-nuts	135-150
(2) F902-1 line assembly B-nuts	135-150	
(2) F902-2 line assembly B-nuts	110-130	
HYDRAULIC RESERVOIR	(1) D487-3, filler-vent	100
	(1) D516-1, filter cap	150
	(1) B563-2, sight gage	150
HYDRAULIC SERVOS	(1) D210-08 nut, attaching D200-2 scissors	25
	(1) B330-6 palnut on D200-2 scissor apex fastener	5-10
LANDING GEAR	(4) NAS6604-46 bolts, securing ground handling wheel support weldments to skid tubes	70
	(4) NAS6607P20 bolt, securing landing gear to fuselage supports and shackles	66 FT-LB
	(2) NAS6607P44 bolt, securing shackles to fuselage	66 FT-LB
	(4) B277-28 clamp, securing fairings to struts	15

20-33 Special Torques (continued)

AREA*	FASTENER*	TORQUE (IN.-LB)*
POP-OUT FLOATS (OPTIONAL EQUIPMENT)	(2) D674-2 hose assembly, B-nuts	245
	(4) D674-6 hose assembly, B-nuts	245
	(2) D674-7 hose assembly, B-nuts	120
	(1) D674-9 hose assembly, B-nuts	245
	(2) D674-10 hose assembly, B-nuts	245
POP-OUT FLOATS (OPTIONAL EQUIPMENT; CONT'D)	(2) D674-11 hose assembly, B-nuts	245
	(1) D674-12 hose assembly, B-nuts	245
	(1) D674-13 hose assembly, B-nuts	245
	(2) D770-1 valve assembly	40
	(2) D770-2 valve assembly	40
	(2) D770-3 valve assembly	40
	(2) D770-4 valve assembly	40
	(2) D770-5 valve assembly	40
MAIN ROTOR BLADE	(2) B289-2 bolts, per blade, self-sealing	70
	(2) A722-4 screws, per blade, tip balance weight	40 wet
	(2) NAS1351N3-12P screws, per blade, tip cover	40 wet
MAIN ROTOR FLIGHT CONTROLS	(2) MS21042L04 nut, low rotor horn V3-1 switch	4-5
MAIN ROTOR GEARBOX	(1) B254-3 strainer, main rotor gearbox sump	200
	(1) B563-2 sight gage	150
	(1) B566-1 chip detector, main rotor gearbox	150
	(1) D205-25 hose assembly, sump to pump B-nuts	120
	(1) F904-1 pinion plug, securing rotor shaft input yoke to main rotor gearbox	60 FT-LB wet Apply A257-9 to threads
	(1) AN814-8D plug, main rotor gearbox filler plug	150
	(1) MS21245L8 nut, securing engine shaft input yoke to main rotor gearbox	40 FT-LB
	(1) chip detector wire terminal nut	5
MAIN ROTOR HUB	(1) NAS634-105 bolt, teeter hinge and (2) NAS634-105 bolt, coning hinges	New bolt: 0.021-0.022 inch elongation, wet  Used bolt: 0.020-0.022 inch elongation, wet, and cotter pin holes must align
MAST TUBE	(1) B277-064 clamp, lower rib to mast tube	50
PITCH LINKS	(2) 21FKF-813 self-locking jam nuts, main rotor pitch links	300

20-33 Special Torques (continued)

AREA*	FASTENER*	TORQUE (IN.-LB)*
POWERPLANT	(1) D745-3 (pressure) switch assembly	65
	(1) F147-1 screw, FCU minimum throttle stop	20
	(1) F170 fitting, engine gearbox	100
	(1) F727-1 line assembly, fuel pump drain	50-65
	(1) F727-2 line assembly, horizontal turbine-firewall shield assembly drain	50-65
	(1) F741-1 line assembly, fuel differential pressure switch	80
	(1) G426-1 (fuel differential pressure) switch assembly	100
	(2) nuts, securing harness wire to MGT thermocouple studs, engine-supplied	20
	(2) nuts, securing harness wires to starter-generator small terminals, starter-generator supplied	20
	(2) nuts, securing harness wires to starter-generator large terminals, starter-generator supplied	180
	(1) nut, securing harness wire to ignition exciter box, engine-supplied	15
	(2) nuts, securing harness and (2) MS21919WCH4 clamps to engine accessory gearbox, engine-supplied	40
	(4) nuts, securing F577-1 bracket assembly, engine-supplied	40
	(2) tee bolts, securing F173-1 struts to engine, engine-supplied	35-40
	(2) AN815-8D unions, engine oil outlet and oil tank vent	250
	(1) AN815-10D union, engine oil inlet	375
	(1) AN919-0D reducer and (1) AN919-2D reducer	100
	(2) NAS6605-3 bolt, securing G200-1 lug to engine (optional)	110
	(6) NAS6605H3 bolts, securing (2) F593-1 support assemblies to engine	110
	(2) NAS6605H4 bolts and (1) NAS6605H2 bolt, securing F593-3 plate to engine	110
(1) CV26-77 check valve, engine oil outlet (early R66s)	250	
SWASHPLATE	(26) NAS1352N08-8 screws, securing spacers, sleeve assembly, shield, and retainers	35 wet
	(2) NAS1352N08-4 screws, securing B769-2 bracket	35
TAIL ROTOR	(1) D210-4 nut, securing C119-2 bumper	120
	(1) NAS6606-53 bolt, teeter hinge	380
TAIL ROTOR FLIGHT CONTROLS	(1) D210-4 nut, outboard of F316-1 bellcrank assembly	90

20-33 Special Torques (continued)

AREA *	FASTENER*	TORQUE (IN.-LB)*
TAIL ROTOR GEARBOX	(1) A610-1 vent assembly	100
	(1) B563-4 sight gage	150
	(1) B566-2 chip detector	100
	(1) D210-5 nut, pitch control housing	240
	(1) AN320-8 nut, input yoke	35-45 FT-LB
	(4) MS20074-04-06 bolts, input cap	60
	(8) MS20074-04-06 bolts, input housing and output cap	100
	(4) NAS1352-5-12P bolts (undrilled), gearbox-to-tailcone attachment	260
TAIL ROTOR GUARD	(1) NAS1352-3-14P screw, securing block assembly to stabilizer	40
WINDOWS	(22) AN526C832R12 screw, thru center brace	16

- \* 1. Values include nut self-locking torque.
- 2. Increase values 10% if torqued at bolt head.
- 3. For elbow & tee fittings which require alignment, torque to indicated value then tighten to desired position.
- 4. Values ± 10% unless range is specified.
- 5. Unless otherwise noted, thread sizes 8-32 & smaller are not used for primary structure & do not require specific torque.
- 6. Unless otherwise specified, refer to applicable maintenance procedure for material required and application when "wet" torque is indicated.

20-34 Push-Pull Tube Rod End Adjustment

**NOTE**  
Refer to § 18-13 to adjust C258 main rotor pitch links.

The following procedure is standard for adjusting push-pull tube rod ends:

1. Loosen palnut and jam nut on rod end shank.
2. Remove hardware securing push-pull tube rod end to attachment point per respective instructions.
3. Screw rod end in or out of push-pull tube as required to obtain proper rigging adjustment.
4. After any rod end adjustment, verify rod end threaded shank blocks passage of 0.020-inch diameter wire thru the witness hole in the push-pull tube per Figure 5-1. When no witness hole is provided, refer to Figure 5-1 for maximum rod end extension.
5. Install fastener securing push-pull tube to attachment point per respective instructions.
6. Refer to Figure 5-2. Position rod ends to allow as much push-pull tube rotation as possible without binding. Standard torque jam nuts & palnuts per § 20-32 & torque stripe per Figure 5-1.

20-35 D210-series Nuts on Critical Fasteners

When performing maintenance that involves disassembly of a critical fastener (joints with a secondary lock), reassemble the fastener using a D210-series nut.

If a fastener is disassembled that has an MS21042L-series or NAS1291-series nut with a B330-series palnut or B332-series lockwasher (secondary lock),

replace MS21042L08 nut or NAS1291-08 nut with D210-08 nut,

replace MS21042L3 nut or NAS1291-3 nut with D210-3 nut,

replace MS21042L4 nut or NAS1291-4 nut with D210-4 nut,

replace MS21042L5 nut or NAS1291-5 nut with D210-5 nut,

replace MS21042L6 nut or NAS1291-6 nut with D210-6 nut,

replace NAS1291-7 nut with D210-7 nut,

replace NAS1291-8 nut with D210-8 nut, or

replace NAS1291-10 nut with D210-10 nut.

20-40 Non-Destructive Testing**WARNING**

**Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.**

20-41 Magnetic Particle Inspection

Ferromagnetic steel parts must be inspected for structural defects using magnetic particle inspection.

Steel parts covered by this specification shall be inspected per ASTM E 1444 wet process with ultra-violet light. Applicable requirements and limitations of the above standard shall apply. Parts shall be thoroughly demagnetized and cleaned after inspections. Record the size and location of all rejectable indications.

Procedures and equipment used to perform the inspection shall conform to requirements of ASTM E 1444. Whenever possible, parts shall be inspected with both circular and longitudinal magnetization.

**A. Inspection Criteria**

Parts (except gears) which are inspected by magnetic particle inspection shall be accepted or rejected according to the following criteria:

Acceptable indications:

- Indications smaller than 0.015 inch are not considered ratable.
- Indications caused by sharp changes in cross-section or part geometry.

Rejectable indications:

- Indications interpreted as cracks, seams, laps, shuts, or any flaws which are open to the surface.
- Indications oriented at an angle of more than 15 degrees from the longitudinal axis with length exceeding 0.125 inch.
- Circumferential indications on any shoulder or fillet (changes in diameter).
- Any indications which break over an edge, shoulder, fillet radius, keyway, spline, or an adjacent area of part more than 0.015 inch.
- Indications caused by undercuts at the toe of a weld.
- Indications caused by cracks in the weld or parent metal.
- Indications caused by inclusions in weld material exceeding 0.1 inch in length.



### 20-42 Fluorescent Penetrant Inspection

This specification provides for surface inspection of parts fabricated from nonmagnetic materials to detect discontinuities open to the surface, such as cracks, cold shuts, laps, porosity and other surface defects.

Applicable requirements and limitations of ASTM E 1417 shall apply. After inspection is complete, solvent clean parts.

The step-by-step procedure and equipment used to perform the inspection shall be accomplished per ASTM E 1417.

#### **A. Inspection Criteria**

Parts inspected by fluorescent penetrant method shall be accepted or rejected on basis of acceptance limits specified. If acceptance limits are not specified, rejectable surface defects and any of the following:

- Cracks
- Seams
- Cold shuts or laps
- Surface inclusions
- In castings, aligned discontinuous surface indications other than cracks, cold shuts and inclusions are rejectable if more than 3/8 inch in length.

### 20-50 Corrosion Control

[Reserved].

### 20-60 Priming and Painting

This specification outlines preparation and application requirements for primers and topcoat. Primers provide corrosion protection and a final finish or a base for topcoat. Use only approved materials listed in § 20-70.

Do not prime or paint with a topcoat finish the following areas (unless directed):

- Sliding friction joints.
- Stainless steel parts.
- Swivel joints and adjustable rod ends.
- Plastic, rubber, electrical components and wires or similar materials.
- Bolted joints where torque is a specific requirement for clamping action.
- Bearing press fit or close tolerance slip fit joints (except where wet chromate primer is part of the assembly procedure).

20-60 Priming and Painting (continued)**WARNING**

**Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.**

**A. Priming****1. Preparing Aluminum**

Unless otherwise specified, chemical conversion coating using Alodine 1201 is the standard treatment before priming aluminum. Follow manufacturers instructions for application of Alodine. However, if bare or clad aluminum is primed without conversion coating, the following procedure must be used:

- a. Alkaline clean if immersion is practical, otherwise wipe clean with an approved degreasing agent.
- b. Lightly scuff the surface with Scotch Brite pads.
- c. Wipe with a tack rag to remove any foreign material or damp wipe with an approved solvent.
- d. Air dry. Do not touch parts with bare hands until primed.

**2. Preparing Steel**

Alkaline clean is the preferred method for cleaning stainless steel. Alternately, stainless steel may be cleaned using an approved solvent.

Steel parts should only be cleaned using an approved solvent; using an alkaline cleaning process on steel may cause a corrosive reaction.

Where immersion is not practical or for extremely greasy or dirty parts, a preclean in a solvent vapor degreaser may be used.

Air or blow dry using filtered, dry, compressed air.

**3. Application**

Apply primer after mixing per manufacturer's recommendations. Primer coating is not to exceed 0.0005–0.0020 inch thickness per coat. For parts with internal openings, such as tubes, prime the inside as follows:

- a. Thin primer to watery consistency using required reducer.
- b. Pour in primer, slosh around, then drain immediately.
- c. Dry parts at least (6) hours before using.

20-60 Priming and Painting (continued)**A. Priming (continued)**

## 4. Inspection

Inspect for complete coverage and excessive thickness. If primer is excessively thick, strip part and re-prime. Refer to § 20-70 for approved methods.

**B. Painting**

Prior to liquid topcoat application, ensure surfaces have been cleaned and primed. In general, most parts will be cleaned and primed as detail parts. However, in some cases, such as the gearbox assembly, this is not practical and primer and topcoat are applied on the assembled component.

Previously primed surfaces, or primed surfaces that have completely cured require the following preparation before paint:

1. Lightly sand using 220-grit or finer sandpaper.
2. Lightly scuff with Scotch Brite pads (optional).
3. Wipe with clean cloth and approved solvent.
4. Wipe with tack cloth.
5. Apply topcoat.

20-70 Approved Materials

The following items are available from the noted manufacturer(s) or their distributor(s). Check with appropriate regulatory authority(s) for allowable usage of materials.

**WARNING**

**Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.**

**CAUTION**

Follow product manufacturer’s instructions for handling and storage.

20-71 Paint Strippers

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
Cee-Bee Stripper A-292	McGean-Rohco: Cee-Bee Division Downey, CA	Metal parts, except blades and flex plates.
Plastic Media Blasting System	Pauli & Griffin Co. Vacaville, CA	Metal parts except blades and unsupported sheet metal less than 0.040 inch thick.

20-72 Solvents and Cleaners

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
QSOL 220	Safety-Kleen Systems, Inc. Plano, TX	General use for cleaning prior to applying primer, topcoat, adhesive, or sealant. " "
Benzene, 1-Chloro-4 (Trifluoromethyl) PCBTF***	Any	
Final Klean 3909S	Du Pont Chemical Los Angeles, CA	
EM-Citro*	LPS Laboratories, Inc. Tucker, GA	
Acetone***	Any	
Lacolene (Aliphatic Hydrocarbon)	Any	Acrylic plastic cleaner only.
Plexus®	B.T.I. Chemical Co. Oak Park, CA	" "
Presolve	LPS Laboratories, Inc. Tucker, GA	Hydraulic components only.
Tetrachloroethylene (Perchloroethylene)	Any	Vapor degreaser.

20-72 Solvents and Cleaners (continued)

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
815 GD	Bulin Corporation Indianapolis, IN	Ultrasonic cleaning, general use. **
SF50	L&R Mfg. Co. Kearny, NJ	" "
#112 Ammoniated or #222 Nonammoniated cleaning & rinse solution	L&R Mfg. Co. Kearny, NJ	Ultrasonic cleaning, avionics components only.
Cleanup Wipe E-4365	Sontara Candler, NC	Cleaning and drying.

\* May be used on acrylic plastic.

\*\* Mix 5%-20% by volume; titration not required.

\*\*\* Acetone and PCBTF may be mixed together at 1:1 ratio.

20-73 Fillers and Putty

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
05819 Finishing Putty 31180 Finishing Glaze	3M St. Paul, MN	Minor surface imperfections.
SBF1191	Gearhead Products Indianapolis, IN	" "
FE-351 Cream Hardener	Catalyst Systems Gnadenhutten, OH	" "

20-74 Torque Seal

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
F-900 (Any color except red)	Organic Products Co. Irving, TX	Torque seal.

20-75 Primers

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
Gray epoxy CA 7422A/B/C or CA 7501A/B	PPG Industries Irvine, CA	Unlimited.
Gray epoxy 4001PS001 with CS4902 curing solution	AkzoNobel Waukegan, IL	Unlimited.
Aviation Primer, Green, A-702 (Aerosol) *	Tempo Products Medina, OH	Limited or touch-up use only.
Green Chromate Epoxy 44-GN-72	PPG Industries Irvine, CA	Use only where specified.
Gray Urethane Primer Filler LE 3404S	Axalta Coating Systems Philadelphia, PA	Scrolls.

\* Shelf life is two years.

20-76 Powder Coat

PRODUCT	MANUFACTURER
Interpon 100-AL101QF Gray Zinc Rich Epoxy Powder*	AkzoNobel Santa Fe Springs, CA
81-2158 Vitralon Grey Zinc Rich Epoxy Powder*	Pratt & Lambert Chemical Coatings Buffalo, NY
39/80020 Smooth Matte Black Polyester Topcoat Powder*	Tiger Drylac USA Cucamonga, CA
49/72460 Smooth Glossy Gray RAL 7043 Polyester Topcoat Powder*	Tiger Drylac USA Cucamonga, CA
49/22460 Smooth Glossy Yellow RAL 1028 Polyester Topcoat Powder*	“ ”
PFWF104S9 White Polyester Topcoat Powder*	Dupont Co. Wilmington, DE

\* Shelf life is 12 months from date of manufacture at ambient temperature.

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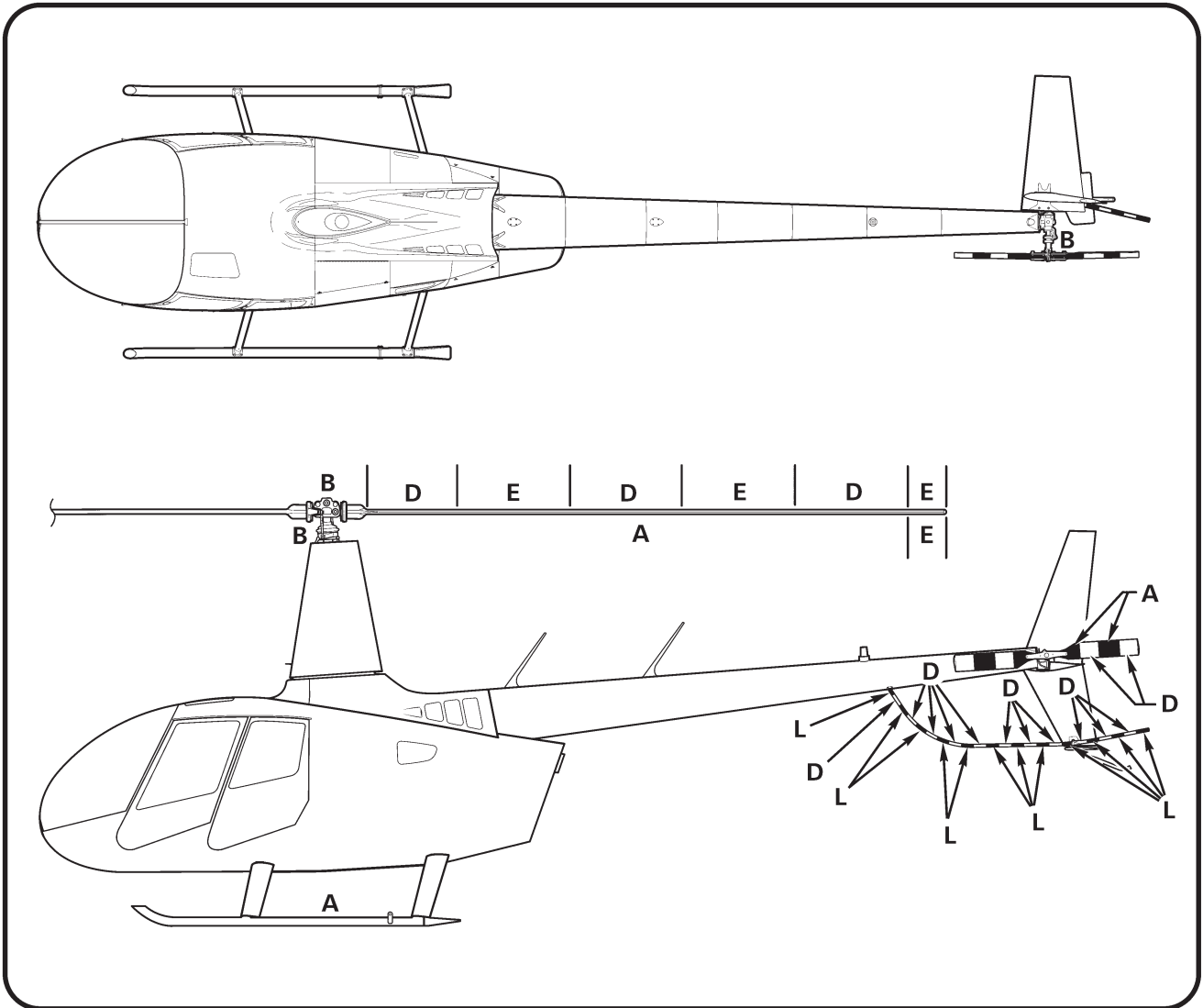


FIGURE 20-3 PAINT CODES

(Refer to Chapter 62 for rotor blade paint dimensions. Exterior surface codes are D & F unless otherwise specified.)



20-77 Paints

Refer to Figures 20-3 & 20-4 for paint code application. Paint codes for specific helicopter serial numbers are listed on the inside cover of Airframe Maintenance Record (logbook).

**NOTE**  
Use fisheye eliminator, accelerator, or other additives per manufacturer's recommendations.

CODE	MATERIAL	MANUFACTURER
A	Flat Black 18BK006 with 18BK006CAT Catalyst	PPG Aerospace; Irvine, CA
	Flat Black 666-58-7038 with X-503 activator	AkzoNobel; Waukegan, IL
B	Dark gray Imron AF400/AF700	Axalta; Wilmington, DE
	Alumigrip 4200G15290	AkzoNobel; Waukegan, IL
D	White Imron AF400/AF700	Axalta; Wilmington, DE
	Alumigrip 4200G10208	AkzoNobel; Waukegan, IL
E	Yellow Imron AF400/AF700	Axalta; Wilmington, DE
	Alumigrip 4200G40227	AkzoNobel; Waukegan, IL
F	Imron AF400/AF700 Colors	Axalta; Wilmington, DE
G	Clear Imron AF740	" "
H	Flat Clear 666-58-9000 with X-503 activator	AkzoNobel; Waukegan, IL
J	White Imron 2.1 FT flat polyurethane enamel with 9T00-A activator, D-121 & D-101 tints, 2100-P 2.1 binder, & 9T20 flattener	Axalta; Wilmington, DE
K	White Cat-L-Ink 50-100R (shelf life 3 years) 20/A Catalyst (shelf life 2 years)	Ethone, Inc.; West Haven, CT
	Yellow Cat-L-Ink 50-202AR or BR (shelf life 3 years) 20/A Catalyst (shelf life 2 years)	" "
	Med Red Cat-L-Ink 50-508R (shelf life 3 years) 20/A Catalyst (shelf life 2 years)	" "
L	Red Imron AF400/AF700	Axalta; Wilmington, DE
	Alumigrip 4200G4	AkzoNobel; Waukegan, IL
M	Orange Imron AF400/AF700	Axalta; Wilmington, DE
N	Krylon 1311 (shelf life 2 years) Matte Clear (aerosol can)	Krylon Div. of Borden Columbus, OH
O	Light gray Imron AF400/AF700	Axalta; Wilmington, DE
P	Silver Bullet AM Tracer Black 20-452AM-F1 with 16-CURE-F4 activator	Burke Industrial Coatings Ridgefield, WA

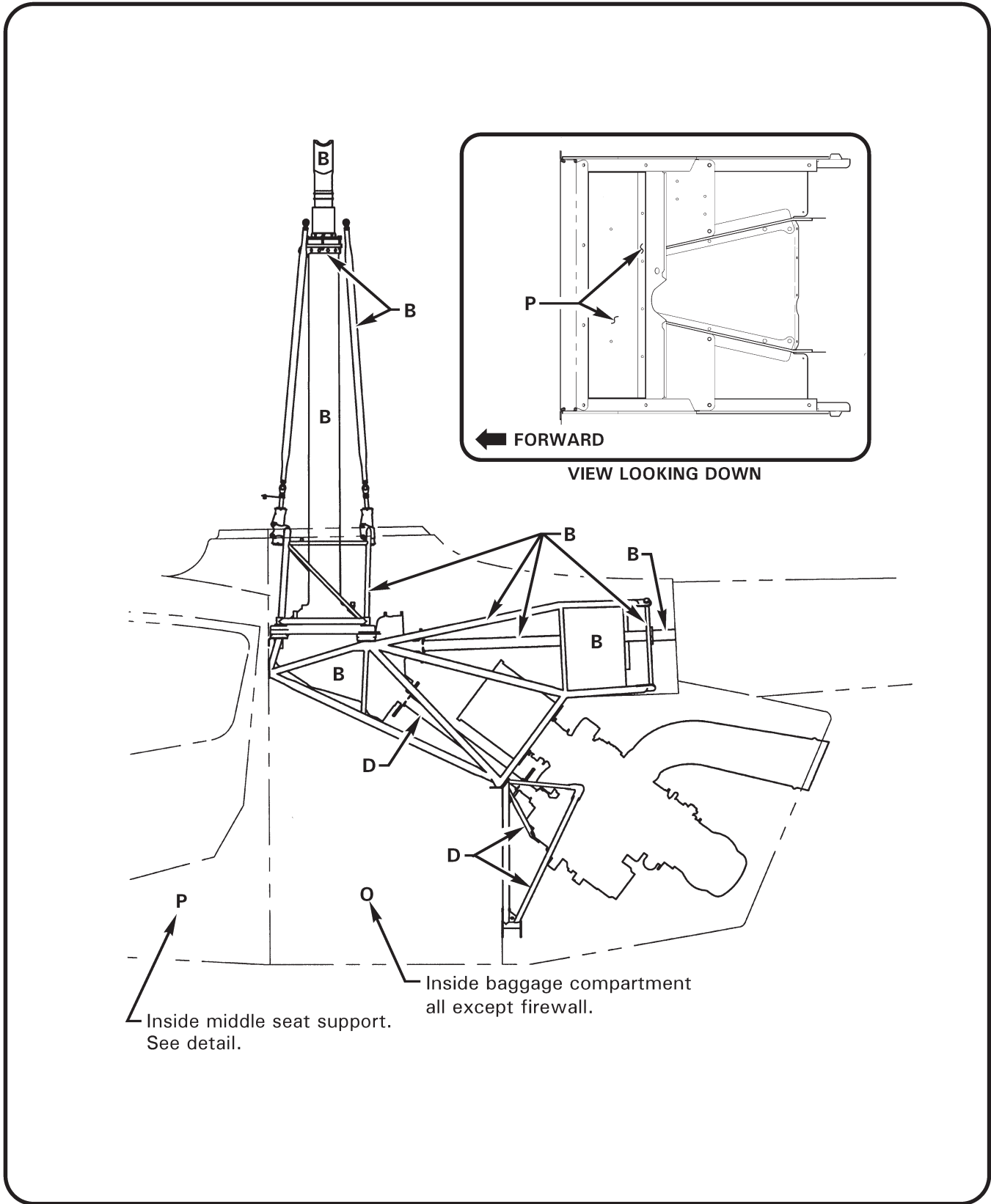


FIGURE 20-4 PAINT CODES

20-77 Paints (continued)

For limited touch-up of interior and landing gear only:

CODE	MATERIAL	MANUFACTURER
A	Cardinal A-2000-05 Flat Black (aerosol can)	Cardinal Industrial Finishes So. El Monte, CA

20-78 Lubricants

RHC PART NO.	LUBRICANT TYPE	MANUFACTURER'S PART NO.	MANUFACTURER
A257-1	Grease (general purpose)	101	Southwestern Petroleum Corp. Fort Worth, TX
A257-3	Grease	Aero Shell 14 MIL-G-25537	Shell Oil Co.
A257-4	Oil (automatic transmission fluid)	Dexron II or Dexron II/Mercon or Dexron III/Mercon	Any
A257-5	Grease (water resistant)	3120  11402	Sta-Lube, Inc. Compton, CA  Lubrimatic Buffalo Grove, IL
A257-6	Grease (fuel resistant)	Fuelube  EZ Turn	Fleet Supplies Inc. Cleveland, OH  United-Erie Div. of Interstate Chemical Co. Erie, PA
A257-7	Dry film lubricant	Lubri-Kote Type A 1040 CR	Mealey Ind. Lubricants Cleveland, OH
A257-8	Rubber lubricant	P-80	International Products Corp. Trenton, NJ
A257-9	Anti-seize	Silver Grade	Loctite Corp. Newington, CT
A257-12	Grease	MobilGrease 28 MIL-PRF-81322	Exxon Mobil Corp., Fairfax, VA
A257-15	Hydraulic fluid	Per MIL-PRF-5606	Any
A257-17	Substitute A257-19		
A257-18	O-ring lubricant	55	Dow Corning Corp. Midland, MI
A257-19	Valve lubricant and sealant compound	111	Dow Corning Corp. Midland, MI
A257-20	Pag oil	3420025-049 (Daphne Hermetic PR) or 3420025-067 (Nissan Type R)	Idemitsu Lubricants America Southfield, MI

20-78 Lubricants (continued)

RHC PART NO.	LUBRICANT TYPE	MANUFACTURER'S PART NO.	MANUFACTURER
A257-21	Petrolatum lubricant	P-16	Panef Corp. Milwaukee, WI
A257-22	Gear oil synthetic	Mobil SHC 629	Exxon Mobil Corp.
A257-23	Turbine oil	Per AS5780 Class HPC	Any

20-79 Adhesives and Sealants

RHC PART NO.	DESCRIPTION	COLOR	MFR. PART NO.	MANUFACTURER
B270-1	Sealant - polysulfide, fuel resistant (2-part)	Gray	FS-8907 B-*	PPG Aerospace Glendale, CA
	Sealant - polysulfide, fuel resistant (2-part)	Gray	WS-8032 B-*	Royal Adhesives & Sealants Wilmington, CA
	Sealant - polysulfide, fuel resistant (2-part)	Gray	AC-350 B-*	Advanced Chemistry & Technology Inc., Garden Grove, CA
B270-2	Substitute B270-1			
B270-4	Substitute B270-13			
B270-5	Sealant - synthetic rubber putty (1-part)	White Light Gray	Q4-2805 94-031	Dow Corning Corp. Midland, MI
B270-6	Sealant & lubricant - thread (1-part)	Gray	Titeseal 55	Radiator Spec. Co. Charlotte, NC
B270-7	Substitute B270-14			
B270-8	Adhesive - rubber, nitrile/acetone (1-part)	Tan	C 160	Stabond Corp. Gardena, CA
B270-9	Adhesive - epoxy, structural, flexible (2-part)	Gray	2216 B/A	3M Co. St. Paul, MN
B270-10	Adhesive/sealant - threadlocker, anaerobic, tight-fits (1-part)	Red	271	Henkel Loctite Corp. Rocky Hill, CT
B270-11	Adhesive/sealant - threadlocker, anaerobic, loose-fits (1-part)	Red	277	Henkel Loctite Corp. Rocky Hill, CT

20-79 Adhesives and Sealants (continued)

RHC PART NO.	DESCRIPTION	COLOR	MFR. PART NO.	MANUFACTURER
B270-12	Sealant - electrical potting (2-part)	Any color except red	MIL-PRF-8516 Type II, Class 2, Category A or B	Any
B270-13	Sealant - silicone rubber, noncorrosive (1-part)	Translucent	3145	Dow Corning Corp. Midland, MI
B270-14	Substitute B270-8			
B270-15	Adhesive - plastic, for vinyl (1-part)	Clear	2262	3M Co. St. Paul, MN
B270-16	Substitute B270-14			
B270-17	Adhesive - cyanoacrylate, instant (1-part)	Clear	Super Bonder 495	Henkel Loctite Corp. Rocky Hill, CT
B270-18	Adhesive - weather strip (1-part)	Black	051135-08008	3M Co. St. Paul, MN
B270-19	Adhesive - epoxy structural, rigid (2-part)	Green	1838 B/A	3M Co. St. Paul, MN
B270-20	Adhesive/sealant - threadlocker, anaerobic, non-permanent (1-part)	Purple	222 or 222MS	Henkel Loctite Corp. Rocky Hill, CT
B270-21	Protectant - corrosion, non-drying (1-part)	Lt. Amber	LPS 3	LPS Laboratories, Inc. Tucker, GA
B270-22	Protectant - corrosion, drying (1-part)	Amber	LPS Hardcoat	LPS Laboratories, Inc. Tucker, GA
B270-23	Sealant - gasket (1-part)	Brown	GM3H (Gasket Maker #4)	Perfect Seal, Inc. Cincinnati, OH
	Sealant - gasket (1-part)	Brown	JV66B	Dana Corp.; Churubusco, IN (Victor Reinz Brand)
B270-24	Activator/Primer - Anaerobic adhesive (1-part)	Translucent Green	7649	Henkel Loctite Corp. Rocky Hill, CT
B270-25	Clear Coat - automotive touch up, brush in bottle (1-part)	Clear	Clear Coat Touch up Bottle	Automotivetouchup Harahan, LA
B270-26	Sealant - Polysulfide, window glazing (2-Part)	Black	AC-251B-1	Advanced Chemistry & Technology Inc., Garden Grove, CA
B270-27	Adhesive - Epoxy, High Strength Structural, Flexible (2-part)	Translucent Red Blue	EA 9309NA EA 9309.2NA	Henkel Loctite Corp. Rocky Hill, CT
B270-28	Substitute B270-27			

\* Dash number for minimum hours application life may be -½, -2, -4, or -12.

20-80 Storage Limits

1. B283 hoses have a shelf storage life of 5 years. Hose service life is "on condition", with a maximum of 12 years or 2000 hours, whichever occurs first.
2. Elastic cords have a shelf storage life of 5 years. Elastic cord service life is "on condition", with a maximum of 12 years. Use invoice or FAA Form 8130 date as start date.
3. Store V-belts at less than 85° F (30° C), with relative humidity below 70%. Avoid solvent and oil vapors, atmospheric contaminants, sunlight, and ozone sources (electric motors, arc welding, ionizing air purifiers, etc.). Belt shelf life is 4 years if preceding recommendations are followed. Use invoice date or FAA Form 8130-3 date as start date.
4. Oils and greases have a 5 year shelf life when stored and kept sealed in their original container. Use invoice date or FAA Form 8130-3 date as start date unless the manufacturer has marked container with manufacture date (in which case use manufacture date as start date).
5. Rubber o-rings, seals, and gaskets have a shelf storage life of 20 quarters (5 years). Flourocarbon (Viton), chloroprene, and silicon rubber products shall adhere to manufacturer's expiration date(s). Service life is "on condition" with a maximum of 12 years. Use cure date on package as start date.
6. Store fuel cell (bladder) at temperatures above 45° F and below 75° F.

## 20-90 Miscellaneous Practices

### 20-91 Part Interchangeability

Refer to R66 Illustrated Parts Catalog for part interchangeability information.

### 20-92 Thermal Fitting Parts

General Procedures for using heat to fit parts during assembly or evaluating parts that may have been overheated in service:

*Aluminum parts* must not be heated above 200°F for more than 5 minutes. Higher temperatures or longer times adversely affect strength and corrosion properties. Scrap any aluminum parts suspected of going above 325°F regardless of time at temperature.

*Steel parts (bare)* – Maximum temperature 300°F. Higher temperature can reduce the strength or cause temper brittleness in some alloys.

*Steel parts (cadmium plated)* – Maximum temperature 300°F. Higher temperatures will melt the plating and adversely affect steel strength by a process called liquid metal embrittlement.

*Bearings and carburized parts* such as gears, clutch shafts, and clutch housings should not be heated above 300°F. Higher temperatures will reduce the surface hardness and increase wear rates.

Always heat parts in an oven with temperature control set no greater than the maximum temperature allowed for the part.

Always attach a pyrometer and thermocouple to the smallest aluminum part in the oven. Never depend on the oven control to determine part temperature.

Cooling a part for thermal fitting at assembly is not recommended. Water vapor from the air will condense on the part and frequently introduce water into the assembly causing severe internal corrosion over time.

### 20-93 Replacement Component Identification (Data) Plates

In order to issue a replacement component identification plate for field installation, RHC must first receive the old identification plate in legible condition. If old identification plate is lost or destroyed, then RHC must have an original letter (photocopies or faxes are NOT acceptable) from customer's Civil Aviation Authority authorizing identification plate replacement AND stating component name, part number, and serial number for each requested identification plate. There is a charge for each plate issued.

Identification plates may be carefully removed using a sharp plastic scraper. If necessary, use a heat gun to soften plate adhesive. Retain in a dry, contaminate-free area until ready for reinstallation.

Damp wipe local area with acetone or equivalent solvent prior to reinstallation. Residual adhesive on identification plate is usually sufficient for good adhesion. If necessary, use B270-9 adhesive or equivalent to secure.

20-94 Crimp Inspection

Refer to Figure 20-5.

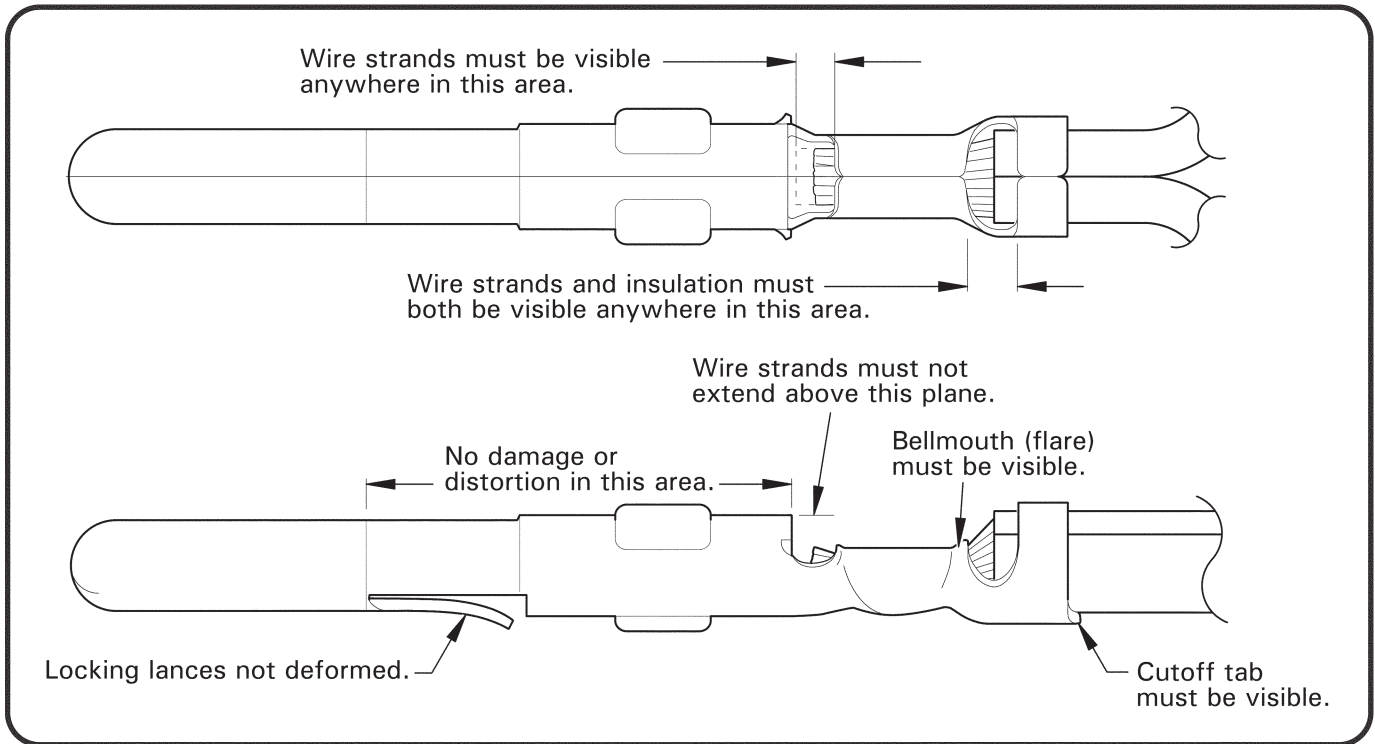


FIGURE 20-5 CRIMP INSPECTION