

CHAPTER

20

**STANDARD
PRACTICES -
AIRFRAME**



**777-200/300
AIRCRAFT MAINTENANCE MANUAL**

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20-EFFECTIVE PAGES			20-10-01 (cont)			20-10-07		
1 thru 7	SEP 05/2018		414	Sep 05/2017		401	May 05/2015	
8	BLANK		415	Sep 05/2017		402	May 05/2015	
20-CONTENTS			416	Sep 05/2017		403	Jan 05/2018	
1	Sep 05/2017		417	Sep 05/2017		404	BLANK	
2	Jan 05/2015		418	Sep 05/2017		20-10-08		
3	Sep 05/2017		419	Jan 05/2018		401	Jan 05/2015	
4	Sep 05/2017		420	Sep 05/2017		402	Jan 05/2018	
5	Jan 05/2015		20-10-02			20-10-09		
6	Sep 05/2017		401	Jan 05/2015		201	Jan 05/2015	
7	Jan 05/2015		402	BLANK		202	Jan 05/2015	
8	May 05/2015		20-10-03			203	Jan 05/2015	
9	Jul 25/2018		401	May 05/2018		204	Jan 05/2015	
10	Jul 25/2018		402	May 05/2018		205	Sep 05/2017	
11	Jul 25/2018		403	May 05/2018		206	Sep 05/2017	
12	Jul 25/2018		404	May 05/2018		207	Jan 05/2017	
13	Jul 25/2018		405	May 05/2018		208	Jan 05/2017	
14	Jul 25/2018		406	May 05/2018		209	Jan 05/2017	
15	Jul 25/2018		407	May 05/2018		210	Jan 05/2017	
16	BLANK		408	May 05/2018		211	Jan 05/2017	
20-00-00			409	Jan 05/2017		212	Jan 05/2017	
201	Sep 05/2015		410	Jan 05/2017		213	Jan 05/2017	
202	Sep 05/2017		20-10-04			214	Jan 05/2017	
20-10-01			401	Sep 05/2017		215	Jan 05/2017	
401	May 05/2015		402	Sep 05/2017		216	Jan 05/2017	
402	Sep 05/2017		403	Sep 05/2017		217	Jan 05/2017	
403	Sep 05/2017		404	BLANK		218	Jan 05/2017	
404	Sep 05/2017		20-10-05			219	Jan 05/2017	
405	Sep 05/2017		401	Sep 05/2017		220	Jan 05/2017	
406	Sep 05/2017		402	Sep 05/2017		221	Jan 05/2017	
407	Sep 05/2017		403	Jan 05/2018		222	Jan 05/2015	
408	Sep 05/2017		404	Jan 05/2015		223	Jan 05/2017	
409	Sep 05/2017		20-10-06			224	Jan 05/2017	
410	Sep 05/2017		401	Jul 25/2018		225	Jan 05/2017	
411	Sep 05/2017		402	Sep 05/2017		226	Jan 05/2017	
412	Sep 05/2017		403	Sep 05/2017		227	Jan 05/2017	
413	Sep 05/2017		404	Jan 05/2018		228	Jan 05/2017	

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229	Jan 05/2017		424	Sep 05/2017		833	Jan 05/2017	
230	Jan 05/2017		425	Sep 05/2017		834	Jan 05/2017	
231	Jan 05/2017		426	BLANK		835	Jan 05/2017	
232	Jan 05/2017		20-10-09			836	Jan 05/2017	
233	Sep 05/2017		801	Jan 05/2015		837	Jan 05/2017	
234	Sep 05/2017		802	May 05/2018		838	Jan 05/2017	
235	Sep 05/2017		803	Sep 05/2017		839	Jan 05/2015	
236	Sep 05/2017		804	May 05/2018		840	Jan 05/2017	
237	Sep 05/2017		805	Sep 05/2017		841	Jan 05/2017	
238	Sep 05/2017		806	Jan 05/2015		842	Jan 05/2017	
239	Sep 05/2017		807	May 05/2015		843	Jan 05/2017	
240	BLANK		808	May 05/2015		844	Jan 05/2017	
20-10-09			809	May 05/2015		845	May 05/2015	
401	Jan 05/2015		810	May 05/2015		846	May 05/2015	
402	Sep 05/2017		811	May 05/2015		847	May 05/2015	
403	Sep 05/2017		812	May 05/2015		848	May 05/2015	
404	Sep 05/2017		813	May 05/2015		849	May 05/2015	
405	Sep 05/2017		814	Jan 05/2015		850	May 05/2015	
406	Sep 05/2017		815	Jan 05/2015		851	May 05/2015	
407	Sep 05/2017		816	Jan 05/2015		852	Jan 05/2017	
408	Sep 05/2017		817	Sep 05/2015		853	Jan 05/2015	
409	Sep 05/2017		818	Sep 05/2015		854	Jan 05/2017	
410	Sep 05/2017		819	Sep 05/2015		855	Jan 05/2017	
411	Sep 05/2017		820	Sep 05/2017		856	Jan 05/2017	
412	Jan 05/2017		821	May 05/2018		857	Jan 05/2017	
413	Jan 05/2017		822	May 05/2017		858	Jan 05/2017	
414	Jan 05/2017		823	May 05/2017		859	Jan 05/2017	
415	Jan 05/2017		824	Jan 05/2018		860	Jan 05/2017	
416	Jan 05/2017		825	May 05/2017		861	Jan 05/2017	
417	Sep 05/2017		826	May 05/2017		862	Sep 05/2017	
418	May 05/2016		827	May 05/2017		R 863	Sep 05/2018	
419	May 05/2015		828	May 05/2017		864	Sep 05/2017	
420	May 05/2015		829	May 05/2017		865	Sep 05/2017	
421	May 05/2015		830	May 05/2017		866	Jan 05/2017	
422	Sep 05/2017		831	May 05/2017		867	Jan 05/2017	
423	Sep 05/2017		832	Jan 05/2017		R 868	Sep 05/2018	

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869	Sep 05/2017		898.7	Sep 05/2017		216	Jan 05/2015	
870	Sep 05/2017		898.8	Sep 05/2017		217	Jan 05/2015	
871	Jan 05/2017		898.9	Sep 05/2017		218	Jan 05/2017	
872	Jan 05/2017		898.10	Sep 05/2017		219	Jan 05/2017	
873	May 05/2015		898.11	Sep 05/2017		220	Jan 05/2017	
R 874	Sep 05/2018		898.12	Sep 05/2017		221	Jan 05/2017	
R 875	Sep 05/2018		898.13	Jul 25/2018		222	Jan 05/2017	
O 876	Sep 05/2018		898.14	Jul 25/2018		223	Jan 05/2018	
877	Jan 05/2017		898.15	Jul 25/2018		224	BLANK	
878	Jan 05/2017		898.16	Jul 25/2018		20-10-10		
879	Jan 05/2017		898.17	Sep 05/2017		401	Sep 05/2017	
880	Jan 05/2017		898.18	Sep 05/2017		402	Sep 05/2017	
881	Jan 05/2017		898.19	Sep 05/2017		403	Jan 05/2018	
882	Sep 05/2017		898.20	Sep 05/2017		404	BLANK	
883	Sep 05/2017		898.21	Sep 05/2017		20-10-10		
884	Sep 05/2017		898.22	Sep 05/2017		801	Jul 25/2018	
885	Jan 05/2017		898.23	Sep 05/2017		802	Sep 05/2017	
886	Sep 05/2017		898.24	Sep 05/2017		803	Sep 05/2017	
887	Sep 05/2017		898.25	Sep 05/2017		804	Sep 05/2017	
888	Sep 05/2017		898.26	BLANK		805	Jan 05/2015	
889	Sep 05/2017		20-10-10			806	Jan 05/2015	
890	Sep 05/2017		201	Jan 05/2015		807	Jan 05/2015	
891	Sep 05/2017		202	Jan 05/2015		808	Jan 05/2015	
892	Sep 05/2017		203	Jan 05/2015		20-10-11		
893	Sep 05/2017		204	Jan 05/2015		401	Jan 05/2015	
894	Sep 05/2017		205	Jan 05/2015		402	Jan 05/2015	
895	Sep 05/2017		206	Jan 05/2015		20-10-12		
896	Sep 05/2017		207	May 05/2015		401	May 05/2018	
897	Sep 05/2017		208	Jan 05/2015		402	Jan 05/2018	
898	Sep 05/2017		209	May 05/2016		403	May 05/2018	
898.1	Sep 05/2017		210	Jan 05/2015		404	Jan 05/2018	
898.2	Sep 05/2017		211	Jan 05/2018		405	Jan 05/2018	
898.3	Sep 05/2017		212	Jan 05/2018		406	Jan 05/2018	
898.4	Sep 05/2017		213	Sep 05/2015		407	Jan 05/2018	
898.5	Sep 05/2017		214	Jan 05/2018		408	Jan 05/2018	
898.6	Sep 05/2017		215	Jan 05/2015		409	Jan 05/2018	

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410	Jan 05/2018		702	Sep 05/2017		301	Sep 05/2015	
20-10-12			703	Sep 05/2017		302	Sep 05/2015	
801	Sep 05/2017		704	Sep 05/2017		20-10-29		
802	BLANK		705	Jan 05/2018		401	Jan 05/2017	
20-10-13			706	BLANK		402	Sep 05/2017	
401	May 05/2018		20-10-23			403	Sep 05/2017	
402	Sep 05/2017		401	Jan 05/2015		404	Jan 05/2018	
403	Sep 05/2017		402	Jan 05/2018		20-10-31		
404	BLANK		403	Jan 05/2018		201	May 05/2017	
20-10-14			404	Jan 05/2018		202	Sep 05/2017	
401	May 05/2018		405	Sep 05/2016		203	Jan 05/2018	
402	Sep 05/2017		406	May 05/2017		204	BLANK	
403	Sep 05/2017		407	Sep 05/2017		20-10-32		
404	Sep 05/2017		408	Sep 05/2017		201	Sep 05/2017	
405	Sep 05/2017		409	Sep 05/2017		202	Sep 05/2017	
406	BLANK		410	BLANK		203	Sep 05/2017	
20-10-15			20-10-24			204	Sep 05/2017	
401	Sep 05/2017		201	Sep 05/2017		205	Sep 05/2017	
402	Sep 05/2017		202	Sep 05/2017		206	BLANK	
403	Sep 05/2017		20-10-25			20-10-33		
404	Sep 05/2017		201	Jan 05/2015		201	Sep 05/2017	
20-10-16			202	BLANK		202	Sep 05/2017	
401	Sep 05/2017		20-10-26			20-10-33		
402	Sep 05/2017		201	Jan 05/2018		701	Sep 05/2015	
403	Jan 05/2018		202	Sep 05/2017		702	Sep 05/2017	
404	BLANK		20-10-27			703	Sep 05/2017	
20-10-17			201	May 05/2016		704	BLANK	
401	Jan 05/2015		202	Sep 05/2015		20-10-34		
402	Jan 05/2018		203	Jan 05/2018		401	Sep 05/2017	
20-10-19			204	Jan 05/2018		402	Sep 05/2017	
401	May 05/2015		205	Jan 05/2018		403	Sep 05/2017	
402	Sep 05/2017		206	May 05/2015		404	Sep 05/2017	
403	Jan 05/2018		207	Jan 05/2018		20-10-35		
404	BLANK		208	May 05/2015		201	May 05/2018	
20-10-22			209	Jan 05/2018		202	Jul 25/2018	
701	Sep 05/2017		210	BLANK		203	Jul 25/2018	

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204	Jul 25/2018		201	Jan 05/2017		201	May 05/2017	
205	Jul 25/2018		202	Jan 05/2018		202	May 05/2017	
206	Jul 25/2018		203	Jan 05/2017		203	Jul 25/2018	
207	May 05/2018		204	Jan 05/2017		204	Jul 25/2018	
208	May 05/2018		205	Jan 05/2017		205	Jan 05/2018	
209	May 05/2018		206	Jan 05/2017		206	Jan 05/2018	
210	May 05/2018		207	Jan 05/2017		207	Jan 05/2018	
211	May 05/2018		208	Jan 05/2017		208	Jan 05/2018	
212	May 05/2018		209	Jan 05/2017		209	May 05/2018	
213	May 05/2018		210	Jan 05/2017		210	BLANK	
214	May 05/2018		211	Jan 05/2017		20-20-02		
215	May 05/2018		212	Jan 05/2017		601	Jan 05/2018	
216	BLANK		213	Jan 05/2017		602	Jan 05/2018	
20-10-36			214	Jan 05/2017		603	Jul 25/2018	
201	Jan 05/2018		215	Jan 05/2017		604	May 05/2017	
202	Sep 05/2017		216	Jan 05/2017		605	Jan 05/2018	
20-10-37			217	Jan 05/2017		606	May 05/2017	
601	Jan 05/2018		218	Jan 05/2017		607	May 05/2015	
602	Jan 05/2018		219	Jan 05/2017		608	BLANK	
603	Jan 05/2018		220	Jan 05/2017		20-20-04		
604	Jan 05/2018		221	Jan 05/2017		201	Jan 05/2015	
605	Jan 05/2018		222	Jan 05/2017		202	Jan 05/2015	
606	Jan 05/2018		223	Jan 05/2017		203	Jan 05/2015	
607	May 05/2017		224	Jan 05/2017		204	BLANK	
608	BLANK		225	May 05/2017		20-20-04		
20-10-78			226	May 05/2017		601	May 05/2015	
201	Jul 25/2018		227	May 05/2017		602	Jan 05/2015	
202	Jul 25/2018		228	May 05/2017		603	Jan 05/2015	
203	Jul 25/2018		20-11-10			604	Jan 05/2015	
204	Jul 25/2018		201	Jan 05/2015		605	Jan 05/2015	
205	Jul 25/2018		202	Jan 05/2015		606	BLANK	
206	Jul 25/2018		203	May 05/2017		20-30-00		
207	Jul 25/2018		204	BLANK		201	May 05/2016	
208	BLANK		20-15-01			202	Jan 05/2015	
			201	May 05/2015				
			202	Jan 05/2015				

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201	Sep 05/2017		201	Jan 05/2017		201	Jan 05/2017	
202	Sep 05/2017		202	BLANK		202	BLANK	
20-30-02			20-30-86			20-30-98		
201	Jan 05/2015		201	Jan 05/2017		201	Jan 05/2017	
202	BLANK		202	Jan 05/2017		202	Jan 05/2017	
20-30-03			20-30-87			203	Jan 05/2017	
201	Jan 05/2015		201	Jan 05/2017		204	BLANK	
202	BLANK		202	Jan 05/2017		20-30-99		
20-30-04			20-30-88			201	Jan 05/2017	
201	Jan 05/2015		201	Jan 05/2017		202	BLANK	
202	BLANK		202	BLANK		20-41-00		
20-30-05			20-30-89			201	May 05/2018	
201	Jan 05/2015		201	Jan 05/2017		202	May 05/2018	
202	BLANK		202	BLANK		203	May 05/2018	
20-30-06			20-30-90			204	May 05/2018	
201	Jan 05/2015		201	Jan 05/2017		205	May 05/2018	
202	BLANK		202	BLANK		206	May 05/2018	
20-30-07			20-30-91			207	May 05/2018	
201	Jan 05/2015		201	Jan 05/2017		208	May 05/2018	
202	BLANK		202	BLANK		20-41-01		
20-30-80			20-30-92			201	May 05/2015	
201	Jan 05/2017		201	Jan 05/2017		202	Sep 05/2017	
202	Jan 05/2017		202	BLANK		203	Sep 05/2017	
20-30-81			20-30-93			204	May 05/2017	
201	Jan 05/2017		201	Jan 05/2017		205	May 05/2017	
202	BLANK		202	BLANK		206	May 05/2017	
20-30-82			20-30-94			207	Sep 05/2017	
201	Jan 05/2017		201	Jan 05/2017		208	May 05/2017	
202	Jan 05/2017		202	BLANK		209	May 05/2017	
20-30-83			20-30-95			210	Sep 05/2017	
201	Jan 05/2017		201	Jan 05/2017		211	Sep 05/2017	
202	Jan 05/2017		202	BLANK		212	Sep 05/2017	
20-30-84			20-30-96			213	Sep 05/2017	
201	Jan 05/2017		201	Jan 05/2017		214	Sep 05/2017	
202	Jan 05/2017		202	BLANK		215	Sep 05/2017	
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218	BLANK		202	BLANK				
20-41-01								
601	May 05/2015							
602	May 05/2017							
20-60-01								
201	Jan 05/2015							
202	Jan 05/2015							
203	Sep 05/2017							
204	BLANK							
20-60-02								
201	Sep 05/2017							
202	Sep 05/2017							
20-60-03								
201	Sep 05/2017							
202	Sep 05/2017							
203	Sep 05/2017							
204	BLANK							
20-60-04								
201	Sep 05/2017							
202	Sep 05/2017							
203	Sep 05/2017							
204	BLANK							
20-60-05								
201	Jan 05/2015							
202	Jan 05/2015							
20-60-06								
201	Sep 05/2016							
202	BLANK							
20-60-07								
201	Jan 05/2015							
202	Sep 05/2017							
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204	BLANK							

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Printed Circuit Card Removal TASK 20-10-01-000-802			418	ARO ALL
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Control Cable Grommet Installation TASK 20-10-06-400-801			401	ARO ALL
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TASK 20-00-00-910-801

1. Airworthiness Limitation Precautions

A. General

- (1) Critical Design Configuration Control Limitations (CDCCLs)
 - (a) All occurrences of CDCCLs found in this chapter of the AMM are identified by this note after each applicable CDCCL design feature:
 - 1) NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801, for important information on Critical Design Configuration Control Limitations (CDCCLs).
 - (b) Design features that are CDCCLs are identified as Special Federal Aviation Regulation (SFAR) 88, and can be found in Section 9 of the Maintenance Planning Data (MPD) document. CDCCLs are a means of identifying certain design configuration features intended to preclude a fuel tank ignition source for the operational life of the airplane. These design features are mandatory and cannot be changed or deleted without the approval of the FAA Oversight Office that is responsible for the airplane model Type Certificate. A critical fuel tank ignition source prevention feature may exist in the fuel system and its related installation or in systems that, if a failure condition were to develop, could interact with a fuel system in such a way that an unsafe condition would develop without this limitation. Strict adherence to configuration, methods, techniques, and practices as prescribed is required to ensure the CDCCL is complied with. Any use of parts, methods, techniques, or practices not contained in the applicable CDCCL must be approved by the FAA Oversight Office that is responsible for the airplane model Type Certificate.
- (2) Airworthiness Limitation Instructions (ALIs)
 - (a) All occurrences of fuel tank system ALIs found in this chapter of the AMM are identified by this note after each applicable ALI inspection feature:
 - 1) NOTE: ALI - Refer to the task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801, for important information on airworthiness limitation instructions (ALIs).
 - (b) Inspection features that are ALIs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88, and can be found in Section 9 of the Maintenance Planning Data (MPD) document. These ALIs identify inspection features related to fuel tank ignition source prevention which must be done to maintain the design level of safety for the operational life of the airplane. These inspection features are mandatory and cannot be changed or deleted without the approval of the FAA Oversight Office that is responsible for the airplane model Type Certificate. Strict adherence to methods, techniques and practices as prescribed is required to ensure the ALI is complied with. Any use of methods, techniques, or practices not contained in these ALIs must be approved by the FAA Oversight Office that is responsible for the airplane model Type Certificate.

B. Location Zones

Zone	Area
100	Lower Half of Fuselage
200	Upper Half of Fuselage
300	Empennage and Body Section 48
400	Powerplants and Nacelle Struts

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(Continued)

Zone	Area

500	Left Wing

600	Right Wing

C. Critical Design Configuration Control Limitations (CDCCLs)

SUBTASK 20-00-00-910-001



OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO MAINTENANCE THAT HAS AN EFFECT ON A CDCCL. IF YOU DO NOT OBEY THE PROCEDURES, IT CAN INCREASE THE RISK OF A SOURCE OF FUEL TANK IGNITION, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR IF THERE IS A FIRE OR EXPLOSION.

- (1) Make sure you follow the procedures for items identified as CDCCLs.

D. Airworthiness Limitation Instructions (ALIs)

SUBTASK 20-00-00-910-002



OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO ANY MAINTENANCE THAT MAY AFFECT AN ALI. IF YOU DO NOT FOLLOW THE PROCEDURES, IT CAN INCREASE THE RISK OF A FUEL TANK IGNITION SOURCE.

- (1) Make sure you follow the procedures for items identified as ALIs.

————— END OF TASK —————

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E/E RACK-MOUNTED COMPONENTS AND PRINTED CIRCUIT CARD - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) The removal of the electrical/electronics (E/E) box from the rack
- (2) The installation of the E/E box

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- (3) Adjust lever latch forks

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- (4) The removal of a printed circuit card
- (5) The installation of a printed circuit card.

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B. Lever latches are used for movement and retention of black boxes mounted on racks. Adjustment of the lever latch fork is necessary to assure proper connector engagement: If a box has two lever latches, both should be adjusted together.

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TASK 20-10-01-000-801

2. E/E Box Removal

(Figure 401)

A. References

Reference	Title
20-41-01-000-802	Conductive Dust Cap and Connector Cover Installation (P/B 201)
20-41-01-000-803	ESDS Handling for Metal Encased Unit Removal (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-9708	Cap - Conductive, Connector (DPXB Connectors) Part #: NEC-0767-001 Supplier: 0RN51
COM-13624	Caps - Connector, conductive (variable sizes 025-xxxx-xxx) Part #: 025-0762-000 Supplier: 71468 Part #: 025-0767-001 Supplier: 71468 Part #: 025-1155-001 Supplier: 71468 Part #: 025-1156-001 Supplier: 71468 Part #: 025-1157-001 Supplier: 71468 Part #: 025-1158-001 Supplier: 71468

C. Location Zones

Zone	Area
117	Main Equipment Center, Left
118	Main Equipment Center, Right
122	Forward Cargo Compartment, Right

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Zone	Area
152	Aft Cargo Compartment, Right
162	Bulk Cargo Compartment, Right
166	Area Aft of Bulk Cargo Compartment, Right
243	Area Above Passenger Compartment Ceiling, Left - Section 44
253	Area Above Passenger Compartment Ceiling, Left - Section 46
264	Area Above Passenger Compartment Ceiling, Right - Section 47
322	Vertical Stabilizer - Auxiliary Spar to Front Spar

ARO ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR

D. E/E Box Removal Procedure

SUBTASK 20-10-01-860-001

- (1) Open the applicable circuit breakers to remove electrical power.

SUBTASK 20-10-01-910-003



DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you, do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-41-01-000-803.

SUBTASK 20-10-01-020-005



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box if it is necessary.

SUBTASK 20-10-01-020-006

- (4) Turn the knob on the front hold-down extractor counterclockwise to disengage the clutch.

SUBTASK 20-10-01-020-007

- (5) Do these steps to disconnect the front hold-down extractor:
 - (a) Apply light pressure down on the E/E box handle while you disconnect the front hold-down extractor.
 - (b) Turn the keeper to align the deep slot with the T-hook.
 - (c) Lower the front hold-down extractor to be clear of the T-hook.

SUBTASK 20-10-01-020-001



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (6) Carefully move the E/E box out from the tray and remove the E/E box.
 - (a) Shake the front of the E/E box from side to side approximately 1/8 in. (3 mm) to help disconnect the E/E box from the electrical connector.

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ARO ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR (Continued)

SUBTASK 20-10-01-420-009

- (7) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

SUBTASK 20-10-01-420-010

- (8) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-41-01-000-802.

ARO ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR

E. E/E Box Removal Procedure

SUBTASK 20-10-01-860-002

- (1) Open the applicable circuit breakers to remove electrical power.

SUBTASK 20-10-01-910-004



DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you, do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-41-01-000-803.

SUBTASK 20-10-01-020-008



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-020-009

- (4) Turn the knob on the front hold-down extractor counterclockwise until you can see the red band.

SUBTASK 20-10-01-020-010

- (5) Do these steps to disconnect the front hold-down extractor:
 - (a) Apply light pressure down on the E/E box handle while you disconnect the front hold-down extractor.
 - (b) Turn the latch counterclockwise to disengage the front hold-down extractor from the T-hook.
 - (c) Lower the front hold-down extractor to be clear of the T-hook.

SUBTASK 20-10-01-020-002



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (6) Carefully move the E/E box out from the tray and remove the E/E box.
 - (a) Shake the front of the E/E box from side to side approximately $\frac{1}{8}$ in. (3 mm) to help disconnect the E/E box from the electrical connector.

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ARO ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR (Continued)

SUBTASK 20-10-01-420-011

- (7) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

SUBTASK 20-10-01-420-012

- (8) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-41-01-000-802.

ARO ALL; AIRPLANES WITH HARTWELL EXTRACTOR

F. E/E Box Removal Procedure

SUBTASK 20-10-01-860-005

- (1) Open the applicable circuit breakers to remove electrical power.

SUBTASK 20-10-01-910-005



DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you, do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-41-01-000-803.

SUBTASK 20-10-01-020-011



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-020-012

- (4) Turn the knob on the front hold-down extractor counterclockwise to disengage the clutch.

SUBTASK 20-10-01-020-013

- (5) Do these steps to disconnect the front hold-down extractor:
 - (a) Apply light pressure down on the E/E box handle while you disconnect the front hold-down extractor.
 - (b) Compress the keeper to disengage the extractor from the T-hook.
 - (c) Lower the front hold-down extractor to be clear of the T-hook.

SUBTASK 20-10-01-020-014



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (6) Carefully move the E/E box out from the tray and remove the E/E box.
 - (a) Shake the front of the E/E box from side to side approximately $\frac{1}{8}$ in. (3 mm) to help disconnect the E/E box from the electrical connector.

SUBTASK 20-10-01-420-013

- (7) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

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ARO ALL; AIRPLANES WITH HARTWELL EXTRACTOR (Continued)

SUBTASK 20-10-01-420-014

- (8) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-41-01-000-802.

ARO ALL; AIRPLANES WITH LEVER LATCH HANDLES

G. E/E Box Removal Procedure

SUBTASK 20-10-01-860-013

- (1) Open the applicable circuit breakers to remove electrical power.

SUBTASK 20-10-01-910-009



DO NOT TOUCH THE CONTROL UNIT BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE CONTROL UNIT.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you, do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-41-01-000-803.

SUBTASK 20-10-01-020-019



DO NOT TOUCH THE LRU CONNECTOR PINS. THE LRU IS SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE LRU.

- (3) Remove the connections from the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-020-020

- (4) Do these steps:
- (a) Depress the lever latch allowing the lever to move away from the handle.
 - (b) Move the lever in an opening direction forcing the unit away from the shelf-mounted connector.



DO NOT TOUCH THE LRU CONNECTOR PINS. THE LRU IS SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE LRU.

- (c) Carefully move the E/E box out from the tray and remove the E/E box.
 - 1) Shake the front of the E/E box from side to side approximately 1/8 in. (3 mm) to help disconnect the E/E box from the electrical connector.
- (d) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).
- (e) Install the conductive connector cap, COM-13624, or connector conductive cap, COM-9708, on the E/E box electrical connector and the tray electrical connector (TASK 20-41-01-000-802).

ARO ALL

————— END OF TASK —————

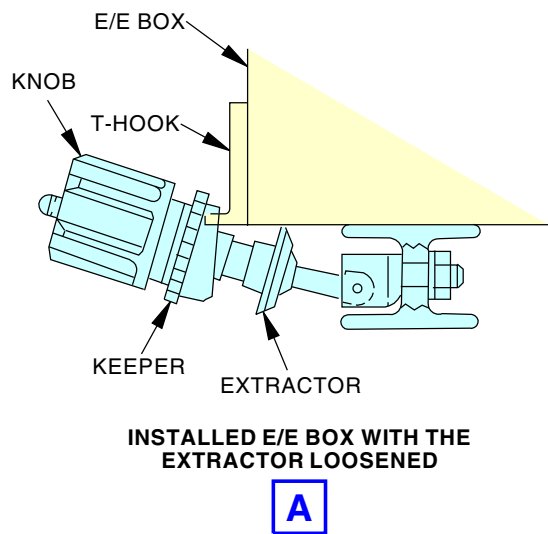
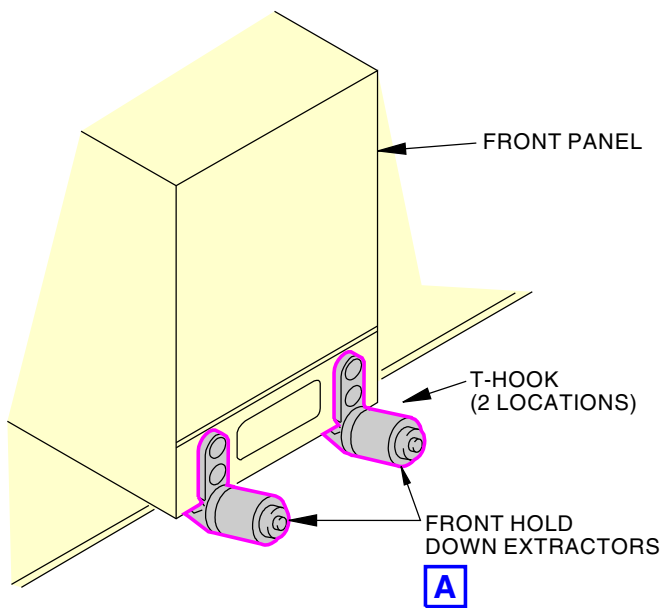
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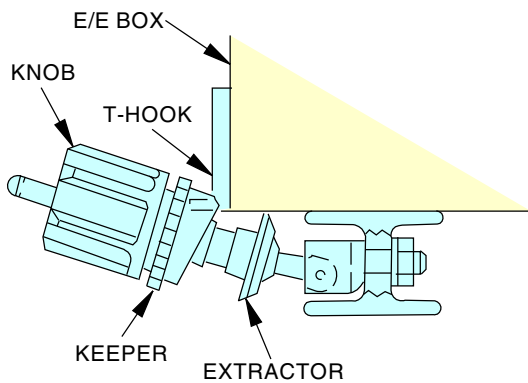
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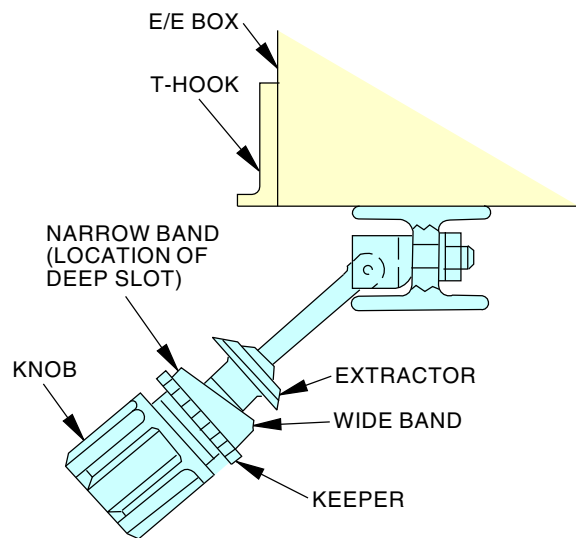


INSTALLED E/E BOX



**INSTALLED E/E BOX WITH THE
EXTRACTOR TIGHTENED**

A



EXTRACTOR FREE POSITION

A

REXNORD AEROSPACE MECHANISMS EXTRACTOR

C26885 S0006402307_V2

**E/E Box Installation
Figure 401/20-10-01-990-801 (Sheet 1 of 5)**

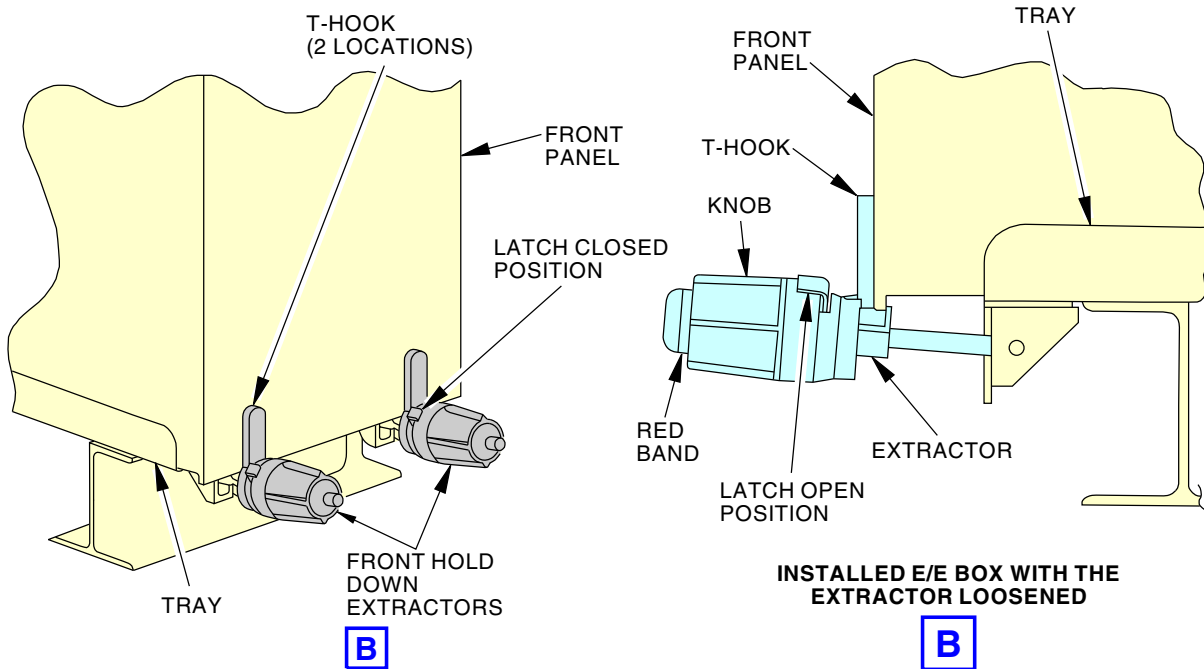
EFFECTIVITY
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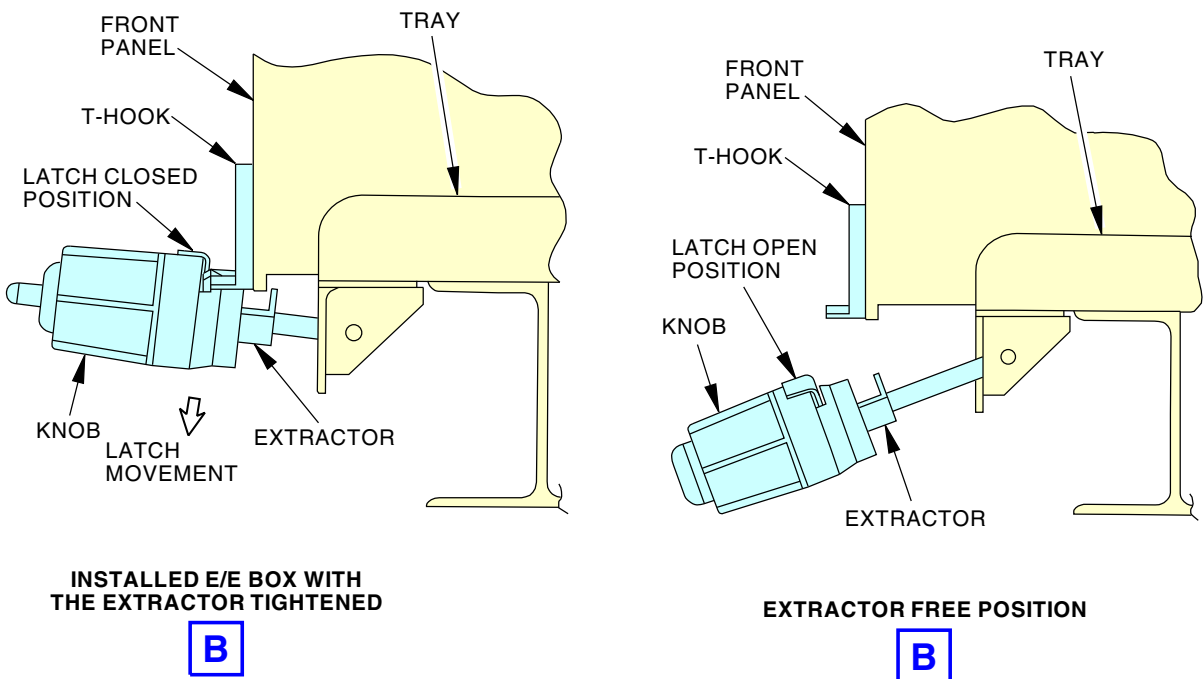
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INSTALLED E/E BOX



INSTALLED E/E BOX WITH THE EXTRACTOR TIGHTENED

HOLLINGSEAD EXTRACTOR

C26925 S0006402308_V2

**E/E Box Installation
Figure 401/20-10-01-990-801 (Sheet 2 of 5)**

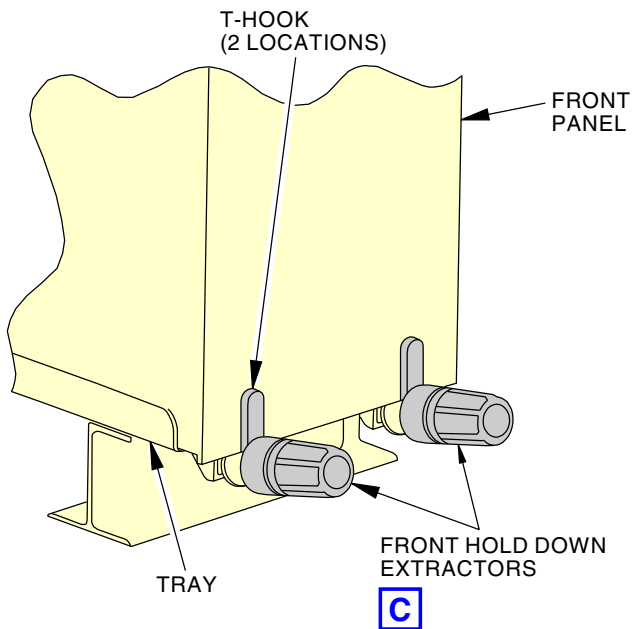
**EFFECTIVITY
ARO ALL; AIRPLANES WITH HOLLINGSEAD
EXTRACTOR**

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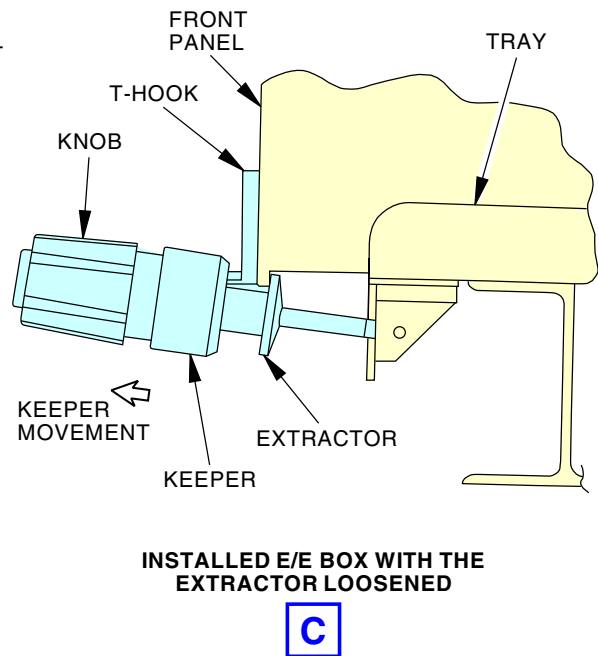
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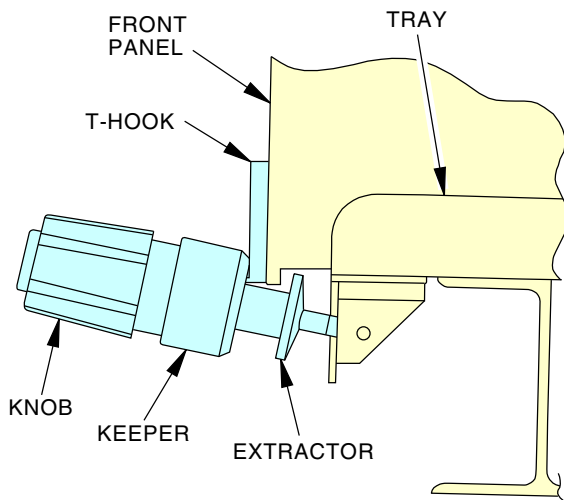
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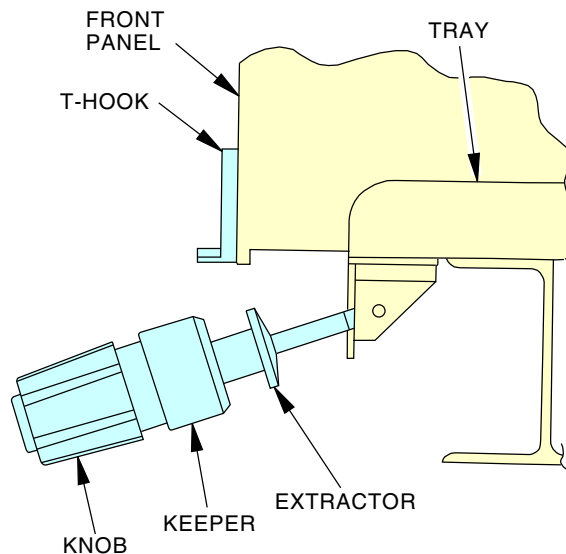
INSTALLED E/E BOX



**INSTALLED E/E BOX WITH THE
EXTRACTOR LOOSENED**



**INSTALLED E/E BOX WITH THE
EXTRACTOR TIGHTENED**



EXTRACTOR FREE POSITION

HARTWELL EXTRACTOR

E81112 S0006402309_V2

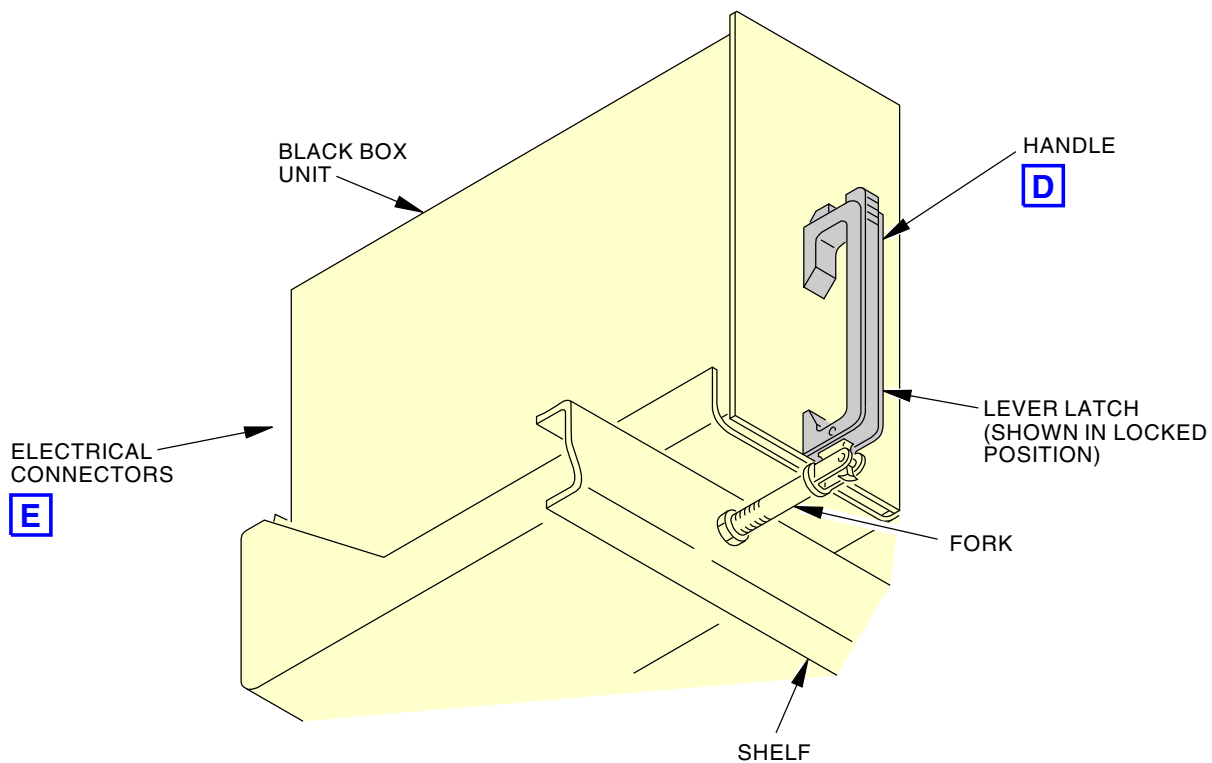
**E/E Box Installation
Figure 401/20-10-01-990-801 (Sheet 3 of 5)**

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**LEVER LATCH TYPE RETENTION
(EXAMPLE)**

2195034 S0000488095_V2

**E/E Box Installation
Figure 401/20-10-01-990-801 (Sheet 4 of 5)**

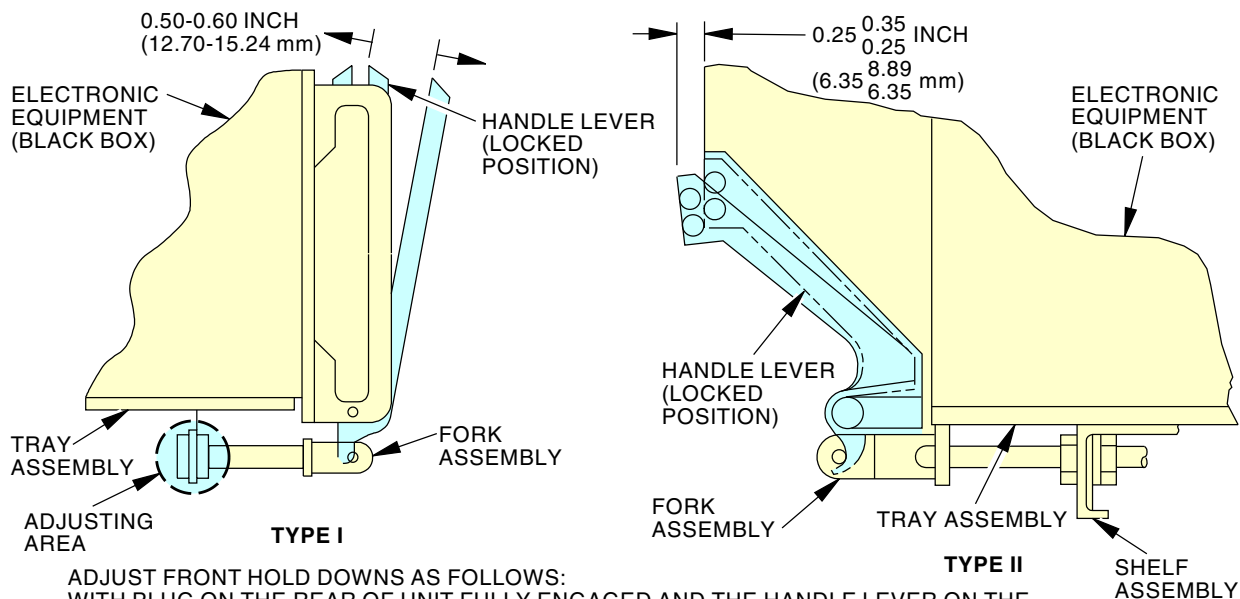
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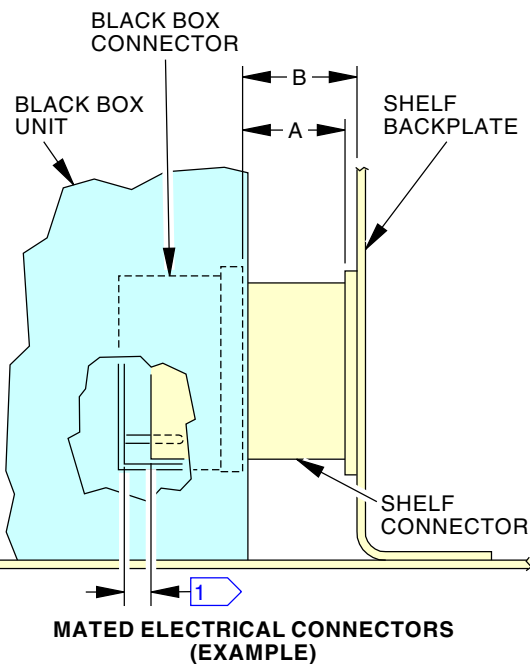


ADJUST FRONT HOLD DOWNS AS FOLLOWS:
WITH PLUG ON THE REAR OF UNIT FULLY ENGAGED AND THE HANDLE LEVER ON THE
THE FRONT OF THE UNIT AT THE DIMENSION SHOWN, ADJUST FORKS BY ROTATING
TO A POSITION WHERE THEY START TO EXERT PRESSURE ON THE LOCKING LEVER.

HANDLE

D

	A		B	
CONNECTOR TYPE	INCH MAX	mm MAX	INCH MAX	mm MAX
AD2	0.157 MAX 0.138 MAX UNKNOWN 0.138 MAX 0.138 MAX	3.989 MAX 3.505 MAX UNKNOWN 3.505 MAX 3.505 MAX	0.297 MAX	7.544 MAX
AMP			0.297 MAX	7.544 MAX
DPA			UNKNOWN	UNKNOWN
DPD				
DPE				
DPDMA				
DPD2				
DPXA			0.297 MAX 0.297 MAX 0.297 MAX 0.581 MAX	7.544 MAX 7.544 MAX 7.544 MAX 14.757 MAX
DPXB				
DPX2				
SR-RAI				



NOTE:

DIMENSIONS CAN BE MEASURED WITH PUTTY
OR A PAPER SLEEVE OR RING OF A SUITABLE LENGTH
THAT WILL BE CRUSHED WHEN THE CONNECTOR IS
MATED PROPERLY.

1 0.09 INCH (2.29 mm) MAXIMUM FOR ANY
CONNECTOR FULLY MATED (ALTERNATE METHOD)

E

2195051 S0000488100_V2

E/E Box Installation
Figure 401/20-10-01-990-801 (Sheet 5 of 5)

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TASK 20-10-01-400-801

3. E/E Box Installation

(Figure 401)

A. References

Reference	Title
20-41-01-400-802	Conductive Dust Cap and Connector Cover Removal (P/B 201)
20-41-01-400-803	ESDS Handling for Metal Encased Unit Installation (P/B 201)
SWPM 20-30-00	ELECTRICAL CONNECTION OF EQUIPMENT AND INSTALLATION OF TERMINAL LUGS

B. Location Zones

Zone	Area
117	Main Equipment Center, Left
118	Main Equipment Center, Right
122	Forward Cargo Compartment, Right
152	Aft Cargo Compartment, Right
162	Bulk Cargo Compartment, Right
166	Area Aft of Bulk Cargo Compartment, Right
243	Area Above Passenger Compartment Ceiling, Left - Section 44
253	Area Above Passenger Compartment Ceiling, Left - Section 46
264	Area Above Passenger Compartment Ceiling, Right - Section 47
322	Vertical Stabilizer - Auxiliary Spar to Front Spar

ARO ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR

C. E/E Box Installation Procedure

SUBTASK 20-10-01-860-006

- (1) Make sure the applicable circuit breakers for the E/E box are open.

SUBTASK 20-10-01-210-001

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-01-910-006

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:



CAUTION

DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-41-01-400-803.
- (b) Do this task: Conductive Dust Cap and Connector Cover Removal, TASK 20-41-01-400-802.

SUBTASK 20-10-01-020-015

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

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ARO ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR (Continued)

SUBTASK 20-10-01-210-002



MAKE SURE THAT THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR HAVE NO BEND OR DAMAGE. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

- (5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.

(a) Replace components if they are damaged (SWPM 20-30-00).

SUBTASK 20-10-01-420-001

- (6) Carefully start to install the E/E box into the tray.

(a) For easier installation of the E/E box, lift the front of the E/E box approximately $\frac{1}{8}$ in. (3 mm) above the tray surface.

SUBTASK 20-10-01-420-002

- (7) Continue to move the E/E box into the tray and engage the electrical connector.

(a) The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately $\frac{1}{8}$ in. (3 mm).

(b) While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-01-820-001

- (8) Turn the keeper to put the deep slot near to and aligned with the T-hook.

SUBTASK 20-10-01-430-001

- (9) Put the extractor on the T-hook and turn the keeper 180 degrees.

SUBTASK 20-10-01-430-002

- (10) To tighten the front hold-down extractor, turn the knob clockwise until the clutch engages fully.

NOTE: You will feel clicks while you turn the knob.

SUBTASK 20-10-01-210-003

- (11) Shake the E/E box to make sure of a tight fit.

SUBTASK 20-10-01-420-003

- (12) Tighten the extractor.

SUBTASK 20-10-01-210-004

- (13) Make sure the electrical connector is engaged.

SUBTASK 20-10-01-430-003

- (14) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-860-007

- (15) Close the applicable circuit breakers for the E/E box.

ARO ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR

D. E/E Box Installation Procedure

SUBTASK 20-10-01-860-008

- (1) Make sure the applicable circuit breakers for the E/E box are open.

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ARO ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR (Continued)

SUBTASK 20-10-01-210-009

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-01-910-007

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:



CAUTION

DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-41-01-400-803.
 - (b) Do this task: Conductive Dust Cap and Connector Cover Removal, TASK 20-41-01-400-802.

SUBTASK 20-10-01-020-016

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

SUBTASK 20-10-01-210-008



CAUTION

MAKE SURE THAT THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR HAVE NO BEND OR DAMAGE. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

- (5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.
 - (a) Replace components if they are damaged (SWPM 20-30-00).

SUBTASK 20-10-01-420-004

- (6) Carefully start to install the box into the tray.
 - (a) For easier installation of the E/E box, lift the front of the E/E box approximately about $\frac{1}{8}$ in. (3 mm) above the tray surface.

SUBTASK 20-10-01-420-005

- (7) Continue to move the box into the tray and engage the electrical connector.
 - (a) The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately $\frac{1}{8}$ in. (3 mm).
 - (b) While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-01-820-002

- (8) Align the front hold-down extractor with the T-hook.

SUBTASK 20-10-01-430-004

- (9) Put the extractor on the T-hook and turn the latch clockwise.

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ARO ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR (Continued)

SUBTASK 20-10-01-430-005

- (10) Turn the knob on the front hold-down extractor clockwise until you cannot see the red band and the clutch engages.

SUBTASK 20-10-01-210-005

- (11) Shake the E/E box to make sure of a tight fit.

SUBTASK 20-10-01-420-006

- (12) Tighten the extractor.

SUBTASK 20-10-01-210-006

- (13) Make sure the electrical connector is engaged.

SUBTASK 20-10-01-430-006

- (14) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-860-009

- (15) Close the applicable circuit breakers for the E/E box.

ARO ALL; AIRPLANES WITH HARTWELL EXTRACTOR

E. E/E Box Installation

SUBTASK 20-10-01-860-010

- (1) Make sure the applicable circuit breakers for the E/E box are open.

SUBTASK 20-10-01-210-010

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-01-910-008

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:



CAUTION

DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-41-01-400-803.
- (b) Do this task: Conductive Dust Cap and Connector Cover Removal, TASK 20-41-01-400-802.

SUBTASK 20-10-01-020-017

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

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ARO ALL; AIRPLANES WITH HARTWELL EXTRACTOR (Continued)

SUBTASK 20-10-01-210-011



MAKE SURE THAT THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR HAVE NO BEND OR DAMAGE. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

- (5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.

(a) Replace components if they are damaged (SWPM 20-30-00).

SUBTASK 20-10-01-420-015

- (6) Carefully start to install the box into the tray.

(a) For easier installation of the E/E box, lift the front of the E/E box approximately about $\frac{1}{8}$ in. (3 mm) above the tray surface.

SUBTASK 20-10-01-420-016

- (7) Continue to move the box into the tray and engage the electrical connector.

(a) The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately $\frac{1}{8}$ in. (3 mm).

(b) While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-01-820-003

- (8) Compress the keeper to engage the T-hook on the E/E box.

SUBTASK 20-10-01-430-007

- (9) To tighten the front hold-down extractors, turn the knob clockwise until the clutch engages fully.

NOTE: You will feel clicks while you turn the knob.

SUBTASK 20-10-01-210-012

- (10) Shake the E/E box to make sure of a tight fit.

SUBTASK 20-10-01-420-017

- (11) Tighten the extractor.

(a) Make sure the keeper is fully seated to the T-hook for Installed E/E Box With the Extractor Tightened (View C, Figure 401).

SUBTASK 20-10-01-210-013

- (12) Make sure the electrical connector is engaged.

SUBTASK 20-10-01-430-008

- (13) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-860-011

- (14) Close the applicable circuit breakers for the E/E box.

ARO ALL; AIRPLANES WITH LEVER LATCH HANDLES

F. E/E Box Installation

SUBTASK 20-10-01-860-014

- (1) Make sure the applicable circuit breakers for the E/E box are open.

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SUBTASK 20-10-01-210-016

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-01-910-010

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:



CAUTION

DO NOT TOUCH THE CONTROL UNIT BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE CONTROL UNIT.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-41-01-400-803.
- (b) Do this task: Conductive Dust Cap and Connector Cover Removal, TASK 20-41-01-400-802.

SUBTASK 20-10-01-020-022

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

SUBTASK 20-10-01-210-017



CAUTION

DO NOT TOUCH THE LRU CONNECTOR PINS. THE LRU IS SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE LRU.

- (5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.
 - (a) Replace components if they are damaged (SWPM 20-30-00).

SUBTASK 20-10-01-420-021

- (6) Slide the unit into the shelf with the lever in the open position until the lever engages the shelf-mounted fork.
 - (a) Remove any protective caps or bags from the unit or shelf prior to installation.

SUBTASK 20-10-01-420-022

- (7) Continue to move the box into the tray and engage the electrical connector.
 - (a) The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately $\frac{1}{8}$ in. (3 mm).
 - (b) While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-01-420-023

- (8) Move the lever latch to its locked position and verify proper adjustment.
 - (a) Adjust the lever latch fork (TASK 20-10-01-800-801).

SUBTASK 20-10-01-210-018

- (9) Shake the E/E box to make sure of a tight fit.

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ARO ALL; AIRPLANES WITH LEVER LATCH HANDLES (Continued)

SUBTASK 20-10-01-210-019

- (10) Make sure the electrical connector is engaged.

SUBTASK 20-10-01-420-024

- (11) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-01-860-015

- (12) Close the applicable circuit breakers for the E/E box.

————— END OF TASK —————

TASK 20-10-01-800-801

4. Lever Latch Fork Adjustment

(Figure 401)

A. Prepare For Adjustment

SUBTASK 20-10-01-860-016

- (1) Open circuit breaker of unit to be adjusted.

SUBTASK 20-10-01-020-023

- (2) Press trigger and pull lever latch to open position.

SUBTASK 20-10-01-020-024

- (3) Remove unit by handle (TASK 20-10-01-000-801).

SUBTASK 20-10-01-020-025

- (4) If installed, loosen jamnut on fork assembly.

SUBTASK 20-10-01-210-020

- (5) Examine all parts of latching mechanism for serviceability.

B. Adjust Lever Latch Fork

SUBTASK 20-10-01-420-025

- (1) Slide unit back on shelf until connectors are partially engaged (TASK 20-10-01-400-801).

SUBTASK 20-10-01-420-026

- (2) Engage lever latch hook with fork assembly pin.

SUBTASK 20-10-01-420-027

- (3) Start closing lever latch handle.

NOTE: It is possible to determine full connector engagement by feel. A sudden increase in handle pressure, resistance to handle movement, indicates that the connectors are fully engaged.

SUBTASK 20-10-01-820-004

- (4) Adjust fork assembly until resistance to handle movement occurs within required gap tolerance.
 - (a) Loosen the nut at the shelf area for fork adjustment.



MAKE SURE THERE IS SUFFICIENT THREAD ENGAGEMENT IN THE LATCH FORK. WITHOUT SUFFICIENT THREAD ENGAGEMENT THE LATCH LEVER COULD FAIL, ALLOWING THE BLACK BOX TO SLIDE OUT OF POSITION.

- (b) Make sure there is sufficient thread engagement in the latch fork.

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ARO ALL; AIRPLANES WITH LEVER LATCH HANDLES (Continued)

SUBTASK 20-10-01-820-005

- (5) Close handle until latched.

SUBTASK 20-10-01-420-028

- (6) Tighten jamnut to snug fit.

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————— END OF TASK —————

TASK 20-10-01-000-802

5. Printed Circuit Card Removal

(Figure 402)

A. References

Reference	Title
20-41-01-000-801	ESDS Handling for Printed Circuit Board Removal (P/B 201)

B. Procedure

SUBTASK 20-10-01-860-003

- (1) Make sure you remove electrical power from the printed circuit card.
 - (a) Open the applicable circuit breakers to remove electrical power.

SUBTASK 20-10-01-910-001



DO NOT TOUCH THE PRINTED CIRCUIT CARD BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT CARD.

- (2) Do the procedure for devices that are sensitive to electrostatic discharge (ESDS Handling for Printed Circuit Board Removal, TASK 20-41-01-000-801).

SUBTASK 20-10-01-010-001

- (3) Open the cardfile door.

SUBTASK 20-10-01-020-018

- (4) Remove the printed circuit card assembly:
 - (a) Turn the ejector levers 90 degrees.

NOTE: This will release the circuit card.
 - (b) Push both latch levers and turn both lock release levers to release the latch lock.
 - (c) Turn the ejectors on the printed circuit card assembly until the printed circuit card is released from the electrical connector.
 - (d) Carefully move the printed circuit card assembly out along the guide.
 - (e) Remove the printed circuit card assembly.

————— END OF TASK —————

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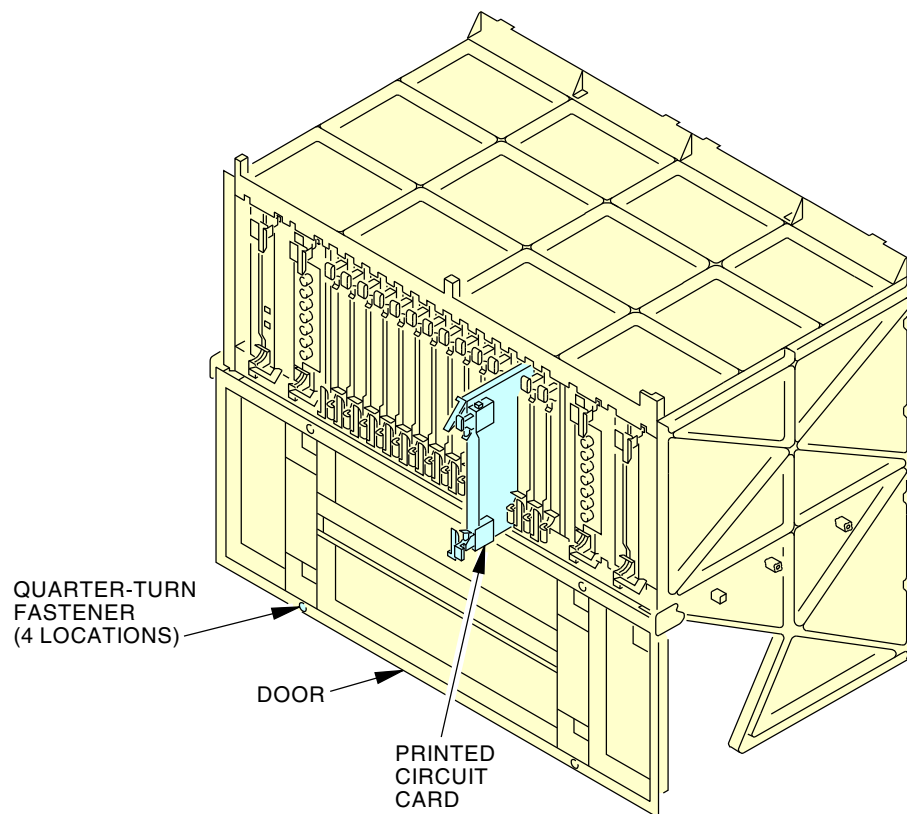
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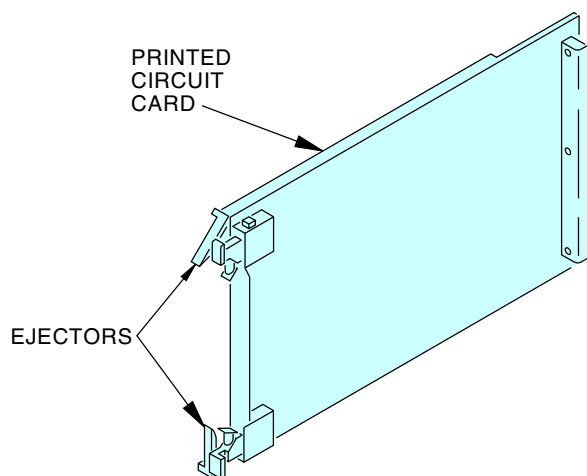
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SYSTEMS CARDFILE
(EXAMPLE)



C26936 S0006402312_V2

Printed Circuit Card Installation
Figure 402/20-10-01-990-802

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TASK 20-10-01-400-802

6. Printed Circuit Card Installation

(Figure 402)

A. References

Reference	Title
20-41-01-400-801	ESDS Handling for Printed Circuit Board Installation (P/B 201)

B. Procedure

SUBTASK 20-10-01-860-004

- (1) Make sure electrical power is removed from the printed circuit card.

SUBTASK 20-10-01-910-002



DO NOT TOUCH THE PRINTED CIRCUIT CARD BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT CARD.

- (2) Do the procedure for devices that are sensitive to electrostatic discharge (ESDS Handling for Printed Circuit Board Installation, TASK 20-41-01-400-801).

SUBTASK 20-10-01-210-014

- (3) Make sure the edge connector has no bent pins.

SUBTASK 20-10-01-420-007

- (4) Put the printed circuit card assembly into the guide.

SUBTASK 20-10-01-420-008

- (5) Carefully push the printed circuit card in until it correctly engages with the electrical connector.
- (a) Press the latches until both of the lock pins snap into position.
 - (b) If both of the lock pins do not snap into position, remove the printed circuit card and repeat the steps above as necessary until the printed circuit card is properly installed in its position.

SUBTASK 20-10-01-210-015

- (6) Make sure that the ejectors touch the card.

SUBTASK 20-10-01-420-018

- (7) Push the latch levers and turn both lock release levers.

SUBTASK 20-10-01-210-007

- (8) Manually turn the ejector levers 90 degrees.

NOTE: This is to tighten the printed circuit card assembly and lock it into place.

NOTE: The levers should be approximately vertical.

SUBTASK 20-10-01-410-001

- (9) Close the card file door.

SUBTASK 20-10-01-860-012

- (10) Close the applicable circuit breakers.

————— **END OF TASK** —————

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BEARINGS AND BUSHINGS - REMOVAL/INSTALLATION

1. General

- A. This procedure has one task for removal and installation of bearings and bushings.
- B. You should use the Standard Overhaul Practices Manual for removal and installation of bearings and bushings.

TASK 20-10-02-900-801

2. Bearing and Bushings Removal and Installation

A. General

- (1) To remove and install bearing and bushings, do the procedures in the Standard Overhaul Practices Manual.

————— **END OF TASK** —————

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CONTROL CABLES - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the control cables.
 - (2) An installation of the control cables.
- B. The installation procedure contains prefabricated and nonprefabricated cables for easier installation when portable swaging machines are available.

TASK 20-10-03-000-801

2. Control Cables Removal

(Figure 401)

A. References

Reference	Title
20-10-04-000-801	Control Cable Air Seal Removal (P/B 401)
20-10-05-000-801	Turnbuckle Locking Clips Removal (P/B 401)
20-10-07-000-801	Control Cable Pulleys Removal (P/B 401)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1569	Clamp - Control Cable Part #: A20005-9 Supplier: 81205

C. Consumable Materials

Reference	Description	Specification
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

D. Procedure

SUBTASK 20-10-03-930-001

- (1) Use Scotch Flatback Masking Tape 250, G00270 to make a mark on the cable and fittings.

NOTE: The masking tape lets you refer to the initial position when you install the new cable.

SUBTASK 20-10-03-020-001

- (2) Do this task: Turnbuckle Locking Clips Removal, TASK 20-10-05-000-801.

SUBTASK 20-10-03-020-002

- (3) Do this task: Control Cable Air Seal Removal, TASK 20-10-04-000-801.

SUBTASK 20-10-03-420-001

- (4) Install control cable clamp, SPL-1569 on the cable you do not remove to keep light tension on the cable.

NOTE: Light tension on the cable will prevent wind off on the cable drums. Light tension will also make sure the cables do not move out of the pulley guides.

SUBTASK 20-10-03-480-001

- (5) If you can isolate the cable between rigging pin locations, it is acceptable to install rigging pins through the applicable drum or quadrant.

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SUBTASK 20-10-03-010-003

(6) Do this task: Control Cable Pulleys Removal, TASK 20-10-07-000-801.

SUBTASK 20-10-03-020-003

(7) Remove the cable.

————— END OF TASK —————

TASK 20-10-03-400-801

3. Control Cables Installation

(Figure 401)

A. General

- (1) If this procedure does not agree with a specified maintenance procedure, use the specified maintenance procedure.
- (2) Detailed data is in (TASK 27-02-20-610-802-002) for flight control cables and in (TASK 32-00-20-800-801) for landing gear cables.

B. References

Reference	Title
12-21-31-600-801	Control Cable Lubrication (P/B 301)
20-10-04-400-801	Control Cable Air Seal Installation (P/B 401)
20-10-05-400-801	Turnbuckle Locking Clips Installation (P/B 401)
20-10-07-400-801	Control Cable Pulleys Installation (P/B 401)
27-02-20-610-802-002	Primary Flight Control Cables - Location and Part Data (P/B 201)
32-00-20-800-801	Landing Gear Control Cables - Location and Part Data (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1569	Clamp - Control Cable Part #: A20005-9 Supplier: 81205
SPL-1583	Kit - Swager, Portable Cable Part #: AT520JK Supplier: 00784 Part #: ATI520HK Supplier: 00784

D. Consumable Materials

Reference	Description	Specification
C00308	Compound - Corrosion Preventive, Petrolatum Hot Application	MIL-C-11796
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

E. Prefabricated Cable Installation

SUBTASK 20-10-03-420-003

- (1) Install the cable.

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- (a) Attach the new cable to the old cable.

NOTE: If you do not attach the new cable to the old cable, you will have a problem in routing the new cable.

- (b) Pull the old cable out, which pulls the new cable through at the same time.
- (c) Keep light tension on the new cable.

SUBTASK 20-10-03-410-001

- (2) Do this task: Control Cable Pulleys Installation, TASK 20-10-07-400-801.

SUBTASK 20-10-03-410-002

- (3) Do this task: Control Cable Air Seal Installation, TASK 20-10-04-400-801.

F. Nonprefabricated Cable Installation

SUBTASK 20-10-03-830-001

- (1) Identify the cable you remove.

- (a) Refer to the applicable system chapter to prepare a new cable.
- (b) Calculate cable length (Figure 401).

NOTE: The total length of the cable after assembly and the test will be longer than the lengths of the terminals and the cable before they are assembled. The terminals will be longer after they are swaged, and the cable will be longer after the proof test. Make sure you include an allowance for each of these changes before you cut the cable to the required length.

SUBTASK 20-10-03-430-001

- (2) Install only those fittings that will permit cable installation as follows:

- (a) If the wire rope has a nylon jacket, remove the nylon from the end of the wire rope before you put the rope in the terminal.
 - 1) Remove a length of nylon to give 0.50 in. (12.70 mm) maximum clearance between the terminal and the jacket after the rope is installed in the terminal.
- (b) Put the cut end of the wire rope into the full depth of the bore of the terminal.
 - 1) If the bore of the terminal does not go completely through, make sure the wire rope is at the full depth as follows:
 - a) Measure the depth of the bore.
 - b) Mark this as a length from the end of the wire rope before you install and swage the fittings.
- (c) Terminals can be staked on the wire rope to keep them in the correct position before they are swaged.
 - 1) The depth of this stake must be a maximum of 0.003 in. (0.076 mm).
 - 2) The stake must be within the minimum swage length given by Table 401 or Table 402.

SUBTASK 20-10-03-830-002

- (3) Use the portable cable swager kit, SPL-1583 to install the fittings as follows:
 - (a) The swaging must smoothly cold-work the fitting until its dimension agree with the data given by the table below.
 - (b) During the swaging process, do not let die touch these areas of the fitting:
 - 1) The hex.
 - 2) The fork.

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- 3) The eye of the terminal.
- (c) Do not swage the same terminal a second time.
- (d) The completed swage dimensions are as follows:

Table 401/20-10-03-993-801 Dimensions after swaging terminals

Cable Diameter	1/16 in. (1.588 mm)	3/32 in. (2.381 mm)	1/8 in. (3.175 mm)	5/32 in. (3.969 mm)	3/16 in. (4.762 mm)
X (Minimum)	0.700 in. (17.780 mm)	0.800 in. (20.320 mm)	1.050 in. (26.670 mm)	1.290 in. (32.766 mm)	1.310 in. (33.274 mm)
AS Diameter (Maximum) ^{*[1]}	0.138 in. (3.505 mm)	0.190 in. (4.826 mm)	0.219 in. (5.563 mm)	0.250 in. (6.350 mm)	0.313 in. (7.950 mm)
AS Diameter (Minimum) ^{*[2]}	0.133 in. (3.378 mm)	0.185 in. (4.699 mm)	0.214 in. (5.436 mm)	0.243 in. (6.172 mm)	0.306 in. (7.772 mm)
AS Diameter (Minimum)	0.128 in. (3.251 mm)	0.180 in. (4.572 mm)	0.209 in. (5.309 mm)	0.236 in. (5.994 mm)	0.299 in. (7.595 mm)

^{*[1]} BASIC MINIMUM DIAMETER AFTER SWAGING

^{*[2]} IN THE AREA OF THE ORIGINAL DESIGN TAPER, THE END OF THE SWAGED AREA CAN HAVE THIS MINIMUM DIAMETER

Table 402/20-10-03-993-802 Dimensions after swaging terminals

Cable Diameter	7/32 in. (5.556 mm)	1/4 in. (6.350 mm)	9/32 in. (7.144 mm)	5/16 in. (7.938 mm)	3/8 in. (9.525 mm)
X (Minimum)	1.550 in. (39.370 mm)	1.700 in. (43.180 mm)	1.890 in. (48.006 mm)	2.060 in. (52.324 mm)	3.120 in. (79.248 mm)
AS Diameter (Maximum)	0.375 in. (9.525 mm)	0.438 in. (11.125 mm)	0.500 in. (12.700 mm)	0.563 in. (14.300 mm)	0.625 in. (15.875 mm)
AS Diameter (Minimum) ^{*[1]}	0.368 in. (9.347 mm)	0.431 in. (10.947 mm)	0.492 in. (12.497 mm)	0.555 in. (14.097 mm)	0.617 in. (15.672 mm)
AS Diameter (Minimum) ^{*[2]}	0.361 in. (9.169 mm)	0.424 in. (10.770 mm)	0.484 in. (12.294 mm)	0.547 in. (13.894 mm)	0.609 in. (15.469 mm)

^{*[1]} BASIC MINIMUM DIAMETER AFTER SWAGING

^{*[2]} IN THE AREA OF THE ORIGINAL DESIGN TAPER, THE END OF THE SWAGED AREA CAN HAVE THIS MINIMUM DIAMETER

- (e) The swaged terminal must have no pits, die marks, cracks that could be seen with a 10-power lens.
 - 1) Small nicks or dents are satisfactory if the swaged surface is 63 micro inches (1.6 micrometers) or smoother.
- (f) The threaded, eye, or fork end of the terminal must be straight with the centerline of the swaged end as shown in Figure 401.
- (g) The length of the swaged cable assembly must agree with the required length when measured under these loads:
 - 1) 17.00 lb (7.71 kg) to 23.00 lb (10.43 kg), for cables with wire rope diameter (without the nylon jacket) of 3/32 in. (2.381 mm) or smaller.
 - 2) 37.00 lb (16.78 kg) to 43.00 lb (19.50 kg), for cables with wire rope diameter (without the nylon jacket) of 3/32 in. (2.381 mm).

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- (h) The cable assembly must not have the following:
- 1) Kinks.
 - 2) Damaged nylon jacket.
 - 3) Popped cores.
 - 4) Broken wire strands.
 - 5) Wire ends above the terminal ends.

SUBTASK 20-10-03-820-001

- (4) Apply a proof load to the cable and to the installed fittings (Figure 401).

NOTE: These loads are 60 percent of the load which will break the cable.

NOTE: This will check the swaging and this will also stretch the cable.

- (a) If you use prestretched cable, do not put a load on all of the cable and do not use a proof load.
- (b) Use other applicable procedures to do a check on the swaging.

Table 403/20-10-03-993-805 Proof Loads For Cable Assemblies

WIRE ROPE TYPE		CABLE DIAMETER ^{*[1]}				
		1/16 in. (1.588 mm)	3/32 in. (2.381 mm)	1/8 in. (3.175 mm)	5/32 in. (3.969 mm)	3/16 in. (5 mm)
		PROOF LOAD				
BMS 7-265 OR MIL-DTL-83420 Carbon Steel, Tin-Zinc Coated (Composition "A (TZ)")	7X7	288 +25 / -0 lb (131 +12 / - 0 kg)	552 +25 / -0 lb (250 +12 / - 0 kg)	---	---	---
	7X19	---	600 +25 / -0 lb (272 +11 / - 0 kg)	1200 +60 / -0 lb (544 +28 / - 0 kg)	1680 +85 / -0 lb (762 +39 / - 0 kg)	2520 +125 / - 0 lb (1143 +57 / -0 kg)
BMS 7-265 OR MIL-DTL-83420 Corrosion Resistant Steel (CRES) (Composition "B")	7X7	288 +25 / -0 lb (131 +12 / - 0 kg)	552 +25 / -0 lb (250 +12 / - 0 kg)	---	---	---
	7X19	---	552 +25 / -0 lb (250 +12 / - 0 kg)	1056 +50 / -0 lb (479 +23 / - 0 kg)	1440 +70 / -0 lb (653 +32 / - 0 kg)	2220 +110 / - 0 lb (1007 +50 / -0 kg)

^{*[1]} THE DIAMETER OF THE WIRE ROPE TELLS YOU THE PROOF LOAD TO USE ON NYLON JACKETED CABLE. DO NOT INCLUDE THE JACKETED CABLE. DO NOT INCLUDE THE JACKET IN THE DIAMETER.

Table 404/20-10-03-993-806 Proof Loads For Cable Assemblies

WIRE ROPE TYPE		CABLE DIAMETER ^{*[1]}				
		7/32 in. (5.556 mm)	1/4 in. (6.350 mm)	9/32 in. (7.144 mm)	5/16 in. (7.938 mm)	3/8 in. (9.525 mm)
		PROOF LOAD				

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Table 404/20-10-03-993-806 Proof Loads For Cable Assemblies (Continued)

WIRE ROPE TYPE		CABLE DIAMETER ^{*[1]}				
BMS 7-265 OR MIL-DTL-83420 Carbon Steel, Tin-Zinc Coated (Composition "A (TZ)")	7X19	3360 +170 / - 0 lb (1524 +77 / -0 kg)	4200 +210 / - 0 lb (1905 +95 / -0 kg)	4800 +240 / - 0 lb (2177 +109 / - 0 kg)	5880 +295 / - 0 lb (2667 +134 / - 0 kg)	8640 +435 / - 0 lb (3919 +197 / - 0 kg)
BMS 7-265 OR MIL-DTL-83420 Corrosion Resistant Steel (CRES) (Composition "B")	7X19	3000 +150 / - 0 lb (1361 +68 / -0 kg)	3840 +190 / - 0 lb (1742 +86 / -0 kg)	4680 +230 / - 0 lb (2123 +105 / - 0 kg)	5400 +270 / - 0 lb (2449 +123 / - 0 kg)	7200 +360 / - 0 lb (3266 +163 / -0 kg)

*[1] THE DIAMETER OF THE WIRE ROPE TELLS YOU THE PROOF LOAD TO USE ON NYLON JACKETED CABLE. DO NOT INCLUDE THE JACKETED CABLE. DO NOT INCLUDE THE JACKET IN THE DIAMETER.

SUBTASK 20-10-03-160-001

- (5) Rub the full length of the cable with cotton wiper, G00034.
 - (a) Make sure that there is sufficient lubrication on the control cables.
 - (b) If necessary, lubricate the cable (Control Cable Lubrication, TASK 12-21-31-600-801).
 - (c) Lubricate only carbon steel cables.
 - (d) Do not lubricate the CRES cables.
 - (e) Wipe the CRES cables with a cotton wiper, G00034 if necessary.

SUBTASK 20-10-03-930-002

- (6) Make marks on the positions of the fittings not installed on the cable before installation.

SUBTASK 20-10-03-800-001

- (7) Put tape on the old cable so it will not unravel.

SUBTASK 20-10-03-800-002

- (8) Cut off the cable end fitting of the old cable and make a splice to attach the old cable to the new cable.

NOTE: If you do not attach the new cable to the old cable, you will have a problem in routing the new cable.

- (a) Make the splice of minimum diameter and sufficiently strong not to break when you pull the cable through.
- (b) Make the splice on only the center strands of the cable.
- (c) Put tape on the loose outer strands.

SUBTASK 20-10-03-800-003

- (9) Pull the old cable out with light tension on the new cable.

SUBTASK 20-10-03-430-002

- (10) Install the remaining fittings and apply a proof load to fittings (Figure 401).
 - (a) Apply the full proof load in less than three seconds and hold it for a minimum of five seconds.

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SUBTASK 20-10-03-160-002

- (11) If necessary, remove unwanted corrosion preventive compound, C00308 from the surface of the control cable with a cotton wiper, G00034.
 - (a) Clean all of the cable, including through the fairleads, air seals, over the pulleys, quadrants, and drums.
 - (b) If necessary, apply to the areas of the cable with the materials (Control Cable Lubrication, TASK 12-21-31-600-801).

SUBTASK 20-10-03-430-003

- (12) Install the turnbuckles with the turnbuckle barrel installed an equal distance on the two threaded terminals.
 - (a) Do not let more than three threads show out of the barrel.

SUBTASK 20-10-03-030-001

- (13) Remove the control cable clamps, SPL-1569 and rigging pins from the control cable and drums.

SUBTASK 20-10-03-430-004

- (14) Tighten the cable as told in the temperature - tension chart in the system chapter.
 - (a) Use a tensiometer to do a check on the cable tension.
 - (b) Apply the tensiometer to the cable at least 6.00 in. (152.40 mm) from the turnbuckle terminal or other fittings.
 - (c) To make sure you have the correct cable tension, permit a minimum of one hour at constant ambient temperature for airplane temperature to become stable.

SUBTASK 20-10-03-710-001

- (15) If a new cable is installed, operate the system for a number of test cycles, with cables tightened to two times the working tension.

NOTE: See the applicable chapter for tension specifications.

SUBTASK 20-10-03-800-004

- (16) Make the last rigging adjustments.

NOTE: Refer to the applicable chapter for rigging load.

SUBTASK 20-10-03-210-001

- (17) Do this task: Control Cable Air Seal Installation, TASK 20-10-04-400-801.

NOTE: Correctly adjusted seals stop deflection of the cable and make sure the cable is free to move.

SUBTASK 20-10-03-220-001

- (18) The minimum clearance from the adjacent structure shall be as follows.

NOTE: The clearances that follow are general guidelines only. Refer to the applicable chapter to find any special conditions for a specific system.

- (a) Between different cable systems -0.50 in. (12.70 mm).

NOTE: A clearance of 2.00 in. (50.80 mm) is recommended.

- (b) Between structure, wiring, tubing and fixed equipment:

- 1) At a fairlead - 0.50 in. (12.70 mm)

- 2) At a rubstrip - 0.10 in. (2.54 mm)

NOTE: A clearance of 1.50 in. (38.10 mm) is recommended below the cable, and 1.00 in. (25.40 mm) is recommended in the other directions.

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- (c) Between doors, landing gear, and components that move - 2.00 in. (50.80 mm).

NOTE: A clearance of 4.00 in. (101.60 mm) is recommended.

SUBTASK 20-10-03-430-005

- (19) Do this task: Turnbuckle Locking Clips Installation, TASK 20-10-05-400-801, on all the turnbuckles adjusted.

SUBTASK 20-10-03-710-002

- (20) Operate controls through full travel to make sure that cables move freely with minimum force.

———— **END OF TASK** ————

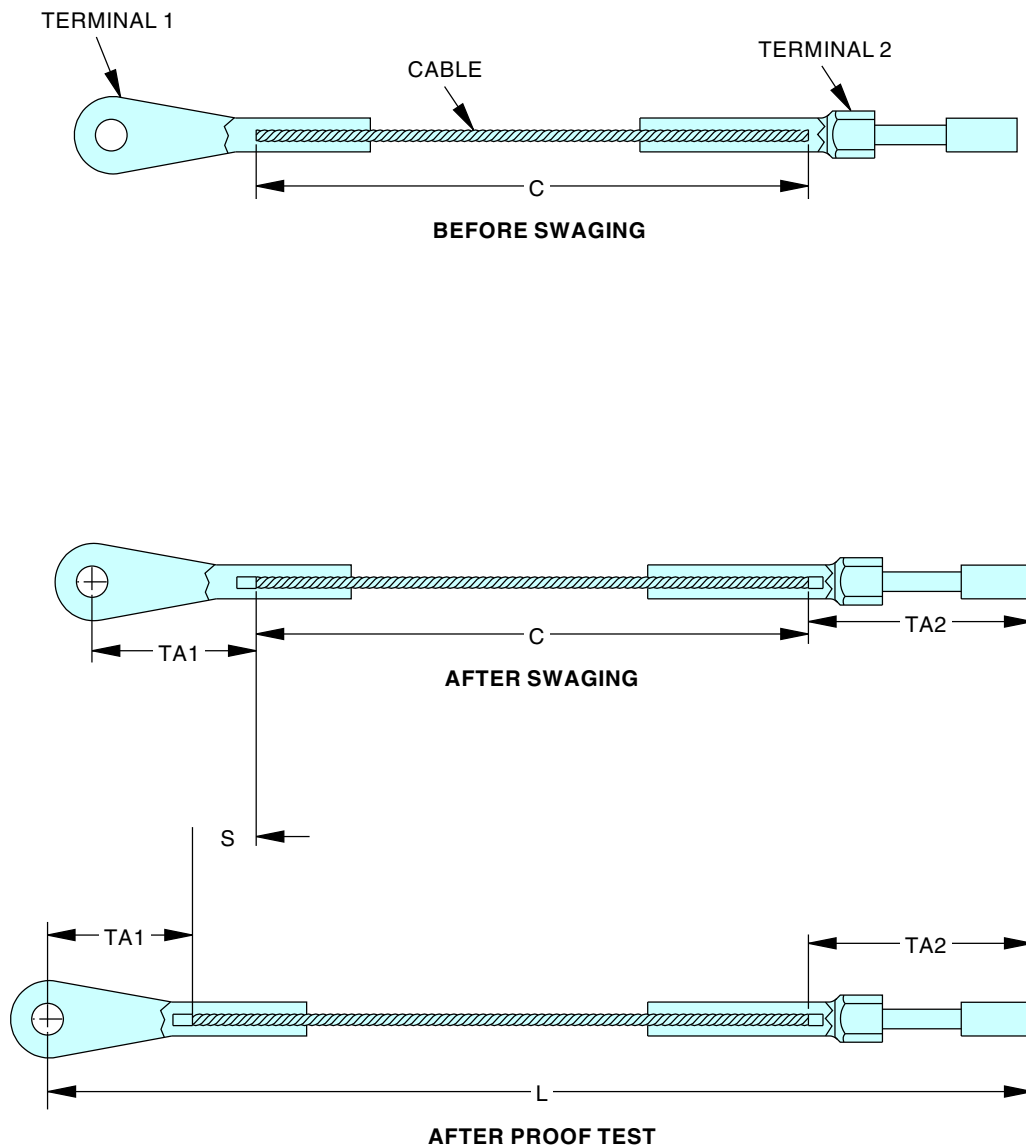
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$C = L - (TA1 + TA2 + S)$ WHERE:
 C = CUT LENGTH OF CABLE
 L = FINAL ASSEMBLY LENGTH
 S = AMOUNT OF INCREASED CABLE LENGTH AFTER PROOF TEST
 TA1 = TERMINAL 1 ALLOWANCE AFTER SWAGING
 TA2 = TERMINAL 2 ALLOWANCE AFTER SWAGING

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**Control Cables Installation
Figure 401/20-10-03-990-801 (Sheet 1 of 2)**

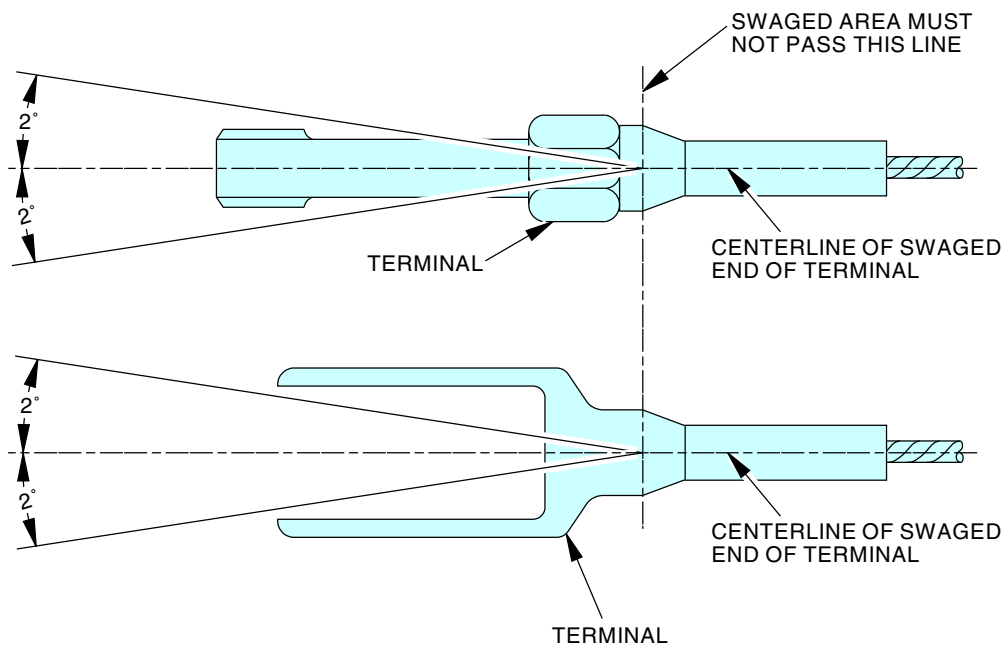
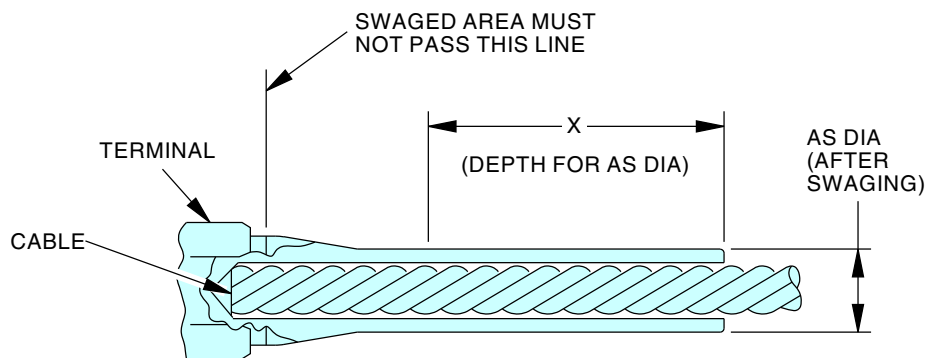
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**Control Cables Installation
Figure 401/20-10-03-990-801 (Sheet 2 of 2)**

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CONTROL CABLE AIR SEAL - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the air seal.
 - (2) An installation of the air seal.

TASK 20-10-04-000-801

2. Control Cable Air Seal Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-04-030-001

- (1) Remove the two seal retaining bolts [6] and washers [7].

SUBTASK 20-10-04-030-002

- (2) Remove the two pieces of the ball [8] from the seal cover [2].

SUBTASK 20-10-04-020-001

- (3) If it is necessary to replace the seal plate [5] or seal cover [2], do the following steps:
 - (a) Disconnect the turnbuckle adjacent to the pressure bulkhead.
 - (b) Remove the seal cover [2] and the seal plate [5] from the bulkhead.
 - (c) Remove the gasket [3] from the bulkhead.

SUBTASK 20-10-04-020-002

- (4) Remove the air seal [1].

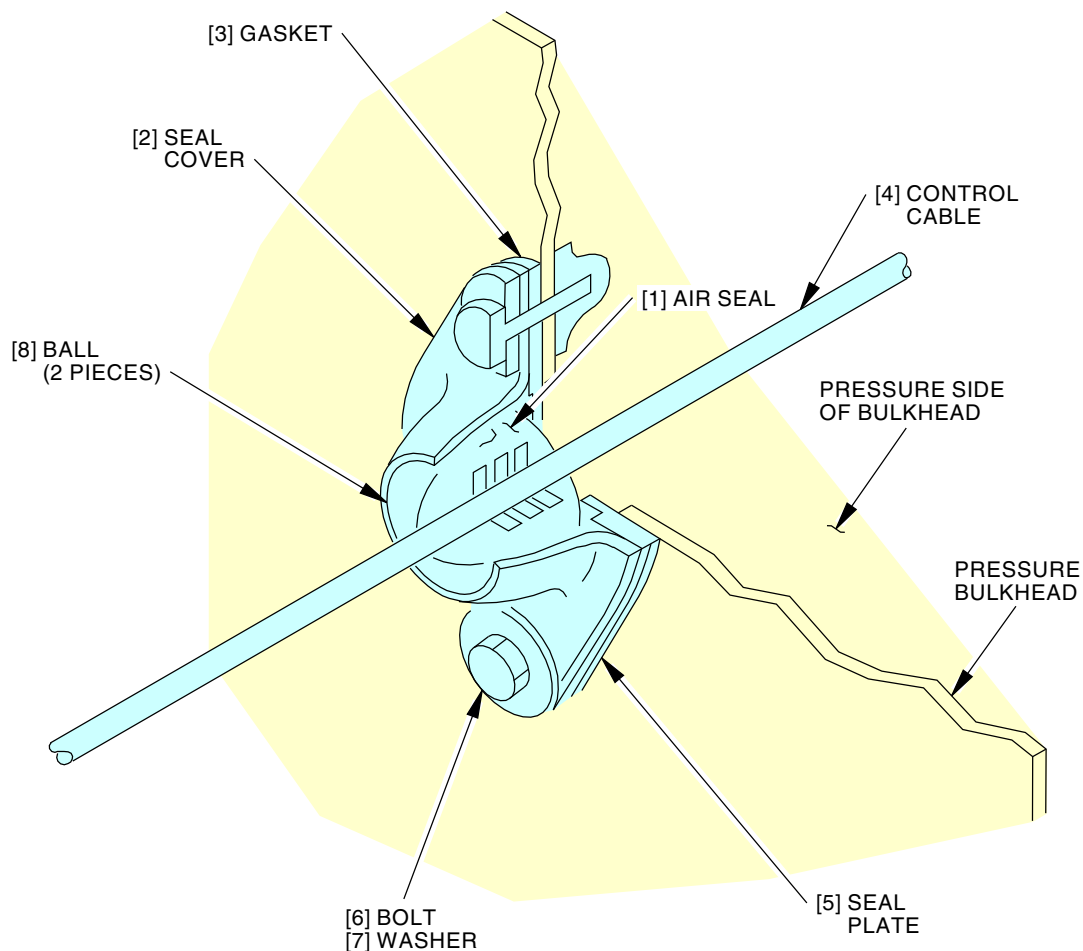
———— **END OF TASK** ————

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Control Cable Air Seal Installation
Figure 401/20-10-04-990-802

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TASK 20-10-04-400-801

3. Control Cable Air Seal Installation

(Figure 401)

A. Consumable Materials

Reference	Description	Specification
D00633	Grease - Aircraft General Purpose	BMS3-33

B. Procedure

SUBTASK 20-10-04-420-001

- (1) If you removed the seal plate [5] or seal cover [2], do these steps:
 - (a) Replace them on the control cable [4].
 - (b) Install the gasket [3] on the control cable [4].
 - (c) If necessary, refer to the specific system rigging instructions to adjust the control cable [4].

SUBTASK 20-10-04-420-002

- (2) Install the air seal [1].

SUBTASK 20-10-04-640-001

- (3) Apply grease, D00633, to the control cable [4] for the full length of travel in the air seal [1].
 - (a) Do not fill the air seal [1] with grease.
 - (b) Do not apply grease to CRES cables, CRES cables should not be lubricated.

SUBTASK 20-10-04-430-002

- (4) Connect the two pieces of the ball [8] on the control cable [4] between the seal cover [2] and seal plate [5].

SUBTASK 20-10-04-420-003

- (5) Install the gasket [3] to the pressure bulkhead.

SUBTASK 20-10-04-430-003

- (6) Loosely install the two seal retaining bolts [6] and washers [7].

SUBTASK 20-10-04-430-004

- (7) Adjust the air seal [1] to attain minimum control cable [4] deflection and tighten the seal retaining bolts [6].

SUBTASK 20-10-04-200-001

- (8) Make sure the control cable pressure seals are correctly adjusted after installation.
 - (a) Make sure there is no control cable [4] deflection.
 - (b) Make sure the control cable [4] moves freely.

————— END OF TASK —————

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TURNBUCKLE LOCKING CLIPS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) Turnbuckle locking clips removal.
 - (2) Turnbuckle locking clips installation.

TASK 20-10-05-000-801

2. Turnbuckle Locking Clips Removal

(Figure 401 or Figure 402)

A. Procedure

SUBTASK 20-10-05-860-001

- (1) Twist the turnbuckle locking clip.

SUBTASK 20-10-05-860-002

- (2) Push the locking hook out of the hole in the center of the turnbuckle barrel.

SUBTASK 20-10-05-020-001

- (3) Move the turnbuckle locking clip out from the turnbuckle slot.

————— **END OF TASK** —————

TASK 20-10-05-400-801

3. Turnbuckle Locking Clips Installation

(Figure 401 or Figure 402)

A. Consumable Materials

Reference	Description	Specification
C00528	Compound - Corrosion Preventive, Petroleum Hot Application (Soft Film)	MIL-C-11796 Class III

B. Locking Clip Installation

SUBTASK 20-10-05-420-001



DO NOT USE THE TURNBUCKLE LOCKING CLIPS AGAIN. THEY CAN BE DEFECTIVE IF YOU USE THEM AGAIN. THIS CAN CAUSE DAMAGE TO EQUIPMENT.

- (1) Tighten the turnbuckle until not more than three threads are out of the barrel and until you have correct cable tension.

SUBTASK 20-10-05-820-001

- (2) Align the slot in the barrel and the cable terminal.

SUBTASK 20-10-05-430-001

- (3) Put the straight end of the locking clip into the aligned slot.

SUBTASK 20-10-05-420-002

- (4) Put the locking clip hook over the hole in the center of the turnbuckle.

SUBTASK 20-10-05-420-003

- (5) Engage the hook into the hole.

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SUBTASK 20-10-05-420-004

- (6) Push the hook shoulder to engage the hook in the turnbuckle.

SUBTASK 20-10-05-420-005

- (7) Do steps 3 through 5 again to lock the second terminal.

NOTE: You can put the locking clips in the same side or in the opposite side of the turnbuckle holes.

SUBTASK 20-10-05-820-002

- (8) To make sure the two turnbuckle locking clips are correctly installed, turn the turnbuckle slightly.

SUBTASK 20-10-05-210-001

- (9) Visually examine the turnbuckle locking clip to make sure the hook is engaged in the turnbuckle.

C. Lockwire Installation (alternate method to locking clips)

SUBTASK 20-10-05-600-001

- (1) Apply a thin coat of compound, C00528 to barrel and cable terminals.

SUBTASK 20-10-05-420-006

- (2) Engage turnbuckle barrel equally with cable terminals and turn barrel until not more than three threads are exposed outside the barrel and the proper cable tension is reached.

SUBTASK 20-10-05-420-007

- (3) Insert correct diameter stainless steel soft annealed wire into either cable terminal. Use .024 for 1/16 inch cable, .031 for 3/32 or 1/8 inch cable, and .043 for 5/32 through 5/16 inch cable.

SUBTASK 20-10-05-420-008

- (4) Twist wire.

NOTE: Do not use a tool which might damage the wire.

SUBTASK 20-10-05-420-009

- (5) Insert ends of wire through opposite holes in barrel. Pull wire through. If tool is used, apply only on ends of wire.

SUBTASK 20-10-05-420-010

- (6) Twist wire down to hole in terminal; insert end of one wire in hole, pull through and twist ends together. Cut off length in excess of 5/8 inch of twisted ends.

SUBTASK 20-10-05-420-011

- (7) Push twisted ends back to lie flat against terminal.

————— **END OF TASK** —————

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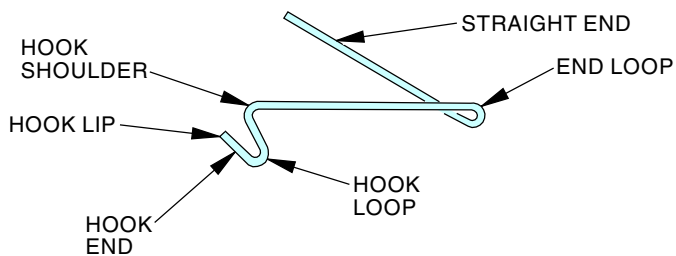
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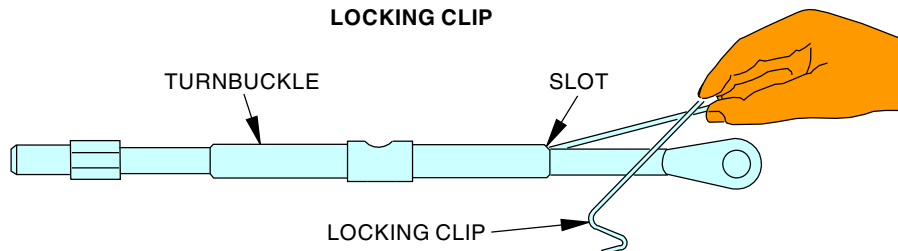
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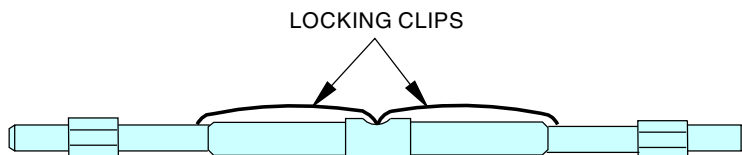
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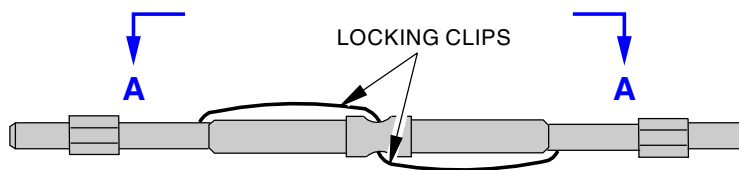
LOCKING CLIP



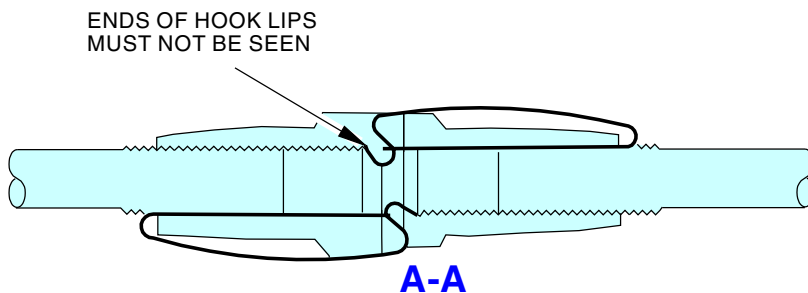
INSERT CLIP IN SLOT



LOCKING CLIP INSERTED IN SAME TURNBUCKLE BARREL HOLE



LOCKING CLIP INSERTED IN OPPOSITE TURNBUCKLE BARREL HOLE



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Turnbuckle Locking Clip
Figure 401/20-10-05-990-801

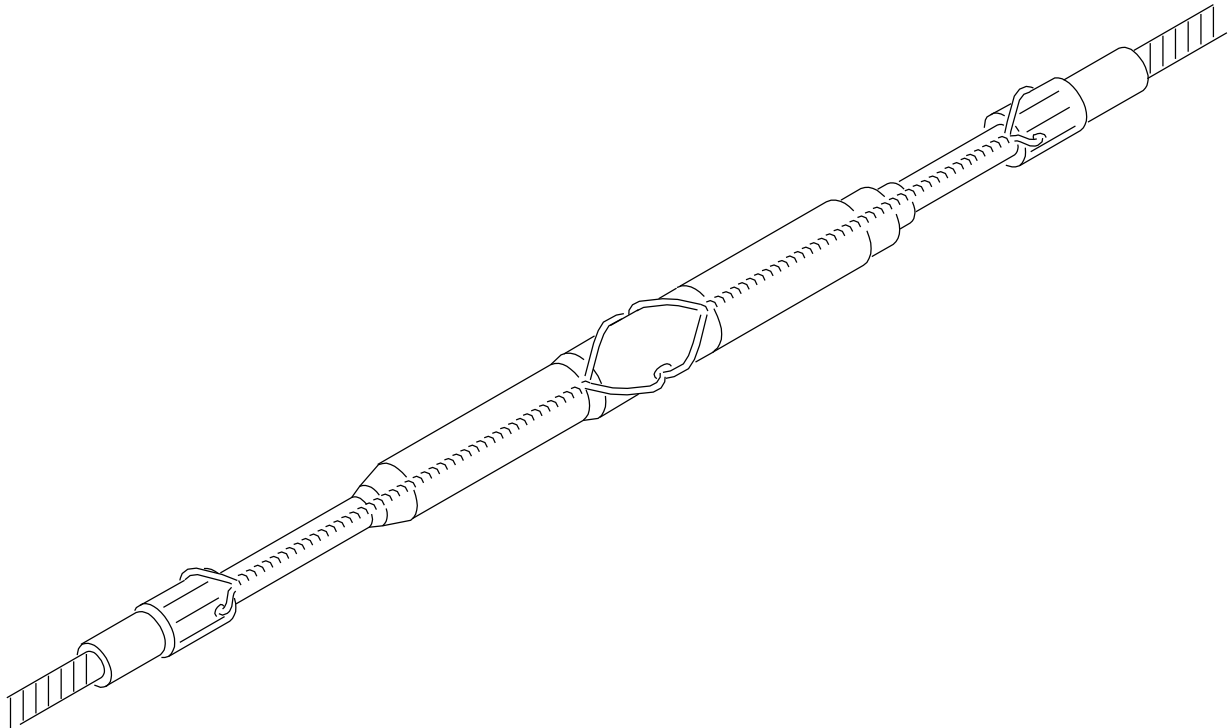
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Turnbuckle Lockwire Installation
Figure 402/20-10-05-990-802

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CONTROL CABLE GROMMET - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the control cable grommet.
- (2) An installation of the control cable grommet.

B. You can replace the control cable grommets in the 3/4, 1, and 1-1/4 inch holes with the control cable removed or installed. You have two alternatives for the replacement of an NAS1368 plastic grommet with the control cable installed:

- (1) You can use a replacement NAS1368 grommet and cut one side of the grommet for installation
- (2) You can use a BACG20H nylon grommet, which is a divided grommet.

TASK 20-10-06-000-801

2. Control Cable Grommet Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-06-020-002

- (1) Cut the grommet to remove the grommet from the bulkhead.

————— **END OF TASK** —————

TASK 20-10-06-400-801

3. Control Cable Grommet Installation

(Figure 401)

A. References

Reference	Title
20-30-98-910-802	Cleaning of Phenolics or Nylon (Series 98-1) (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1549	Set - Installation, NAS 1368 Grommets Part #: A20006-32 Supplier: 81205 Opt Part #: ST1065C Supplier: 81205

C. Consumable Materials

Reference	Description	Specification
A00119	Adhesive - Synthetic Rubber Cement, Naphtha Soluble	BMS5-55
A00273	Adhesive - Epoxy Polyamide, 2 Part, Natural Colored	BMS5-126 Type II Class 1
A00435	Adhesive - Epoxy Polyamide, 2 Component, Natural Color	BMS5-126 Type III Class 1
B01051	Solvent - Cleaning Of Phenolics Or Nylon - Series 98-1	

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D. Install the Grommet with the Control Cable Removed

SUBTASK 20-10-06-110-001



DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (1) Clean the bulkhead area that will touch the grommet with Series 98-1 solvent, B01051 (TASK 20-30-98-910-802).

SUBTASK 20-10-06-640-001

- (2) Apply adhesive, A00273, or adhesive, A00435 on the NAS1368 grommet area that will touch the bulkhead.

SUBTASK 20-10-06-420-001

- (3) Put the grommet in the bulkhead hole.

SUBTASK 20-10-06-480-001

- (4) Put the grommet tool NAS 1368 grommet installation set, SPL-1549 around the grommet and tighten the NAS1801 screw.

SUBTASK 20-10-06-080-001

- (5) Remove the grommet tool NAS 1368 grommet installation set, SPL-1549.

NOTE: The grommet can be loose in the bulkhead hole, but it should not fall out.

E. Install the Grommet with the Control Cable Installed

SUBTASK 20-10-06-110-002



DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (1) Clean the bulkhead area that will touch the grommet with Series 98-1 solvent, B01051 (TASK 20-30-98-910-802).

SUBTASK 20-10-06-420-002

- (2) Do these steps to install the NAS1368 grommet:
 - (a) Put the grommet tool NAS 1368 grommet installation set, SPL-1549 around the grommet and tighten the NAS1801 screw.
 - (b) Remove the grommet tool NAS 1368 grommet installation set, SPL-1549.
 - (c) Cut one side of the NAS1368 grommet.
 - (d) Place the grommet over the control cable.
 - (e) Apply adhesive, A00273, or adhesive, A00435, on the NAS1368 grommet area that will touch the bulkhead.
 - (f) Install the grommet into the bulkhead hole.
 - (g) Align the slit part of the grommet at the 12 o'clock position.

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SUBTASK 20-10-06-420-003

- (3) Do this step to install the BACG20H grommet:
- (a) Apply adhesive, A00119, on the BACG20H grommet area that will touch the bulkhead.
 - (b) Install the grommet in the bulkhead hole.
 - (c) Align the cut part of the grommet at the 12 o'clock position.

———— **END OF TASK** ————

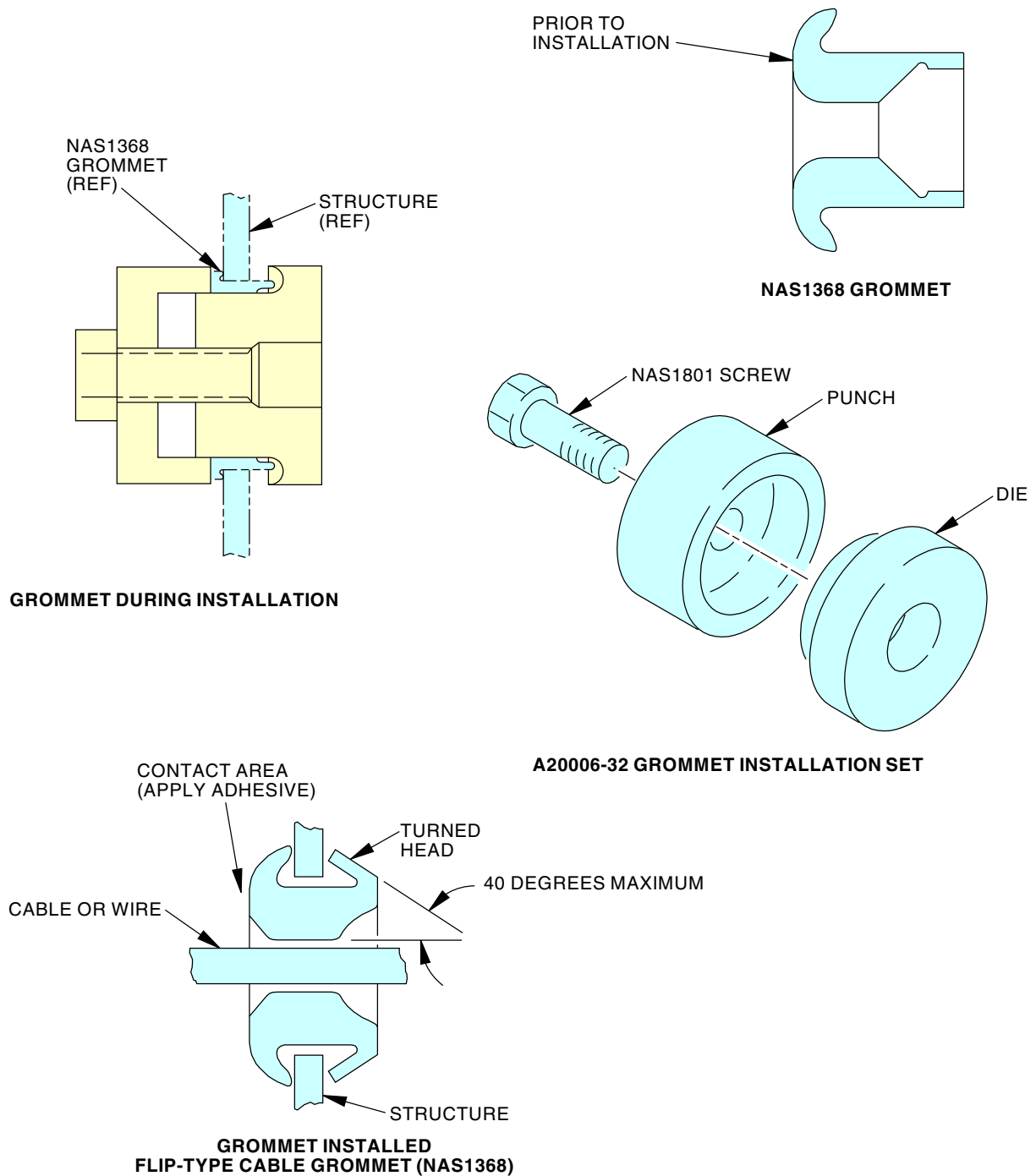
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**Control Cable Grommets Installation
Figure 401/20-10-06-990-801**

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CONTROL CABLE PULLEYS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the control cable pulleys.
 - (2) An installation of the control cable pulleys.
- B. (Figure 401) shows examples of control cable pulleys. If this procedure does not agree with specified maintenance procedures, use the specified maintenance procedures.

TASK 20-10-07-000-801

2. Control Cable Pulleys Removal

(Figure 401)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1569	Clamp - Control Cable Part #: A20005-9 Supplier: 81205

B. Procedure

SUBTASK 20-10-07-030-001

- (1) Loosen the turnbuckle nearest to the control cable pulley to release the tension.

SUBTASK 20-10-07-030-002

- (2) Install cable control cable clamp, SPL-1569 on the cable between the pulley to keep light tension.

NOTE: Keep light tension on cables not removed so that cable drums will not unwrap and the cable will not move out of the pulley guides. As an option, rigging pins can be installed through the applicable drum or quadrant to isolate cable sections.

SUBTASK 20-10-07-030-003

- (3) Remove the bolt from the pulley disk.

SUBTASK 20-10-07-020-001

- (4) Remove the pulley disk.

————— END OF TASK —————

TASK 20-10-07-400-801

3. Control Cable Pulleys Installation

(Figure 401)

A. References

Reference	Title
20-10-05-400-801	Turnbuckle Locking Clips Installation (P/B 401)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
SPL-1569	Clamp - Control Cable Part #: A20005-9 Supplier: 81205

C. Procedure

SUBTASK 20-10-07-420-001

- (1) Install the components applicable to the control cable pulley.

SUBTASK 20-10-07-420-002

- (2) Install the turnbuckles with the turnbuckle barrel installed an equal distance on the two treated terminals.

NOTE: Do not let more than three threads show out of the turnbuckle barrel.

SUBTASK 20-10-07-030-004

- (3) Remove the cable control cable clamp, SPL-1569 and rigging pins from the control cable and drums.

SUBTASK 20-10-07-430-001

- (4) Tighten the cable as shown in the temperature-tension chart of the applicable system chapter.
 - (a) Do a check of the cable tension with a tensiometer.

NOTE: Attach the tensiometer to the cable at least six inches from the turnbuckle terminal or other fittings.

SUBTASK 20-10-07-430-002

- (5) Do this task: Turnbuckle Locking Clips Installation, TASK 20-10-05-400-801.
on all turnbuckles that you adjusted.

SUBTASK 20-10-07-710-001

- (6) Operate the controls, as specified in the applicable system chapter, through full travel.
 - (a) Make sure the controls move freely.
 - (b) Make sure the force is not excessive or abnormal.

————— **END OF TASK** —————

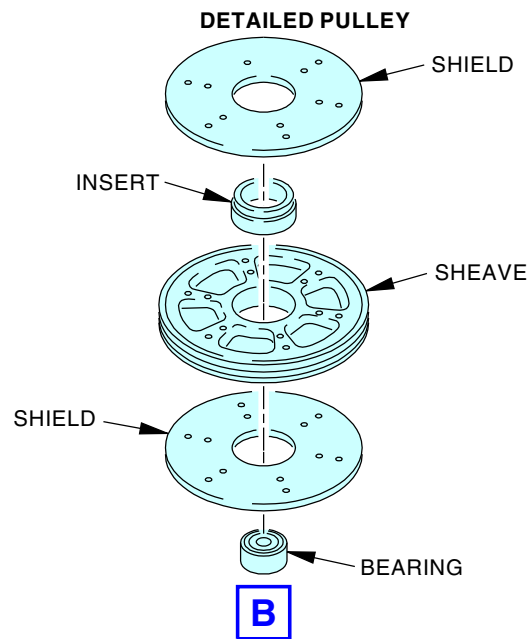
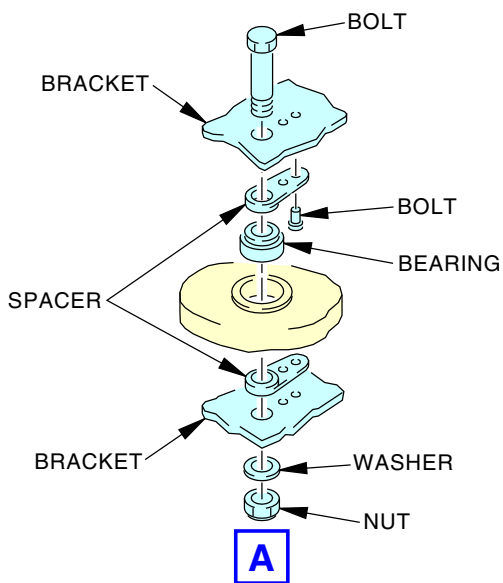
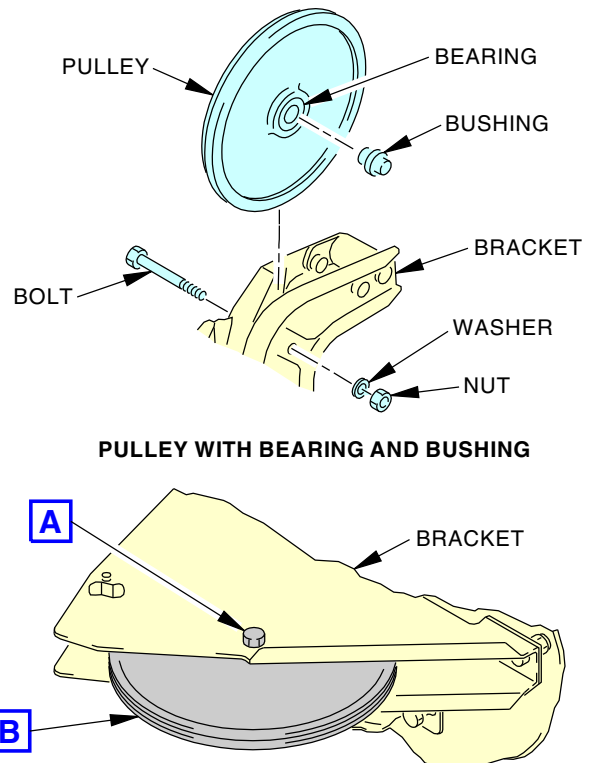
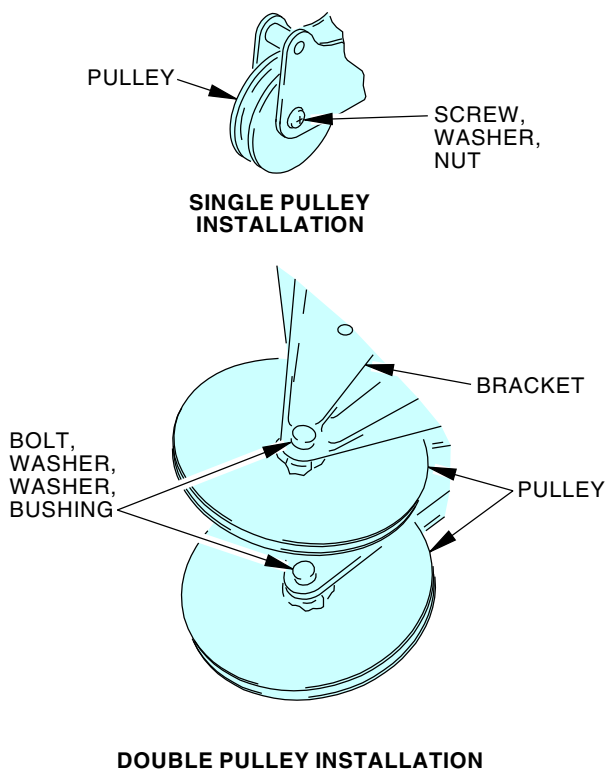
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**Control Cable Pulleys Installation
Figure 401/20-10-07-990-801**

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CONTROL CABLE QUICK STOPS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the control cable quick stops.
 - (2) An installation of the control cable quick stops.

TASK 20-10-08-960-801

2. Control Cable Stops Removal

(Figure 401)

A. **Procedure**

SUBTASK 20-10-08-020-001

- (1) Remove the lockwire that attaches the control cable stop to the swaged cable terminal stud.

SUBTASK 20-10-08-020-002

- (2) Move the control cable stop longitudinally away from the swaged cable terminal stud until the control cable stop disengages.

SUBTASK 20-10-08-980-001

- (3) Move the control cable stop laterally to permit the cable to go through the slot in the control cable stop.

————— **END OF TASK** —————

TASK 20-10-08-420-801

3. Control Cable Stops Installation

(Figure 401)

A. **References**

Reference	Title
20-10-23-400-801	Lockwire, Cotter Pins, and Lockrings - Installation (P/B 401)

B. **Procedure**

SUBTASK 20-10-08-420-001

- (1) Put the large center hole of the control cable stop near the swaged cable terminal stud.

SUBTASK 20-10-08-420-002

- (2) Move the slot of the control cable stop along the cable.

SUBTASK 20-10-08-420-003

- (3) Push the control cable stop on the end of the swaged cable terminal stud until the control cable stop fully engages.

SUBTASK 20-10-08-820-001

- (4) To adjust the control cable stop, twist the swaged cable terminal stud to get the dimension shown.

SUBTASK 20-10-08-420-004

- (5) Install a lockwire from the control cable stop to the swaged cable terminal stud, do this task: Lockwire, Cotter Pins, and Lockrings - Installation, TASK 20-10-23-400-801.

————— **END OF TASK** —————

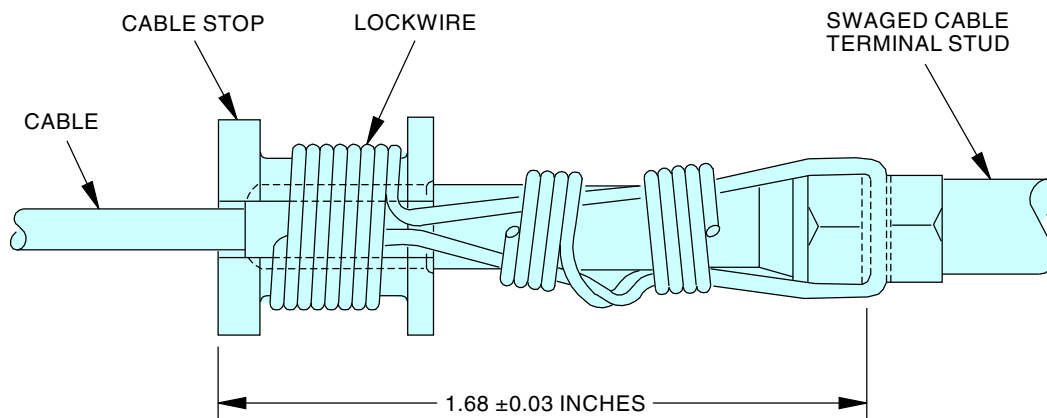
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Control Cable Stops Installation
Figure 401/20-10-08-990-801

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DETERMINE INSTALLATION TORQUE FOR TUBES/FITTINGS/HOSES

TASK 20-10-09-910-801

1. Tube Material and End Fitting Determination for Hydraulic Tube Assembly

A. General

- (1) This task provides the steps on how to find the correct torque value for the hydraulic tube assembly, fitting or hose assembly. Use this task when the specific torque value is not given in the procedure. For further information, please refer to Service Letter per model (see Table 201).

Table 201/20-10-09-993-914

Models
737-SL-29-118
747-SL-29-077
757-SL-29-053
767-SL-29-066
777-SL-29-040

B. Procedure

SUBTASK 20-10-09-910-001

- (1) Use the Boeing drawing system to determine tube material and end fittings. Do the following:
- (a) Review the Parts List (PL) for the Tube Assembly
NOTE: GA notes indicate hydraulic system, tube size and material
 - (b) Determine the outer diameter in inches
NOTE: Dimension may also be referred to as a size or dash number. For example, a Hydraulic System A with dimension 3/8 can also be defined as sixteenths of an inch = $6/16$ = size 06 or —6.
 - (c) Review breakdown of tube sizes and corresponding thread sizes. Table 202

Table 202/20-10-09-993-903 Typical Tube Size Designation/Corresponding Thread Sizes

Tube - Actual Diameter (inches)	Tube Size in Sixteenths of an Inch	Typical Dash No. Designation	Typical Size Designation	Corresponding Thread Size for Threaded End
1/4	4	-4	04	0.4375-20
3/8	6	-6	06	0.5625-18
1/2	8	-8	08	0.7500-16
5/8	10	-10	10	0.8750-14
3/4	12	-12	12	1.0625-12
1	16	-16	16	1.3125-12
1-1/4	20	-20	20	1.6250-12
1-1/2	24	-24	24	1.8750-12
2	32	-32	32	2.5000-12

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- (d) Review the same entry in the Parts List (PL) to determine the end fittings for the Tube Assembly.

NOTE: For example, may need 2 each P/N AS1581T06 sleeves ("T" in P/N means titanium material) and 2 each P/N BACN10YA6L B-nuts (N10YA nut made from titanium material). See Figure 202

NOTE: Contact Boeing if no drawing system access is available.

SUBTASK 20-10-09-800-022

- (2) Use Tubing Specification and Wall Thickness table for Hydraulic Tubes:

NOTE: The table shows the standard tube materials, related procurement specification, tube diameter and wall thickness. The tube materials and respective outside diameters/wall thickness listed in the table include 3AL-2.5V titanium, 21-6-9 corrosion resistant steel (CRES) and 6061-T6 aluminum.

- (a) Information is provided for all models in Table 203

Table 203/20-10-09-993-905 Tube Specification and Wall Thickness Table for All Models

Models	Location in AMM
737-300/400/500	20-10-51/801
737-600/700/800/900	20-10-51/801
747-100/200	20-11-05/801
747-400	20-11-05/801
747-8	20-11-05/801
757	20-10-09/801
767	20-10-09/801
777	20-10-09/801

SUBTASK 20-10-09-800-021

- (3) Use Cross Reference of Tubing table to correspond to Boeing Material Specification (BMS):

- (a) Information is provided for all models in Table 204

Table 204/20-10-09-993-906 Cross Reference of Tubing to BMS/MIL Specification for All Models

Models	Location in AMM
737-300/400/500	20-10-51/801
737-600/700/800/900	20-10-51/801
747-100/200	20-11-05/801
747-400	20-11-05/801
747-8	20-11-05/801
757	20-10-09/801
767	20-10-09/801
777	20-10-09/801

SUBTASK 20-10-09-800-023

- (4) Use Hydraulic Tubing Material Identification in Multi-Model Maintenance Tip to determine the material of hydraulic tubing:

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- (a) Information is provided for all models in Table 205

Table 205/20-10-09-993-907 Multi-Model Maintenance Tip Table for All Models

Models
737NG-737 MT 29-014
747-8 MT 29-027
747-400 MT 29-007
757 MT 29-007
767 MT 29-012
777 MT 29-008

SUBTASK 20-10-09-200-004

- (5) Use the Illustrated Parts Catalog (IPC) to find the type of material that you will attach each end of the tubing to:

NOTE: This step is necessary to determine the torque value that you will apply to the reconnectable fittings on the ends of the tube assembly. For example: A titanium B-nut that will be assembled to an aluminum fitting will require a lower torque value than is required for a similar fitting made from titanium or CRES material.

- (a) Hydraulic fittings have the material code marked on the wrench pas area. Use Table 206 to identify the materials

Table 206/20-10-09-993-908 Hydraulic Fitting Material Codes

Codes	Material
"No Code" or "—"	Carbon Steel with Cadmium Plate Finish
"D"	2014/2024 Aluminum - Green Anodize Finish ("D" code now inactive)
"H"	15-5PH CRES — no Finish (dull gray to metallic bright) - See also "V" code. "H" used for earlier fittings in the 15-5PH CRES material, such as flareless BACS13BX sleeves and BACU24AB unions ("H" + "P" suffix code used for these fittings in 15-5PH CRES material with cadmium plate finish)
"J"	304 CRES — no Finish (dull gray to metallic bright)
"K"	3169 CRES - no Finish (dull gray to metallic bright)
"P"	15-5PH CRES with Cadmium Plate Finish*
"R"	321 CRES — no Finish (dull gray to metallic bright)
"S"	347 CRES (now cancelled)
"T"	6AL-4V Titanium - usually Gray from Fluoride Phosphate Finish
"V"	15-5PH CRES — no Finish (dull gray to metallic bright)*
"W"	7075 Aluminum - Brown Anodize Finish
"V - P"	15-5PH CRES with Cadmium Plate Finish

SUBTASK 20-10-09-910-002

- (6) Select and apply the correct torque value as follows:

- (a) Use Table 207 to locate the correct torque values per model for Flareless Tubing Fittings:

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Table 207/20-10-09-993-909 Installation Torque for Flareless Tubing Fittings Table for All Models

Models	Location in AMM
737-300/400/500	20-50-11/201
737-600/700/800/900	20-50-11/201
747-400	20-51-01/201
747-8	20-51-01/201
757	20-11-00/201
767	20-11-00/201
777	20-11-00/201

- (b) Use Table 208 to locate the correct torque values per model for Flareless Fittings in pressurized area:

NOTE: Pressurized area refers to parts of the airplane that are subject to cabin pressure. These are cockpit, passenger and cargo.

Table 208/20-10-09-993-910 Installation Torque for Flareless Fittings in Pressurized Area

Models	Location in AMM
737-300/400/500	20-10-51/401
737-600/700/800/900	20-10-50/401
747-400	20-51-01/401
747-8	20-11-05/401
757	20-10-09/401
767	20-10-09/401
777	20-10-09/401

————— **END OF TASK** —————

TASK 20-10-09-910-802

2. Torque Values for Tubes, Hoses or Fittings installed to Components Determination

A. General

- (1) This task will help determine the correct torque value for Tubes, Hoses or Fittings installed to Components. For further information, refer to Service Letter per model (see Table 209).

Table 209/20-10-09-993-915 Service Letter for All Models

Models
737-SL-29-118
747-SL-29-077
757-SL-29-053
767-SL-29-066
777-SL-29-040

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B. References

Reference	Title
20-10-10-990-809	Figure: Hydraulic Hose Identification (P/B 201)

C. Procedure

SUBTASK 20-10-09-200-005

- (1) Determine torque for Hydraulic Tube or Hose End with seal (e.g. Union P/N MS21902) installed in Component Boss Port (see Figure 201). Do the following:
 - (a) Determine the materials. Do one of the following:
 - 1) Tube Assembly (see Tube Material and End Fitting Determination for Hydraulic Tube Assembly, TASK 20-10-09-910-801).
 - 2) Hose End (see Figure 20-10-10-990-809).
 - 3) Union (see Figure 202).
 - (b) Use Component Maintenance Manual (CMM) to determine the component material
NOTE: Most components have flareless union fittings on their external ports. Determine the material of the union fitting (see Table 206).
NOTE: Contact Boeing if no CMM access is available.
 - (c) Select the correct torque (see Table 210).

Table 210/20-10-09-993-913 Selecting Torque for Tube or Hose Assembly on Mating Union or Component

--		Mating Union Fitting or Component Material (if no union fitting is present)		
		Aluminum	Corrosion Resistant Steel (CRES)	Titanium (Ti)
Tube Material or Tube End / Hose End Fitting Material	Aluminum or Annealed CRES	Use Aluminum Values	Use Aluminum Values	Use Aluminum Values
	Corrosion Resistant Steel(CRES)	Use Aluminum Values	Use CRES/Titanium Values	Use CRES/Titanium Values
	Titanium (Ti)	Use Aluminum Values	Use CRES/Titanium Values	Use CRES/Titanium Values



CAUTION

USE TWO WRENCHES WHEN YOU TIGHTEN THE TUBE CONNECTORS. USE ONE WRENCH TO HOLD THE MATING TUBE ADAPTER. USE THE OTHER WRENCH TO TURN THE TUBE CONNECTOR. IF YOU DO NOT OBEY THIS INSTRUCTION, YOU CAN CAUSE DAMAGE TO THE TUBES.

- (d) Apply torque value for the end of the tube or hose assembly attached to the union fitting clockwise (see Table 207 and Table 208).

NOTE: Do not align or rotate fittings or tube assemblies after the joint has been tightened. Rotating the joint after tightening may cause leaks.

SUBTASK 20-10-09-200-006

- (2) Determine torque for Hydraulic Tube or Hose End installed to Union Fitting that has a Recessed Seal Boss End and Seal (e.g. Union Fitting P/N BACA14AZ with Flareless End per AS33541 and Boss End per BACD2037) (See Figure 201). Do the following:
 - (a) Determine the materials. Do one of the following:

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- 1) Tube Assembly (see Tube Material and End Fitting Determination for Hydraulic Tube Assembly, TASK 20-10-09-910-801).
 - 2) Hose End (See Figure 20-10-10-990-809).
 - 3) Union (see Figure 202).
- (b) Use Component Maintenance Manual (CMM) to determine the component material.
- NOTE: Most components have flareless union fittings on their external ports. Determine the material of the union fitting (see Table 206).
- NOTE: Contact Boeing if no CMM access is available.
- (c) Select the correct torque (see Table 210).



USE TWO WRENCHES WHEN YOU TIGHTEN THE TUBE CONNECTORS. USE ONE WRENCH TO HOLD THE MATING TUBE ADAPTER. USE THE OTHER WRENCH TO TURN THE TUBE CONNECTOR. IF YOU DO NOT OBEY THIS INSTRUCTION, YOU CAN CAUSE DAMAGE TO THE TUBES.

- (d) Apply torque value for the end of the tube or hose assembly attached to the union fitting clockwise (see Table 207 and Table 208).
- NOTE: Do not align or rotate fittings or tube assemblies after the joint has been tightened. Rotating the joint after tightening may cause leaks.

SUBTASK 20-10-09-910-003

- (3) Determine torque for Hydraulic Swivel Elbow Fitting (e.g. P/N BACE21BR) installed to Standard Union Fitting with Seal (e.g. Union P/N MS21902) in Component Boss Port (see Figure 201). Do the following:
- (a) Determine the materials of Elbow Fitting and Union (see Figure 202).
 - (b) Use Component Maintenance Manual (CMM) to determine the component material.
- NOTE: Most components have flareless union fittings on their external ports. Determine the material of the union fitting (see Table 206).
- NOTE: Contact Boeing if no CMM access is available.
- (c) Select the correct torque (see Table 210).



USE TWO WRENCHES WHEN YOU TIGHTEN THE TUBE CONNECTORS. USE ONE WRENCH TO HOLD THE MATING TUBE ADAPTER. USE THE OTHER WRENCH TO TURN THE TUBE CONNECTOR. IF YOU DO NOT OBEY THIS INSTRUCTION, YOU CAN CAUSE DAMAGE TO THE TUBES.

- (d) Apply torque value for the end of the tube or hose assembly attached to the union fitting clockwise (see Table 207 and Table 208).
- NOTE: Do not align or rotate fittings or tube assemblies after the joint has been tightened. Rotating the joint after tightening may cause leaks.

————— **END OF TASK** —————

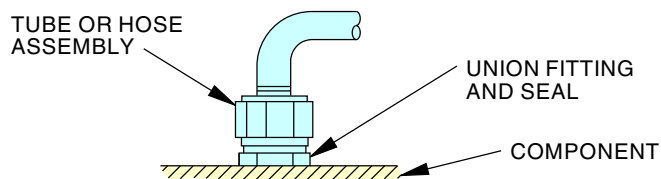
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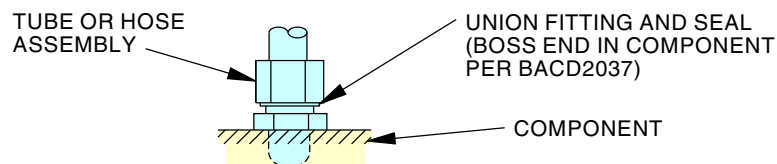
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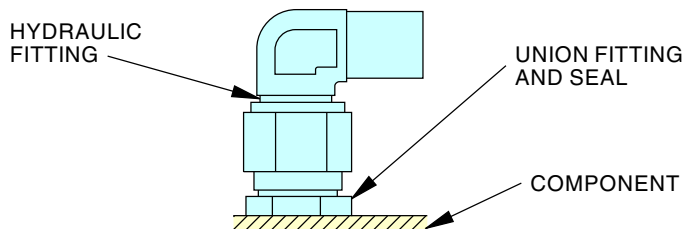
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**HYDRAULIC TUBE OR HOSE END TO UNION WITH SEAL
(eg., UNION P/N MS21902) INSTALLED IN COMPONENT
BOSS PORT**



**HYDRAULIC TUBE OR HOSE END INSTALLED TO UNION
FITTING THAT HAS A RECESSED SEAL BOSS END AND SEAL
(EG., UNION FITTING P/N BACA14AZ WITH FLARELESS END
PER AS33514 AND BOSS PER BACD2037)**



**SWIVEL ELBOW FITTING (eg., P/N BACE21BR)
INSTALLED TO STANDARD UNION FITTING WITH SEAL
(eg., UNION P/N MS21902) IN COMPONENT BOSS PORT**

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**Tubes, Hoses, and Fittings Installed to Components
Figure 201/20-10-09-990-934**

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SLEEVE AND B-NUT FITTINGS						
FITTING TYPE	ILLUSTRATION	PARMT NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
SLEEVE, INTERNALLY SWAGED		BACS13BX	CRES	H = 15-5PH, NO FINISH; HP = 15-5PH, CADMIUM PLATE FINISH	NATURAL SILVERY COLOR OR YELLOWISH BROWN (CADMIUM PLATED)	BACS13BX06HP
SLEEVE, WELDED		AS1581	TITANIUM (CRES VERSION NOT USED)	T = 6AI-4V	NATURAL SILVERY COLOR	AS1581T06
NUT, TUBE COUPLING, LIGHTWEIGHT, REDUCED CROSS SECTION		BACN10YA	TITANIUM	NONE (BASE P/N = 6AI-4V)	DULL GRAY OR, IF DRY FILM LUBRICATED (N SUFFIX CODE), DARK	BACN10YA6N
		BACN10YE	CRES	NONE (BASE P/N = 15-5PH)	NATURAL SILVERY COLOR ("L" CODE = DRY FILM ON ID ONLY)	BACN10YE6L
		BACN10YL	ALUMINUM	NONE (BASE P/N = 7075)	BROWN	BACN10YL06
NUT, COUPLING, WIRED, FLARELESS, 3,000 PSI		BACN11AU	TITANIUM	NUT - NONE (BASE P/N = 6AI-4V); WIRE - CRES (BACN11BB)	DARK GRAY, FROM DRY FILM LUBRICATION	BACN11AU06 NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY
NUT, TUBE COUPLING, STANDARD, CROSS SECTION		MS21921 (SEE STANDARD AS21921)	CRES	V-P = 15.5PH WITH CADMIUM PLATE FINISH (REPLACES "-" OR NO CODE CARBON STEEL)	YELLOWISH BROWN (CADMIUM PLATED)	CODES J, K, R, S - SEE BACN10YE; CODE T - SEE BACN10YA; CODE W - SEE BACN10YL
			CRES	V = 15-5PH (NO FINISH)	NATURAL SILVERY COLOR	
			J (304), K (316), R (321)	NATURAL SILVERY COLOR		
			ALUMINUM	W = 7075	BROWN	
			TITANIUM	T = 6AI-4V	DULL GRAY	

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2324399 S0000527692_V2

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UNION FITTINGS						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
STANDARD FLARELESS UNION (NO REDUCER PROVISIONS)		MS21902 (SEE STANDARD AS21902)	CARBON STEEL	NO CODE (REPL BY V--P)	YELLOWISH BROWN	"-" OR "NO CODE" - USE CODE V-P; CODES J, K, R - SEE AS5230J; CODE T - SEE AS5230T; CODE W - SEE AS5230W
			CRES	J (304), K (316), R (321) V (15-5PH) NO FINISH V--P (15-5PH WITH CADMIUM PLATE FINISH)	NATURAL SILVERY COLOR NATURAL SILVERY COLOR YELLOWISH BROWN	
			ALUMINUM	W = 7075	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
FLARELESS UNION, REDUCER		MS21916 (REDUCER - SEE STANDARD AS21916)	CARBON STEEL	NO CODE (REPL BY V--P)	YELLOWISH BROWN	"-" OR "NO CODE" - USE CODE V-P; CODES J, K, R - SEE AS5230J; CODE T - SEE AS5230T; CODE W - SEE AS5230W
			CRES	J (304), K (316), R (321) V (15-5PH) NO FINISH V-P (15-5PH WITH CADMIUM PLATE FINISH)	NATURAL SILVERY COLOR NATURAL SILVERY COLOR YELLOWISH BROWN	
			ALUMINUM	W = 7075	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
		BACR17E	TITANIUM	T (6Al-4V)	DULL GRAY	BACR17E8-4

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2324579 S0000527693_V2

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UNION FITTINGS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
LIGHTWEIGHT FLARELESS SWAGE UNION		BACU24AB (ONE SWAGED END)	CRES	H (15-5PH)	NATURAL SILVERY COLOR	BACU24AB10HP
				HP (15-5PH WITH CADMIUM PLATE FINISH - ON AI TUBE ONLY)	YELLOWISH BROWN	
LIGHTWEIGHT FLARELESS WELD UNION		AS1582 (ONE WELDED END)	ALUMINIUM	W = 7075	BROWN	AS1582T08
			TITANIUM	T (6Al-4V)	NATURAL SILVERY COLOR	
FLARELESS BULKHEAD UNION (NO REDUCER PROVISIONS)		MS21924 (SEE STANDARD AS21924)	CARBON STEEL	NO CODE (REPL BY V--P)	YELLOWISH BROWN	MS21924V4P
			CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR	
				V (15-5PH) NO FINISH	NATURAL SILVERY COLOR	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
FLARELESS BULKHEAD UNION, REDUCER		BACU24AA (REDUCER ONLY, AVAILABLE IN EXTENDED LENGTH)	ALUMINIUM	W (7075)	BROWN	BACU24AA0812J
			TITANIUM	T (6Al-4V)	DULL GRAY	
			CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	
			CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR	
			ALUMINIUM	D (2024)	GREEN	
			TITANIUM	T (6Al-4V)	DULL GRAY	

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2336628 S000053495_V2

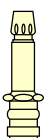
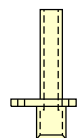
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777-200/300 AIRCRAFT MAINTENANCE MANUAL

EXTERNALLY SWAGED (PERMASWAGE TYPE) ADAPTER UNION FITTINGS							
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA	
ADAPTER, EXTERNALLY SWAGED TO FLARELESS BULKHEAD, REDUCER		BACA14BP	CRES	NO CODE (21-6-9, ANNEALED)	GREEN ON TIP AND HEX FLATS, YELLOWISH BROWN		BACA14BP1212J
			ALUMINUM	D (6061-T6, OVERAGED)	GREEN, EXCEPT FOR BULKHEAD END (GOLDISH ANODIZE)		
ADAPTER, EXTERNALLY SWAGED TO BOSSED FLANGE		BACA14BM	CRES	NO CODE (21-6-9, ANNEALED)	GREEN ON TIP AND BACK OF FLANGE, YELLOWISH BROWN	CODE J - USE CODE JA; CODE DA - USE CODE DA SUFFIX	BACA14BM0606JA
			ALUMINUM	D (6061-T6, OVERAGED)	GREEN, EXCEPT FOR BULKHEAD END (GOLDISH ANODIZE)	CODE E = EXTENDED LENGTH OPTION	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2324604 S0000527694_V2

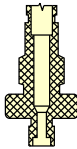
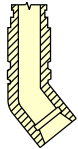
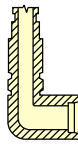
Hydraulic Fitting Identification Information
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FLARELESS FITTINGS WITH BOEING RECESSED SEAL BOSS END						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ADAPTER, STRAIGHT, FLARELESS TUBE TO RECESSED SEAL BOSS		BACA14AZ	CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR	NOTE: SIZE DESIGNATION IN P/N HAS "A" INCLUDED, EG., SIZE 08 IS "8A"
			ALUMINUM	D (2024)	GREEN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
ADAPTER, 45 DEGREE, FLARELESS TUBE TO RECESSED SEAL BOSS		BACA14BA	CARBON STEEL	NO CODE (WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	NOTE: SIZE DESIGNATION IN P/N HAS "B" INCLUDED, EG., SIZE 12 IS "12B", AVAILABLE IN NON-REDUCER ONLY
			CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
ADAPTER, 90 DEGREE, FLARELESS TUBE TO RECESSED SEAL BOSS		BACA14BB	CARBON STEEL	NO CODE (WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	NOTE: SIZE DESIGNATION IN P/N HAS "B" INCLUDED, EG., SIZE 12 IS "12B", AVAILABLE IN NON-REDUCER ONLY
			CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
						EXAMPLE OF P/N
						BACA14AZ8A10J
						BACA14BA12BJ
						BACA14BB8BJ

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2324705 S0000527695_V2

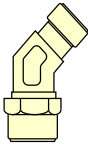
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FITTING SHAPES WITH FLARELESS ENDS						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 45 DEGREE, SWIVEL, REDUCER (LIGHTWEIGHT REDUCED BODY)		BACE21BR	CRES	JN (304) - WITH DRY FILM LUBE	NATURAL SILVERY COLOR	CODES JN, P, T - SEE AS4137 IN CODES J, P, T, RESPECTIVELY
			TITANIUM	P (15-5PH WITH CADMIUM PLATE FINISH) T (6AI-4V)	YELLOWISH BROWN DARK GRAY	
		AS4137	CRES	J (304), DRY FILM ON NUT ID V (15-5PH), DRY FILM ON NUT ID V--P (15-5PH WITH CADMIUM PLATE FINISH)	NATURAL SILVERY COLOR NATURAL SILVERY COLOR YELLOWISH BROWN	AS4137V0806P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
			TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DARK GRAY	

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.
2325229 S0000527696_V2

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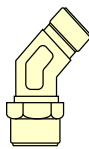
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 45 DEGREE, SWIVEL, REDUCER (STANDARD WEIGHT)		BACE21AU	CARBON STEEL	"NO CODE" WITH N SUFFIX	YELLOWISH BROWN (WITH DRY FILM LUBE ON SWIVEL NUT)	CODES N, M, RM - SEE BACE21BR P, J, RESPECTIVELY; CODES "NO CODE", D, J, K, S - SEE NAS1761 "-", W, J, K, S, RESPECTIVELY; NOTE: BACE21BR IN CODES JN, P, T NOW SUPERSEDED BY AS4137J, P, T RESPECTIVELY
				L (2014/2024)	GREEN (DRY FILM LUBE)	
			ALUMINUM	R (2014/2024)	GREEN (DRY FILM LUBE-SWIVEL NUT ONLY)	
			CRES	M SUFFIX FOR CODES J (304), K (316), S (347)	NATURAL SILVERY COLOR (WITH DRY FILM LUBE)	
				RM SUFFIX CODE FOR R (321)	NATURAL SILVERY COLOR (WITH DRY FILM LUBE)	
		ALUMINUM	W (7075)		BROWN (DRY FILM LUBE-SWIVEL NUT ONLY)	CODES "NO CODES", T, J, K, S - SEE BACE21BR CODES P, T, J, RESPECTIVELY; CODE W - SEE BACE21AU CODE W NOTE: BACE21BR IN CODES JN, P, T NOW SUPERSEDED BY AS4137J, P, T, RESPECTIVELY
		ALUMINUM	D (2014/2024)		GREEN	
		CRES	J (304), K (316), S (347)		NATURAL SILVERY COLOR	
		ALUMINUM	W (7075)		BROWN	
		TITANIUM	T (6Al-4V)		DULL GRAY	
		NAS1761				NAS1761J0812

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2336924 S0000533496_V2

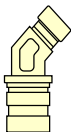
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)									
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N		
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA			
ELBOW, 45 DEGREE, BULKHEAD, REDUCER (LIGHTWEIGHT REDUCED BODY)		BACE21BM	CRES	J (304)	NATURAL SILVERY COLOR	CODES J, P, T - SEE AS4130V--P, J, T, RESPECTIVELY	BACE21BM1208T		
				P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN				
			TITANIUM	T (6AI-4V)	DULL GRAY				
		AS4130	CRES	J (304), DRY FILM ON NUT ID	NATURAL SILVERY COLOR	AS4130V0806P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.			
				V (15-5PH), DRY FILM ON NUT ID	NATURAL SILVERY COLOR				
			CRES	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN				
				TITANIUM	T (6AI-4V), DRY FILM ON NUT ID			DARK GRAY	
		ELBOW, 45 DEGREE, FLARELESS, NON-REDUCER STANDARD WEIGHT		BACE21AT	CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	"NO CODE", P, T, J, K, S, R - SEE BACE21BM CODES P, T, J, RESPECTIVELY; CODE W - SEE AS1010W NOTE: BACE21BM IN CODES J, P AND T IS NOW SUPERSEDED BY AS4130 IN CODES V-P, J AND T RESPECTIVELY.	BACE21AT1008W
					CRES	J (304, K (316), R (321), S (347)	NATURAL SILVERY COLOR		
					ALUMINUM	W (7075)	BROWN		
MS21907 (SEE STANDARD AS21907)	CRES			V-P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	CODES "NO CODE", P, T, J, K - SEE BACE21BM CODES P, T, J, RESPECTIVELY; CODE S - SEE CODE R; CODE W - SEE AS1010W; CODES V-P, R, V - SEE AS4130 IN CODES V-P, J AND V, RESPECTIVELY.	MS21907V4P		
				J (304), K (316), R (321)	NATURAL SILVERY COLOR				
	ALUMINUM			W (7075)	BROWN				
	TITANIUM			T (6AI-4V)	DULL GRAY				

NOTE:

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2325488 S0000527697_V2

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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 45 DEGREE, FLARELESS, NON-REDUCER STANDARD WEIGHT		AS1010	CARBON STEEL	"NO CODE" OR F	YELLOWISH BROWN	(NO CODE)(-OR F) - SEE AS4130V-P; (NO CODE) D - SEE AS1010 (NO CODE) W: (NO CODE) J, K, R, S - SEE AS4130J (NO CODE) T - SEE AS4130T; G - SEE AS4130V-P; G - (D, F, J, K, R, S, T, W) - SEE AS1010G (D, F, J, K, R, S, T, W) - GD - SEE AS1010GW; GF - SEE AS4130V-P; G (J, K, S) - SEE AS4130J T - SEE AS4130T-
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	
			TITANIUM	T (6A1-4V)	DULL GRAY	
			ALUMINUM	W (2024-T6)	GREEN	
				W (7075)	BROWN	
ELBOW, 90 DEGREE, SWIVEL, REDUCER, (LIGHTWEIGHT, REDUCED BODY)		BACE21BT	CRES	JN (304) WITH DRY FILM LUBE ON SWIVEL NUT	NATURAL SILVERY COLOR	CODES JN, P, T - SEE AS4138 IN CODES J, V-P, T, RESPECTIVELY
			TITANIUM	P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
		AS4138		T (6A1-4V)	DULL GRAY	
			CRES	J (304) DRY FILM ON NUT ID	NATURAL SILVERY COLOR	
				V (15-5PH) DRY FILM ON NUT ID	NATURAL SILVERY COLOR	
				V-P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	T (6A1-4V), DRY FILM ON NUT ID	DARK GRAY	

NOTE:
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 90 DEGREE, SWIVEL, REDUCER (STANDARD BODY)		BACE21AW	CARBON STEEL	"NO CODE" WITH N SUFFIX	YELLOWISH BROWN (WITH DRY FILM LUBE ON SWIVEL NUT)	CODES L, R - USE CODE W; CODES N, (JM, KM, SM, RM, M) AND T - SEE BACE21BT IN CODES P, J AND T.
			ALUMINUM	L (2014/2024)	GREEN (DRY FILM LUBE)	RESPECTIVELY;
			ALUMINUM	R (2014/2024)	GREEN (DRY FILM LUBE, SWIVEL NUT ONLY)	NOTE:
			CRES	M SUFFIX - CODES J (304), K (316), S (347), R (321)	NATURAL SILVERY COLOR (WITH DRY FILM LUBE)	BACE21BT IN CODES JN, P AND T NOW SUPERSEDED BY AS4138 CODES J, V-P AND T, RESPECTIVELY.
			ALUMINUM	W (7075)	BROWN (WITH DRY FILM ON SWIVEL NUT ONLY)	BACE21AW1208W
ELBOW, 90 DEGREE, SWIVEL, REDUCER (STANDARD BODY)		NAS1762	CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	CODES "NO CODE", J, K, S AND T - SEE BACE21BT IN CODES P, J AND T, RESPECTIVELY;
			CRES	J (304), K (316), S (347)	NATURAL SILVERY COLOR	CODE W - SEE BACE21AW CODE W.
			ALUMINUM	W (7075)	BROWN	NOTE:
			TITANIUM	T (6Al-4V)	DULL GRAY	BACE21BT IN CODES JN, P AND T NOW SUPERSEDED BY AS4138 CODES J, V-P AND T, RESPECTIVELY.

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2325934 S0000527699_V2

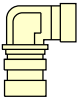
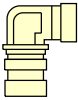
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 90 DEGREE, BULKHEAD, REDUCER (LIGHTWEIGHT REDUCED BODY)		BACE21BN	CRES	J (304)	NATURAL SILVERY COLOR	CODES J, P, T - SEE AS4132 IN CODES J, V-P, T, RESPECTIVELY.
				P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
		AS4132	TITANIUM	T (6AI-4V)	DULL GRAY	AS4132V0806P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
			CRES	J (304)	NATURAL SILVERY COLOR	
ELBOW, 90 DEGREE, FLARELESS, STANDARD WEIGHT		BACE21AS (REDUCER ONLY)	CRES	V (15-5PH), DRY FILM ON NUT ID	NATURAL SILVERY COLOR	"NO CODE" J, K, R, S, T - SEE BACE21BN IN CODES J, P, T, RESPECTIVELY; NOTE: BACE21BN IN CODES J, P AND T NOW SUPERSEDED BY AS4132 IN CODES J, V-P AND T RESPECTIVELY.
			TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DARK GRAY	
			CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	BACE21AS1008W
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6AI-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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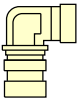
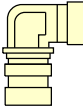
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777-200/300 AIRCRAFT MAINTENANCE MANUAL

FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 90 DEGREE, FLARELESS, STANDARD WEIGHT		MS21908 (SEE STANDARD AS21908, NON-REDUCER)	CRES	V (15-5PH)	NATURAL SILVERY COLOR	"NO CODE" J, K, S, T, V - SEE BACE21BN IN CODES K, P, T, RESPECTIVELY; CODE S - USE CODE R; CODES R, V, V-P - SEE AS4132 IN CODES J, V, V-P, RESPECTIVELY; CODE W - SEE AS1008 CODE W; NOTE: BACE21BN IN CODES J, P AND T IS NOW SUPERSEDED BY AS4130 IN CODES J, V-P AND T RESPECTIVELY.
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
				J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
ELBOW, 90 DEGREE, FLARELESS, STANDARD WEIGHT		AS1008	TITANIUM	T (6Al-4V)	DULL GRAY	AS1008W0808 NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY
			CARBON STEEL	"NO CODE" OR F	YELLOWISH BROWN	
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	
			TITANIUM	T (6Al-4V)	DULL GRAY	
			ALUMINUM	D (2024-T6)	GREEN	
				W (7075)	BROWN	

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2326190 S0000527701_V2

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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW, 90 DEGREE, REDUCER (LIGHTWEIGHT REDUCED BODY)		BACE21BL	CRES	J (304)	NATURAL SILVERY COLOR	CODES J, P, T - SEE AS4131 IN CODES V-P, J, T RESPECTIVELY
			TITANIUM	T (6AI-4V)	DULL GRAY	
			CRES	J (304), DRY FILM ON NUT ID V (15-5PH), DRY FILM ON NUT ID V--P (15-5PH WITH CADMIUM PLATE FINISH)	NATURAL SILVERY COLOR NATURAL SILVERY COLOR YELLOWISH BROWN	
		AS4131	TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DARK GRAY	AS413V0806P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
ELBOW, 90 DEGREE, REDUCER		BACE21AR (STANDARD WEIGHT)	CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	"NO CODE" J, K, R, S, T - SEE BACE21BL IN CODES J, P, T, RESPECTIVELY; CODE W SEE AS1004, CODE W; NOTE: BACE21BL IN CODES J, P, T, NOW SUPERSEDED BY AS4131 IN CODES J, V--P, T, RESPECTIVELY.
			CRES	J (304)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
		AS1004	TITANIUM	T (6AI-4V)	DULL GRAY	AS1004VW0808 NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY
			ALUMINUM	D (2024-T6)	GREEN	
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2326932 S0000527702_V2

**Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 13 of 32)**

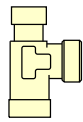
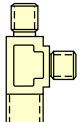
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)							
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE/LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA	
TEE, FLARELESS, REDUCER, LIGHTWEIGHT		BACT16BL	CRES	J (304)	NATURAL SILVERY COLOR	CODES J, P, T - SEE AS4133 IN CODES J, V-P, T RESPECTIVELY.	BACT16BL120810T
				P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN		
			TITANIUM	T (6AI-4V)	DULL GRAY		
		AS4133	CRES	J (304)	NATURAL SILVERY COLOR		AS4133V080606P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
				V (15-5PH)	NATURAL SILVERY COLOR		
TEE, FLARELESS, REDUCER, STANDARD WEIGHT		BACT16AS		V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	CODES J, K, S, R, "NO CODE", T - SEE BACT16BL IN CODES J, P, T, RESPECTIVELY; CODE W - SEE AS1005 CODE W; NOTE: BACT16BL IN CODES J, P, T NOW SUPERSEDED BY AS4133 CODES J, V-P AND T, RESPECTIVELY.	BACT16AS120810J
			TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DARK GRAY		
			CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN		
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR		
			ALUMINUM	W (7075)	BROWN		
			TITANIUM	T (6AI-4V)	DULL GRAY		

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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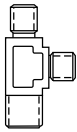
**Hydraulic Fitting Identification Information
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, FLARELESS, REDUCER, STANDARD WEIGHT		MS21905 (SEE STANDARD AS21905 NON- REDUCER)	CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	CODE "NO CODE", - SEE BACT16BL IN CODE P; CODE P SEE AS4133
			CRES	J (304)	NATURAL SILVERY COLOR	CODE P; CODE W - SEE AS1005 CODE W;
			ALUMINUM	W (7075)	BROWN	CODES J, K - SEE SUPERSEDED BACT16BL CODE J;
			TITANIUM	T (6AI-4V)	DULL GRAY	CODE S - SEE AS4133 CODE J; CODE V - SEE AS4133V.
TEE, BULKHEAD- ON-SIDE, LIGHTWEIGHT, REDUCER		AS1005	ALUMINUM (ONLY MATERIAL CODE USED BY BOEING)	W (7075)	BROWN	USE AS4133 FOR ALL MATERIAL APPLICATIONS EXCEPT ALUMINUM.
			CRES	J (304)	NATURAL SILVERY COLOR	CODES J, P, T - SEE AS4135 IN CODES J, V-P AND T RESPECTIVELY.
		BACT16BM	TITANIUM	T (6AI-4V)	DULL GRAY	BACT16BM060410T
			CRES	V (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
		AS4135	TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DULL GRAY	AS4135V080608P
			CRES	V (15-5PH)	NATURAL SILVERY COLOR	NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.

NOTE: NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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Hydraulic Fitting Identification Information
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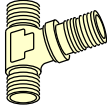
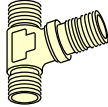
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, BULKHEAD-ON-SIDE, STANDARD WEIGHT, REDUCER		BACT16AW	CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	CODES "NO CODE", J, K, R, S, T - SEE BACT16BM IN CODES J, P, T, RESPECTIVELY; CODE W - SEE AS1009 CODE W; CODES J, P, T NOW SUPERSEDED BY AS4135 IN CODES J, V--P AND T, RESPECTIVELY.
			CRES	J (304)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
TEE, BULKHEAD-ON-SIDE, STANDARD WEIGHT, NON-REDUCER		MS21909 (SEE STANDARD AS21909)	CRES	J (304)	NATURAL SILVERY COLOR	CODES "NO CODE", J, K, S, R AND T -SEE BACT16BM IN CODES P, J AND T, RESPECTIVELY; CODES V-P, R AND V - SEE AS4135 IN CODES P, J AND V, RESPECTIVELY; CODE W - SEE AS1009 IN NON-REDUCER SIZES ONLY; NOTE: BACT16BM IN CODES J, P, T NOW SUPERSEDED BY AS4135 IN CODES J, V--P AND T, RESPECTIVELY.
				V--P	YELLOWISH BROWN	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2327557 S0000527705_V2

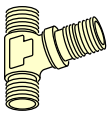
**Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 16 of 32)**

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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, BULKHEAD-ON-SIDE, STANDARD WEIGHT, REDUCER		AS1009	CARBON STEEL	"-" (NO CODE)	YELLOWISH BROWN	CODES (NO CODE) (-, F) - SEE AS4135V; CODES (NO CODE) (D) - USE (NO CODE) (W); CODES (NO CODE) (J, K, R, S) - SEE AS4135J; CODES (NO CODE) (T) - SEE AS4135T; CODE G "-" - SEE AS4135V-P; CODE G, CODES D, F, J, K, R, S, T, W USE G, D, F, J, K, R, S, T, W
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	NOTE: (1) PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY. (2) SUFFIX "G" FOLLOWING BASIC P/N IS FOR PARTS WITH AS4377 STYLE G FITTING END - STYLE G PARTS NOT FOR USE IN PORTS (SEE AS1009 STANDARD FOR DETAILS).
			ALUMINUM	W (7075)	BROWN	NOTE: "-" IN P/N IS DROPPED; CODE GD - SEE GW G CODES J, K, R, S SEE AS4135J; CODE GF - SEE AS4135V--P; GJ, K, R, S - SEE AS4135J; AS1009G T SEE AS4135T.
			TITANIUM	T (6Al-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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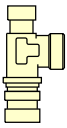
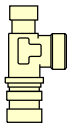
Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 17 of 32)

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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, BULKHEAD-ON-RUN, LIGHTWEIGHT, REDUCER		BACT16BN	CRES	J (304)	NATURAL SILVERY COLOR	CODES J, P, T - SEE AS4134 IN CODES J, V-P AND T RESPECTIVELY.
				P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	T (6AI-4V)	DULL GRAY	
		AS4134	CRES	J (304)	NATURAL SILVERY COLOR	AS4134V080608P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
TEE, BULKHEAD-ON-RUN, STANDARD WEIGHT, REDUCER		BACT16AX		V (15-5PH)	NATURAL SILVERY COLOR	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DARK GRAY	
			CRES	V--P	YELLOWISH BROWN	CODES "NO CODE", T AND J, K, S, R - SEE BACT16BN IN CODES P, T AND J, RESPECTIVELY; CODE W - SEE AS1003, CODE W; CODES J, P, T - SEE AS4134 IN CODES J, V--P AND T, RESPECTIVELY.
		BACT16AX		V	DULL GRAY TO METALLIC BRIGHT	
			ALUMINUM	W (7075)	BROWN	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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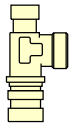
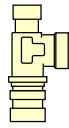
**Hydraulic Fitting Identification Information
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, BULKHEAD-ON-RUN, STANDARD WEIGHT, NON-REDUCER		MS21912 (SEE STANDARD AS21912)	CARBON STEEL	"-" OR NO CODE (4130)	YELLOWISH BROWN	CODES "-", J, K, T - SEE BACT16BN IN CODES J, P AND T, RESPECTIVELY; CODES S, V - SEE AS4134 CODES J, V; CODE W - SEE AS1003 CODE W.
			CRES	J	NATURAL SILVERY COLOR	NOTE: BACT16BN SUPERSEDED BY AS4134; BACT16BN CODES J, P, T NOW SUPERSEDED BY AS4134 CODES J, V-P AND T, RESPECTIVELY.
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
TEE, BULKHEAD-ON-RUN, (STANDARD WEIGHT, REDUCER)		AS1003	CARBON STEEL	"-" (NO CODE)	YELLOWISH BROWN	CODES (NO CODE) (-, F) - SEE AS4135V-P; CODES (NO CODE) W - SEE AS1003W; CODES (NO CODE) (J, K, R, S) - SEE AS4134J; CODES (NO CODE) T - SEE AS4135T; G - (NO CODE) - SEE AS4135V--P; G - (NO CODE) D, F, J, K, R, S, T, W - SEE G (CODES D, F, J, K, R, S, T, W, RESPECTIVELY.
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR	NOTE: (1) PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY. (2) SUFFIX "G" FOLLOWING BASIC P/N IS FOR PARTS WITH AS4377 STYLE G FITTING END AND ARE NOT FOR USE IN PORTS (SEE AS1003 STANDARD FOR DETAILS).
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	

NOTE:

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2327611 S0000527707_V2

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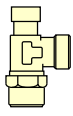
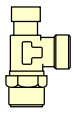
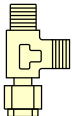
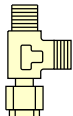
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, SWIVEL-ON-RUN, LIGHTWEIGHT, REDUCER		BACT16BR	CRES	JN (304), DRY FILM ON NUT ID	NATURAL SILVERY COLOR	CODES JN, P, T SUPERSEDED BY AS4139 CODES J, P, T, RESPECTIVELY.
				P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	T (6AI-4V)	DULL GRAY	
TEE, SWIVEL-ON-RUN, LIGHTWEIGHT, REDUCER		AS4139	CRES	JN (304), DRY FILM ON NUT ID	NATURAL SILVERY COLOR	AS4139V0806O8P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
				V (15-5PH)	NATURAL SILVERY COLOR	
			CRES	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
				T (6AI-4V)	DULL GRAY	
TEE, SWIVEL-ON-RUN, STANDARD WEIGHT, REDUCER		BACT16AY	CARBON STEEL	N (CARBON STEEL WITH DRY FILM ON SWIVEL NUT)	YELLOWISH BROWN	CODES M, N - SEE BACT16BR CODES J, P RESPECTIVELY; W CODE STILL ACTIVE.
			CRES	K (316), M (304, S (347)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075-T73)	BROWN	
TEE, SWIVEL-ON-RUN, STANDARD WEIGHT, NON-REDUCER		NAS1763	CARBON STEEL	"-" WITH CADMIUM PLATE FINISH	YELLOWISH BROWN	CODES "-", J, K, S, T - SEE BACT16BR CODES J, P, T RESPECTIVELY; CODE W - SEE BACT16AY IN CODE W.
			CRES	J (304), K (316), S (347)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6AI-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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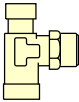
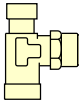
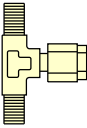
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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, SWIVEL-ON-SIDE, LIGHTWEIGHT, REDUCER		BACT16BT	CRES	JN (304), DRY FILM ON NUT ID	NATURAL SILVERY COLOR	CODES JN, P, T - SEE AS4140 IN CODES J, V-P, T RESPECTIVELY.
				P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	T (6AI-4V)	DULL GRAY	
TEE, SWIVEL-ON-SIDE, LIGHTWEIGHT, REDUCER		AS4140	CRES	JN (304), DRY FILM ON NUT ID	NATURAL SILVERY COLOR	AS4140V0808O6P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
				V (15-5PH)	NATURAL SILVERY COLOR	
				V-P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
TEE, SWIVEL-ON-SIDE, STANDARD WEIGHT, REDUCER		BACT16AZ	TITANIUM	T (6AI-4V), DRY FILM ON NUT ID	DULL GRAY	CODES M, RN, N - SEE BACT16BT IN CODES J, P RESPECTIVELY; CODE W STILL ACTIVE.
			CARBON STEEL	N OR NO CODE WITH DRY FILM ON NUT	YELLOWISH BROWN	
			CRES	M - J (304), K (316), RN (321) OR S (347) WITH DRY FILM ON NUT	NATURAL SILVERY COLOR	
		NAS1764	ALUMINUM	W (7075) WITH DRY FILM ON NUT	BROWN	CODES "-", J, K, S, T - SEE BACT16BT IN CODES J, P, T RESPECTIVELY; CODE W - SEE BACT16AZ IN CODE W.
			CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	
			CRES	J (304), K (316), S (347)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6AI-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2328567 S0000527709_V2

Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 21 of 32)

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FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
CROSS, REDUCER ONLY		BACC27AC	CARBON STEEL	F	YELLOWISH BROWN	CODES F, J, K, R, T - SEE AS4136 CODES V--P, J, T RESPECTIVELY; CODE W - SEE AS1006W.
			CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
CROSS, REDUCER AND NON-REDUCER		AS4136	CRES	J (304)	NATURAL SILVERY COLOR	AS4136V 08060608P NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
				V (15-5PH)	NATURAL SILVERY COLOR	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	T (6Al-4V), DRY FILM ON NUT ID	DARK GRAY	
CROSS, NON-REDUCER		MS21906 (SEE STANDARD AS21906)	CARBON STEEL	"-" OR NO CODE	YELLOWISH BROWN	CODES V, V--P, "-", J, R, S, T - SEE AS4136 CODES V, V--P, J, T, RESPECTIVELY; CODE W IS NOW SUPERSEDED BY AS1006W (NON-REDUCER SIZE COMBINATIONS ONLY)
			CRES	J (304), K (316), S (347)	NATURAL SILVERY COLOR	
				V (15-5PH)	NATURAL SILVERY COLOR	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			ALUMINUM	W (7075)	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2328570 S0000527710_V2

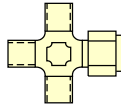
**Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 22 of 32)**

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777-200/300 AIRCRAFT MAINTENANCE MANUAL

FITTING SHAPES WITH FLARELESS ENDS (CONTINUED)							
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA	
CROSS, REDUCER		AS1006	CARBON STEEL	NO CODE	YELLOWISH BROWN	CODES J, K, R, S - SEE AS4136 CODE J; CODE T - SEE AS4136 CODE T; CODE W IS ACTIVE.	AS1006W08080808 NOTE: PHASE-IN TO AIRPLANE PRODUCTION UNDERWAY.
			CRES	J (304), K (316), R (321), S (347)	NATURAL SILVERY COLOR		
			ALUMINUM	W (7075)	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		
CROSS, SWIVEL-ON-ONE-LEG, STANDARD WEIGHT, REDUCER		BACC27AD	CARBON STEEL	F (WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	CODES F, FN - SEE AS4141 CODES V-P; CODES J, K, R - SEE AS4141j; CODES (NO CODE) (NO CODE), (NO CODE) N USE CODES W AND WN	BACC27AD 10080412WN (1) N SUFFIX = DRY FILM LUBE ON SWIVEL NUT (2) BACC27AD P/N NOW SPECIFIED WITH 1ST PORT BEING THE LARGER PORT (FORMERLY SMALLER PORT WAS 1ST PORT)
			CRES	J (304), K (316), R (321)	NATURAL SILVERY COLOR		
			ALUMINUM	W (7075)	BROWN		

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2328688 S0000527711_V2

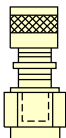
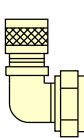
Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 23 of 32)

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AXIAL SWAGE FITTING CONFIGURATIONS WITH ONE OR MORE FLARELESS ENDS							
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA	
STRAIGHT, FEMALE FLARELESS ADAPTER		AS5792	TITANIUM	T (6A1-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS		AS5792T0806
STRAIGHT, MALE FLARELESS ADAPTER		AS5793	TITANIUM	T (6A1-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS		AS5793T0806
ELBOW, 90 DEGREE, FEMALE FLARELESS		AS5801	TITANIUM	T (6A1-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS		AS5801T0806
ELBOW, 45 DEGREE, FEMALE FLARELESS		AS5803	TITANIUM	T (6A1-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS		AS5803T0806

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2339164 S000053498_V2

**Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 24 of 32)**

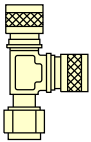
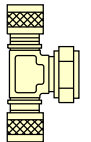
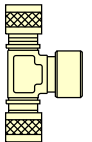
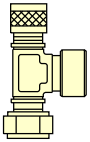
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AXIAL SWAGE FITTING CONFIGURATIONS WITH ONE OR MORE FLARELESS ENDS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, FEMALE FLARELESS ON RUN		AS5804	TITANIUM	T (6Al-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS	AS5804T080808
TEE, FEMALE FLARELESS ON BRANCH		AS5806	TITANIUM	T (6Al-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS	AS5806T080606
TEE, MALE FLARELESS ON BRANCH		AS5807	TITANIUM	T (6Al-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS	AS5807T080808
TEE, FEMALE FLARELESS ON RUN		AS5809	TITANIUM	T (6Al-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS	AS5809T080808
TEE, MALE FLARELESS ON RUN		AS5810	TITANIUM	T (6Al-4V)	DULL GRAY WITH BLUE STRIPE ON SWAGE ENDS	AS5810T080606

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2328851 S0000527712_V2

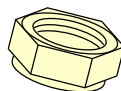
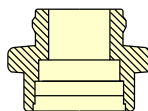
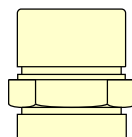
**Hydraulic Fitting Identification Information
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777-200/300 AIRCRAFT MAINTENANCE MANUAL

777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS							
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA	
NUT, TUBE COUPLING, STANDARD CROSS-SECTION		AS4660	CRES	V (15-5PH) (NO CODE)	NATURAL SILVERY COLOR		AS4660V20P NOTE: AS4660 AVAILABLE ONLY IN SIZES 20 AND 24
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN (FROM CADMIUM)		
			ALUMINUM	W = 7075	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		
UNION, SHORT FLARELESS		AS4663	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4663V20P NOTE: AS4663 AVAILABLE ONLY IN SIZES 20 AND 24
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN (FROM CADMIUM)		
			ALUMINUM	7075-T73	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		
UNION, BULKHEAD, SHORT FLARELESS		AS4664	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4664V2020P NOTE: AS4664 AVAILABLE ONLY IN SIZES 2020 AND 2424
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN		
			ALUMINUM	7075-T73	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2328917 S0000527713_V2

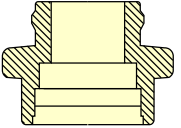
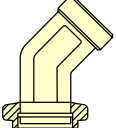
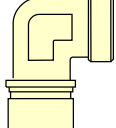
Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 26 of 32)

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777-200/300 AIRCRAFT MAINTENANCE MANUAL

777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS (CONTINUED)							
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA	
ADAPTER, UNION AND REDUCER, SHORT FLARELESS TO BOSS		AS4665	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4665V2020P NOTE: AS4665 AVAILABLE IN REDUCER COMBINATION SIZES 20 TO 04 AND SIZE 24 NON-REDUCER.
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN		
			ALUMINUM	7075-T73	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		
ELBOW ASSEMBLY, 45 DEGREE, RETAINED NUT, SHORT FLARELESS		AS4667	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4667V2020P NOTE: AS4667 AVAILABLE ONLY IN SIZES 2020 AND 2424
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN		
			ALUMINUM	7075-T73	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		
ELBOW, 90 DEGREE, BULKHEAD, SHORT FLARELESS		AS4669	CRES	V (15-5PH) WITH NO FINISH	NATURAL SILVERY COLOR		AS4669V2020P NOTE: AS4669 AVAILABLE ONLY IN SIZES 2020 AND 2424
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN		
			ALUMINUM	7075-T73	BROWN		
			TITANIUM	T (6Al-4V)	DULL GRAY		

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2328920 S0000527714_V2

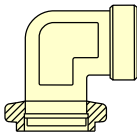
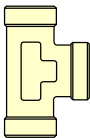
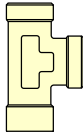
Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 27 of 32)

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777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
ELBOW ASSEMBLY, 90 DEGREE, RETAINED NUT, SHORT FLARELESS		AS4670	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4670V2020P NOTE: AS4670 AVAILABLE ONLY IN SIZES 2020 AND 2424
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			ALUMINIUM	7075-T73	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
TEE, SHORT FLARELESS		AS4671	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4671V202020P NOTE: AS4671 AVAILABLE ONLY IN SIZES 2020 AND 2424
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			ALUMINIUM	7075-T73	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
TEE, BULKHEAD ON RUN, SHORT FLARELESS		AS4672	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4672V202020P NOTE: AS4672 AVAILABLE ONLY IN SIZES 2020 AND 2424
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			ALUMINIUM	7075-T73	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2330004 S0000527715_V2

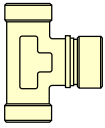
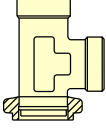
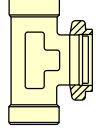
Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 28 of 32)

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777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS (CONTINUED)								
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA				MATERIAL CODE SUPERSESSION DATA	EXAMPLE OF P/N
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION			
TEE, BULKHEAD ON SIDE, SHORT FLARELESS		AS4673	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4673V202020P NOTE: AS4673 AVAILABLE ONLY IN SIZES 202020 AND 242424.	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN			
			ALUMINUM	7075-T73	BROWN			
			TITANIUM	T (6Al-4V)	DULL GRAY			
TEE ASSEMBLY, RETAINED NUT ON RUN, SHORT FLARELESS		AS4674	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4674V202020P NOTE: AS4674 AVAILABLE ONLY IN SIZES 202020 AND 242424.	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN			
			ALUMINUM	7075-T73	BROWN			
			TITANIUM	T (6Al-4V)	DULL GRAY			
TEE ASSEMBLY, RETAINED NUT ON SIDE, SHORT FLARELESS		AS4675	CRES	V (15-5PH)	NATURAL SILVERY COLOR		AS4675V202020P NOTE: AS4675 AVAILABLE ONLY IN SIZES 202020 AND 242424.	
				V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN			
			ALUMINUM	7075-T73	BROWN			
			TITANIUM	T (6Al-4V)	DULL GRAY			

NOTE:
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2330089 S0000527716_V2

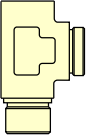
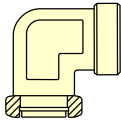
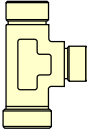
Hydraulic Fitting Identification Information
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777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, BULKHEAD AND BOSS ON RUN, SHORT FLARELESS		AS4676	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4676V202020P NOTE: AS4676 AVAILABLE ONLY IN SIZES 202020 AND 242424.
			ALUMINIUM	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	7075-T73	BROWN	
				T (6Al-4V)	DULL GRAY	
ELBOW, 90 DEGREE, FLARELESS AND SHORT FLARELESS REDUCER, RETAINED NUT		AS4687	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4687V2020P NOTE: AS4687 AVAILABLE IN REDUCER COMBINATIONS, FROM SIZES 20 TO 04 TO 04 AND SIZE 24 NON-REDUCER.
			ALUMINIUM	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	7075-T73	BROWN	
				T (6Al-4V)	DULL GRAY	
TEE, REDUCER, FLARELESS AND SHORT FLARELESS		AS4688	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4688V2020P NOTE: AS4688 AVAILABLE IN REDUCER COMBINATIONS, FROM SIZES 20 TO 04 TO 04 AND SIZE 24 NON-REDUCER.
			ALUMINIUM	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	7075-T73	BROWN	
				T (6Al-4V)	DULL GRAY	

NOTE:
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2330382 S0000527717_V2

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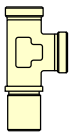
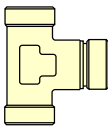
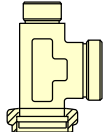
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777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, REDUCER, BULKHEAD ON RUN, FLARELESS AND SHORT FLARELESS		AS4689	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4687V242420P NOTE: AS4687 AVAILABLE IN REDUCER COMBINATIONS ONLY, FROM SIZE 20 AND SIZE 24 FORGINGS ONLY.
			ALUMINUM	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	7075-T73	BROWN	
				T (6Al-4V)	DULL GRAY	
TEE, REDUCER (ONLY), BULKHEAD ON SIDE, FLARELESS AND SHORT FLARELESS		AS4690	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4690V242420P NOTE: AS4690 AVAILABLE IN REDUCER COMBINATIONS ONLY, FROM SIZE 20 AND SIZE 24 FORGINGS ONLY.
			ALUMINUM	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	7075-T73	BROWN	
				T (6Al-4V)	DULL GRAY	
TEE, FLARELESS AND SHORT FLARELESS, REDUCER, RETAINED NUT ON RUN		AS4691	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4691V162020P NOTE: AS4691 AVAILABLE IN REDUCER ONLY, FROM SIZE 20 TO 24 FORGINGS ONLY.
			ALUMINUM	V--P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			TITANIUM	7075-T73	BROWN	
				T (6Al-4V)	DULL GRAY	

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2330599 S0000527718_V2

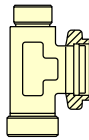
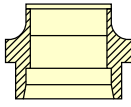
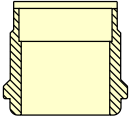
Hydraulic Fitting Identification Information
Figure 202/20-10-09-990-936 (Sheet 31 of 32)

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777 ONLY - SHORT FLARELESS HYDRAULIC FITTINGS (CONTINUED)						
FITTING TYPE	ILLUSTRATION	PART NUMBER	MATERIAL DATA			
			AVAILABLE MATERIALS	MATERIAL CODE LETTER	COLOR IDENTIFICATION	MATERIAL CODE SUPERSESSION DATA
TEE, FLARELESS AND SHORT FLARELESS, REDUCER, RETAINED NUT ON RUN		AS4692	CRES	V (15-5PH)	NATURAL SILVERY COLOR	AS4692V162020P NOTE: AS4692 AVAILABLE IN REDUCER ONLY, FROM SIZE 20 AND SIZE 24 FORGINGS ONLY.
				V-P (15-5PH WITH CADMIUM PLATE FINISH)	YELLOWISH BROWN	
			ALUMINUM	7075-T73	BROWN	
			TITANIUM	T (6Al-4V)	DULL GRAY	
UNION, TUBE END, EXTERNAL THREAD TO WELD, SHORT FLARELESS		AS4693	TITANIUM	T (6Al-4V)	DULL GRAY	AS4693T20-070 NOTE: BOEING USES AS4693 IN TITANIUM MATERIAL ONLY.
SLEEVE, TUBE END, ACORN TO WELD, SHORT FLARELESS		AS4695	TITANIUM	T (6Al-4V)	DULL GRAY	AS4695T20-070 NOTE: BOEING USES AS4695 IN TITANIUM MATERIAL ONLY.

NOTE:
NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2339909 S0000533499_V2

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FLARELESS TUBING ASSEMBLY - REMOVAL/INSTALLATION

1. General

- A. This procedure contains these tasks:
- (1) A removal of the flareless tubing assembly.
 - (2) An installation of the flareless tubing assembly.
 - (3) A check of the electrical resistance specifications in the fuel tank.
 - (4) An installation of flareless fittings in pressurized areas.
 - (5) A check of the tubing clearances.
 - (6) A check of the space between tubing clamps.
- B. You can use these procedures to remove and install all flareless tubing except tubing for the oxygen systems and water and waste systems. Refer to AMM Chapter 35 for Oxygen Systems and AMM Chapter 38 for Water and Waste Systems.
- C. You must identify the tubing assembly configuration and the tubing material before removal.
- D. When you disconnect the tubing, always use the necessary precautions to prevent leakage of fluids. If fluids fall on the airplane, identify the fluid and clean the area as specified for that fluid (TASK 12-25-01-100-801).
- E. When you remove, install, or do work with hydraulic tube assemblies, obey the guidelines that follow:
- (1) When you remove tubes, make sure the tubes and port fittings have tags that identify the correct connection locations.
 - (2) Do not move or change the tube bends. If you move or change the bend in the tube, these bad effects can occur:
 - (a) If you move or change the bend in the tube, it can become possible that the tube will align with the incorrect port fittings. If this occurs, incorrect reconnection or cross-connection of the tubes can become possible.
 - (b) If you move or change the bend in the tube, it can become possible that the tube will have too much stress. Stress can cause cracks in the tubes.
- F. You can use the nuts and fittings again if they are not damaged and there is a good seal on the assembly. Make sure the threads on the nuts and fittings turn smoothly.
- G. Flareless BACS13AP sleeves that are not correctly set can cause leaks. It is recommended that you set flareless sleeves by machine. Set the flareless sleeves by hand only when you cannot set them by machine.

NOTE: It is recommended that cadmium plated corrosion resistant steel or cadmium plated steel fittings be used as replacements for aluminum fittings in the high pressure and normal brake return systems between the antiskid module and parking brake module. Cadmium plated corrosion resistant steel or cadmium plated steel fittings may be used as replacements for aluminum fittings in other systems.

- H. When you install the tubing, align the fittings and tubing so you can tighten the B-nuts by hand before you tighten the B-nuts with a wrench. Do not use the fitting nuts to align the tubing and connections.

NOTE: Move the sleeve until it touches the mating surface. Do not use the nut to pull the tube into position. Leakage from the fittings or the tubing can occur if you cause damage to the fittings or the tubing.

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- I. The 777 airplane uses a new, short "AS" flareless end design for Size 20 and Size 24 fittings. Fittings with the new "AS" design are not interchangeable with existing "MS" flareless fittings. Make sure you note the differences when repairing tube assemblies in Size 20 and 24. In addition, Size 20 and 24 aluminum tubes with BACS13BX sleeves used with the short flareless fittings require a shorter "P" dimension than for the existing "MS" flareless fittings. Note this difference when replacing or repairing Size 20 and 24 tube assemblies with BACS13BX sleeves.

NOTE: Use AS4661 caps and AS4662 plugs with 777 "AS" fittings when protecting/sealing tube ends during removal or repair of tube assemblies.

- J. B-Nut torquing:
- (1) The correct torquing can be applied to B-nut only if the tubing material is identified correctly (aluminum, titanium or steel).
 - (2) If the normal finish color of the B-nut is covered by the gray drilube coating, a color-coded ring is applied on the back side of the B-nut.

Table 401/20-10-09-993-859

TUBE MATERIAL	FINISH	COLOR	B-NUT (MAY BE COVERED WITH DRILUBE)
ALUMINUM	Primer	Green	GOLD OR BROWN
CRES	None, Primer, or Primer plus Enamel	Natural, Green or Grey	SILVER, BRIGHT
TITANIUM	None	Natural	DULL GRAY

- (3) If a steel or titanium B-nut connects to a aluminum tube or fitting, use the lower torque value (aluminum).

- (4) FLARELESS TUBING ASSEMBLY - REPAIRS, PAGEBLOCK 20-10-09/801.

TASK 20-10-09-000-801

2. Flareless Tubing Assembly Removal

A. Procedure

SUBTASK 20-10-09-010-001

 WARNING	REMOVE ALL PRESSURE FROM THE SYSTEM AS SPECIFIED IN THE APPLICABLE MAINTENANCE INSTRUCTIONS BEFORE YOU START THE REMOVAL OF THE FLARELESS TUBING ASSEMBLY. A PRESSURIZED SYSTEM CAN CAUSE INJURY.

- (1) Get access to the tube assembly fittings.

SUBTASK 20-10-09-020-004

- (2) Remove the support clamps on the tubing you will remove.

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SUBTASK 20-10-09-020-006



MAKE SURE EACH TUBE AND THE PORT FITTINGS HAVE TAGS TO IDENTIFY THE CORRECT INSTALLATION LOCATIONS. IF YOU DO NOT PUT TAGS ON THE TUBES AND PORT FITTINGS, CROSS-CONNECTION OF THE TUBES CAN OCCUR DURING INSTALLATION. IF THIS OCCURS, UNINTENDED OPERATION OR MALFUNCTION OF AIRPLANE SYSTEMS CAN RESULT AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

- (3) Install tags on the tubes and port fittings to clearly identify the correct connection locations.

SUBTASK 20-10-09-020-005



USE TWO WRENCHES TO LOOSEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE MATING PART, AND THE OTHER TO LOOSEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND MATING PART CAN OCCUR.

- (4) Loosen the adjacent tubing assemblies and clamps if it is necessary.

SUBTASK 20-10-09-020-001

- (5) Remove the tubing assembly from the airplane.

SUBTASK 20-10-09-420-027

- (6) Install caps on the ports and the hydraulic lines to prevent leakage and contamination.

SUBTASK 20-10-09-160-001



QUICKLY CLEAN THE AREA OF ALL HYDRAULIC FLUID. THE HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE AIRPLANE EQUIPMENT.

- (7) Clean all hydraulic fluid from the area.

————— END OF TASK —————

TASK 20-10-09-400-801

3. Flareless Tubing Assembly Installation

(Figure 405, Figure 406)

A. General

- (1) This task has one or more steps which are a means to satisfy Critical Design Configuration Control Limitation (CDCCL) requirements. A CDCCL note will follow the step to which it applies. Any step or sub-step that precedes or follows a CDCCL identified step is not subject to the CDCCL requirement.
- (a) For important information on CDCCL requirements, refer to this task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801.

NOTE: This is applicable to Airworthiness Limitation 28-AWL-06.

B. References

Reference	Title
12-25-01-100-801	Clean (Wet Wash) the External Surfaces of the Airplane (P/B 301)
20-00-00-910-801	Airworthiness Limitation Precautions (P/B 201)

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C. Procedure

SUBTASK 20-10-09-160-002



DO NOT USE THIS PROCEDURE ON OXYGEN TUBING. GREASE, DIRT, OR OTHER FLAMMABLE MATERIALS IN THE OXYGEN TUBING CAN CAUSE A FIRE OR EXPLOSION.



QUICKLY CLEAN THE INSTALLATION AREA OF ALL HYDRAULIC FLUID. THE HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE AIRPLANE EQUIPMENT.

- (1) Clean all hydraulic fluid from the installation area; do this task: Clean (Wet Wash) the External Surfaces of the Airplane, TASK 12-25-01-100-801.

SUBTASK 20-10-09-210-001

- (2) Examine the tube ends and fittings for defects or contamination that can prevent a good seal during the installation.
 - (a) Clean the area if necessary.

SUBTASK 20-10-09-210-002

- (3) Look for worn areas or dents on the tube.
 - (a) Replace the tube if necessary.

SUBTASK 20-10-09-640-001

- (4) Apply the thread compound applicable to your system, (Table 402) immediately before installation as follows (Figure 405):
 - (a) Apply the thread compound to the circumference of the external threads, shoulder, and conical seal surface of the sleeve.
NOTE: Thread compound is not required when you assemble Dri-Lubed B-nuts.
 - (b) Do not get the thread compound on the internal surfaces of the tube or the inner surface of the bore of the fitting.

Table 402/20-10-09-993-838 Thread Compounds

SYSTEM	BULK CODE	APPROVED THREAD COMPOUND (Straight Thread Fittings)
Compressed Gas (not oxygen)	D50004	Antiseize Compound BMS3-28
Deicing or Anti-icing	D50004	Antiseize Compound BMS3-28
Instrument Air	D50004	Antiseize Compound BMS3-28
Pneumatic	D50004 D00062	Antiseize Compound BMS3-28 or Pneumatic Grease AMS-G-4343
Air Conditioning	D00002 D00062	Antiseize Compound BMS3-28 or Pneumatic Grease AMS-G-4343
Fire Protection	D50004	Antiseize Compound BMS3-28
Coolant	D00070	Hydraulic Fluid MIL-PRF-5606
Water Injection	D50004	Antiseize Compound BMS3-28
Fuel ^[1]	D00070	Hydraulic Fluid MIL-PRF-5606
Lubrication	D00070	Hydraulic Fluid MIL-PRF-5606

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Table 402/20-10-09-993-838 Thread Compounds (Continued)

SYSTEM	BULK CODE	APPROVED THREAD COMPOUND (Straight Thread Fittings)
Hydraulic MIL-PRF-5606	D00070	Hydraulic Fluid MIL-PRF-5606
Hydraulic BMS3-11	D00054	Skydrol Assy Lube MCS 352B
Hydraulic MIL-PRF-6083	D00070 D00106	Hydraulic Fluid MIL-PRF-5606 or Hydraulic Fluid MIL-PRF-6083
Miscellaneous Tubing	D50004 D00053	Antiseize Compound BMS3-28 or Grease AMS-G-6032

*[1] CDCCL - Refer to the task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801, for important information on Critical Design Configuration Control Limitations (CDCCLs). This is applicable to Airworthiness Limitation 28-AWL-06.

SUBTASK 20-10-09-420-001

- (5) Put the tubing assembly in the airplane and keep the tube clamps loose to permit you to align the tube in the fitting.

SUBTASK 20-10-09-820-004

- (6) Look at the tags to make sure the tubes are aligned with the correct port fittings.

SUBTASK 20-10-09-820-001

- (7) Align the tube and fitting by hand and make the tube end touch the bottom of the fitting.

SUBTASK 20-10-09-420-028

- (8) Keep the tube end at the bottom and aligned in the fitting.
(a) Turn the B-nut by hand until the B-nut touches the bottom of the sleeve shoulder.

SUBTASK 20-10-09-420-002



USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE MATING PART, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND MATING PART CAN OCCUR.

- (9) Tighten the flareless tubing assembly with a torque wrench to the installation torque in (Table 404), if it is one of the following types:
- (a) Steel, Titanium, and Cres Tubes:
- 21-6-9 Cres and all other Cres tube ends with BACS13BX swaged sleeves and 21-6-9 Cres tube ends with CRYOLIVE sleeve assemblies.
 - MIL-T-6845, MIL-T-8504 and MIL-T-8808 Cres flared tube ends
 - MIL-T-6845 (304-1/8 hard) Cres using BACS13AP preset sleeve or CRYOLIVE sleeve assembly with a tube wall thickness shown in (Table 403):

Table 403/20-10-09-993-839 Tube Wall Thickness

Tube Dash No.	Wall Thickness
-4	0.020 in. (0.508 mm)
-5	0.020 in. (0.508 mm)
-6	0.028 in. (0.711 mm)
-8	0.035 in. (0.889 mm)
-10	0.049 in. (1.245 mm)

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Table 403/20-10-09-993-839 Tube Wall Thickness (Continued)

Tube Dash No.	Wall Thickness
-12	0.049 in. (1.245 mm)
-16	0.065 in. (1.651 mm)

- 4) Hose end fittings with steel inserts (nipples)
 - 5) All titanium tube ends.
- (b) Aluminum and Annealed Cres Tubes:
- 1) Aluminum with BACS13BX swaged sleeves
 - 2) 6061-T6 aluminum with BACS13BX swaged sleeves (sizes 04 through 16) or CRYOLIVE sleeve assemblies (sizes 04 through 12).
 - 3) Flareless type hose end fittings with aluminum inserts (nipples)
 - 4) Aluminum flared tube ends.
- (c) Tube Material Specifications:
- 1) 6061-T6 aluminum - MIL-T-7081, WW-T-700/6, AMS4083
 - 2) Annealed Cres - MIL-T-8504, MIL-T-8606, MIL-T-8808
 - 3) 1/8 hard Cres - MIL-T-6845
 - 4) 21-6-9 Cres - BMS7-185
 - 5) TI-3AL-2.5V-BMS7-234 and AMS4945.

Table 404/20-10-09-993-841 Tubing Assembly - Installation Torque

ANNEALED OUTER DIAMETER	TUBE DASH NO.	STEEL, TITANIUM, AND CRES TUBES TORQUE	ALUMINUM & ANNEALED CRES TUBES TORQUE
3/16 in. (4.762 mm)	-3	100 ±5 in-lb (11 ±1 N·m)	80 ±4 in-lb (9 ±0 N·m)
¼ in. (6.350 mm)	-4	140 ±7 in-lb (16 ±1 N·m)	110 ±6 in-lb (12 ±1 N·m)
5/16 in. (7.938 mm)	-5	190 ±10 in-lb (21 ±2 N·m)	140 ±7 in-lb (16 ±1 N·m)
¾ in. (9.525 mm)	-6	270 ±14 in-lb (31 ±2 N·m)	170 ±9 in-lb (19 ±1 N·m)
0.500 in. (12.700 mm)	-8	500 ±25 in-lb (56 ±3 N·m)	280 ±14 in-lb (32 ±2 N·m)
⅝ in. (15.875 mm)	-10	700 ±35 in-lb (79 ±4 N·m)	360 ±18 in-lb (41 ±2 N·m)
¾ in. (19.050 mm)	-12	900 ±45 in-lb (102 ±5 N·m)	450 ±23 in-lb (51 ±3 N·m)
1.000 in. (25.400 mm)	-16	1200 ±60 in-lb (136 ±7 N·m)	750 ±38 in-lb (85 ±5 N·m)
1¼ in. (31.750 mm)	-20	1600 ±80 in-lb (181 ±9 N·m)	900 ±45 in-lb (102 ±5 N·m)
1½ in. (38.100 mm)	-24	2000 ±100 in-lb (226 ±11 N·m)	900 ±45 in-lb (102 ±5 N·m)
2.000 in. (50.800 mm)	-32	2000 ±100 in-lb (226 ±11 N·m)	--

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SUBTASK 20-10-09-420-003

- (10) If the flareless tubing assembly is a reducer fitting, use the boss or bulkhead size to get the correct torque and tighten the assembly.

SUBTASK 20-10-09-420-004



CAUTION USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE MATING PART, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND MATING PART CAN OCCUR.

- (11) Tighten the flareless tubing assembly with a torque wrench to the installation torques in (Table 405, Table 406) if it is an assembly that follows:
- (a) Steel, Titanium, and Cres Tubes:
- 1) MIL-T-6845 (304-1/8 hard) Cres with BAC13AP preset sleeve with a wall thickness shown in (Table 405):

Table 405/20-10-09-993-842 Steel, Titanium, and Cres Tubes

Tube Dash No.	Wall Thickness	Torque
-8	0.028 in. (0.711 mm)	375 in-lb (42 N·m)
-10	0.035 in. (0.889 mm)	575 in-lb (65 N·m)
-12	0.042 in. (1.067 mm)	725 in-lb (82 N·m)

- (b) Aluminum and Annealed Cres Tubes:
- 1) 6061-T6 aluminum and Annealed Cres with BACS13AP sleeves with a wall thickness shown in (Table 406):

Table 406/20-10-09-993-843 Aluminum and Annealed Cres Tubes

Tube Dash No.	Wall Thickness	Torque
-6	0.020 in. (0.508 mm)	160 in-lb (18 N·m)
-10	0.020 in. (0.508 mm)	250 in-lb (28 N·m)
-12	0.020 in. (0.508 mm)	325 in-lb (37 N·m)

SUBTASK 20-10-09-420-005



CAUTION USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE MATING PART, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND MATING PART CAN OCCUR.

- (12) Tighten the flareless tubing assembly with a torque wrench to the installation torque (Table 404, Table 405, Table 406) if it is a material listed above as follows:
- (a) Hold the union with a wrench and tighten the B-nut to the recommended torque value (Table 404).
- NOTE:** If you have a leak, you can loosen and tighten the B-nut again.
- 1) Do not use the B-nut to align the tube.
 - 2) Do not let the B-nut touch the bottom of the sleeve shoulder.

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SUBTASK 20-10-09-420-006

- (13) On nuts which you can not get access to with a torque wrench, tighten the nuts with your hand as follows:

- (a) Hand tighten until a clear increase in torque occurs, then tighten 1/6 to 1/3 turn more.
- (b) Tighten the flareless fittings with the BACS13AP sleeves two times (tighten, loosen, and tighten again).

NOTE: The maximum tube collapse permitted after you tighten the BACS13AP sleeves is 0.015 in. (0.381 mm) less than the tube diameter.

SUBTASK 20-10-09-420-007



ALWAYS KEEP THE CLAMPS TIGHT. TIGHT CLAMPS KEEP THE AREA BETWEEN THE TUBE AND THE CLAMP SURFACES FREE OF UNWANTED MATERIALS AND CONTAMINATION. IF SURFACES ARE NOT CLEAN, DAMAGE BY FRICTION CAN OCCUR.

- (14) Tighten all of the tube clamps.

- (a) Make sure that you do not clamp the tube at the repair fitting location.

NOTE: Clamps are sized to fit standard tube diameters. If a repair swage is clamped, the clamp can move off of the uniform surface because the tube can migrate or flex.

28-AWL-06: CDCCL

SUBTASK 20-10-09-280-003

- (15) If you replaced hydraulic tubing in the fuel tank, measure the resistance cross the in-line (tube-to-tube) fittings (TASK 20-10-09-760-801).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801, for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: This is applicable to Airworthiness Limitation 28-AWL-06.

SUBTASK 20-10-09-710-001

- (16) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

SUBTASK 20-10-09-710-002

- (17) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

————— END OF TASK —————

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TASK 20-10-09-760-801

4. Electrical Resistance Specifications in the Fuel Tank Check

(Figure 407, Figure 408, Figure 401, Figure 402, Figure 403)

A. General

- (1) This task gives the steps to measure the electrical resistance across tubes and fittings in the fuel tanks.
- (2) This task has one or more steps which are a means to satisfy Critical Design Configuration Control Limitation (CDCCL) requirements. A CDCCL note will follow the step to which it applies. Any step or sub-step that precedes or follows a CDCCL identified step is not subject to the CDCCL requirement.
 - (a) For important information on CDCCL requirements, refer to this task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801.

NOTE: This is applicable to Airworthiness Limitation 28-AWL-06.

B. References

Reference	Title
20-00-00-910-801	Airworthiness Limitation Precautions (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1550	Bonding Meters - Approved, Intrinsically Safe (Approved for use in Class I, Divisions I & II hazardous (classified) locations. Outside these hazardous locations, COM-614 can be used in lieu of COM-1550). Part #: 620LK Supplier: 1CRL2 Part #: M1 Supplier: 3AD17 Part #: T477W Supplier: 01014 Opt Part #: M1B Supplier: 3AD17

D. Procedure

SUBTASK 20-10-09-760-005



MAKE SURE A METER YOU USE IS RESISTANT TO AN EXPLOSION. IF NOT, MAKE SURE THE AMOUNT OF DANGEROUS GAS, AS MEASURED BY A GAS DETECTOR, IS LESS THAN 10 PERCENT OF THE LOWER EXPLOSIVE LIMIT. IF NOT, AN EXPLOSION CAN OCCUR WHICH CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

- (1) Do a check of the electrical resistance with the intrinsically safe approved bonding meter, COM-1550.

SUBTASK 20-10-09-760-001



MAKE SURE THE BOND RESISTANCE IS NOT MORE THAN THE VALUES SHOWN. BOND RESISTANCE IS VERY IMPORTANT IF A LIGHTNING STRIKE OCCURS.

- (2) Replace the fittings which have resistances more than the values in (Table 407, Table 408)

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- (a) Do a check of the resistance again.

NOTE: Do not use bonding jumpers to connect high resistance hydraulic installations.

SUBTASK 20-10-09-760-002

- (3) Measure the resistance between the bulkhead fittings and hydraulic tube (Figure 401).
(a) Make sure the resistance is less than the value shown in (Table 407)

Table 407/20-10-09-993-861

TUBE MATERIAL	TUBE SIZE	TUBE CONFIGURATION	MAXIMUM RESISTANCE - MILLIOHMS	MAXIMUM RESISTANCE - OHMS
Aluminum	-06	--	0.70	0.0007
	-08	--	0.50	0.0005
	-10	--	0.41	0.0041
	-12	--	0.30	0.0003
	-16	--	0.20	0.0002
	-20	--	0.10	0.0001
Titanium	-06	Flareless	8.0	0.008
		Permanent	4.0	0.004
	-08	Flareless	5.0	0.005
		Permanent	2.5	0.0025
	-10	Flareless	3.0	0.003
		Permanent	1.5	0.0015
	-12	Permanent	1.3	0.0013
	-16	Permanent	0.81	0.00081

SUBTASK 20-10-09-760-008

- (4) Measure the resistance across the bulkhead fitting and structure (Figure 402).
(a) Make sure that the resistance is less than 1 milliohm (0.001 ohm).

SUBTASK 20-10-09-760-003

 28-AWL-06: CDCCL

- (5) Measure the electrical bonding resistance across the in-line union/tee fittings (tube-to-tube) (Figure 408, Figure 403).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801, for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: This is applicable to Airworthiness Limitation 28-AWL-06.

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28-AWL-06: CDCCL

- (a) Make sure the electrical bonding resistance is equal to or less than the value in the Table 408.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions, TASK 20-00-00-910-801, for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: This is applicable to Airworthiness Limitation 28-AWL-06.

Table 408/20-10-09-993-917

TUBE MATERIAL (Figure 404)	TUBE SIZE	MAXIMUM RESISTANCE - OHMS (MILLOHMS)
Aluminum (part number is rubber stamped with clear overcoat) (swage joints that connect aluminum tubes are green)	-06 to -08 ($\frac{3}{8}$ inch to $\frac{1}{2}$ inch (10 mm to 13 mm) diameter)	0.0015 (1.5)
	-10 to -20 ($\frac{5}{8}$ inch to 1- $\frac{1}{4}$ inch (16 mm to 32 mm) diameter)	0.0010 (1.0)
Titanium (part number is electro-etched)	-06 to -08 ($\frac{3}{8}$ inch to $\frac{1}{2}$ inch (10 mm to 13 mm) diameter)	0.0080 (8.0)
	-10 to -16 ($\frac{5}{8}$ inch to 1- $\frac{1}{4}$ inch (16 mm to 32 mm) diameter)	0.0030 (3.0)

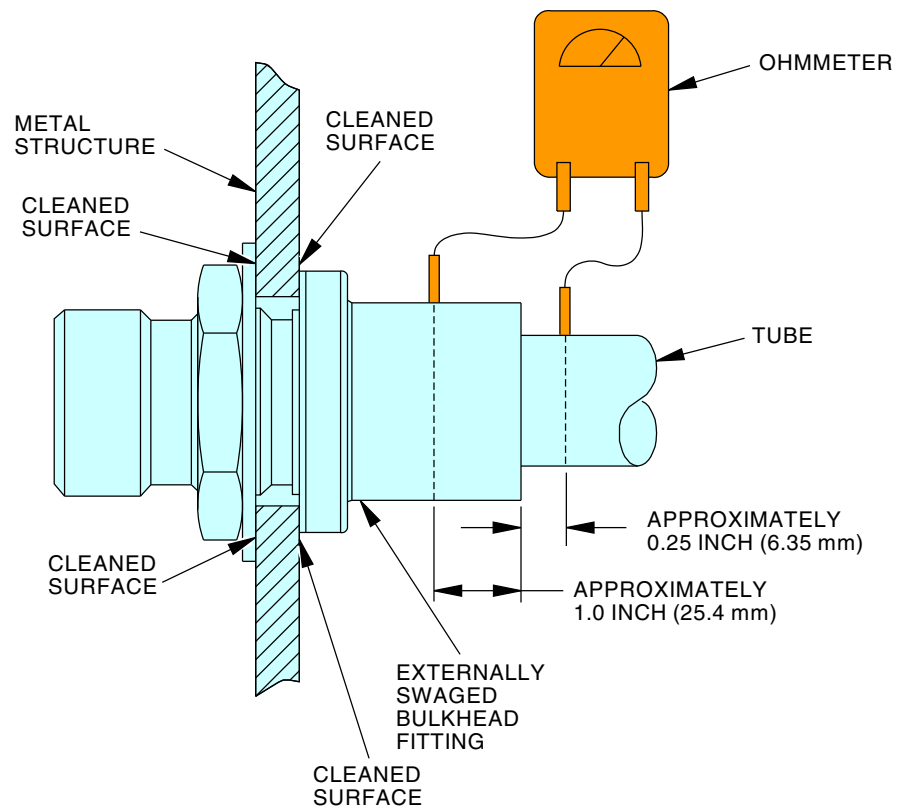
———— **END OF TASK** ————

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2167479 S0000477039_V2

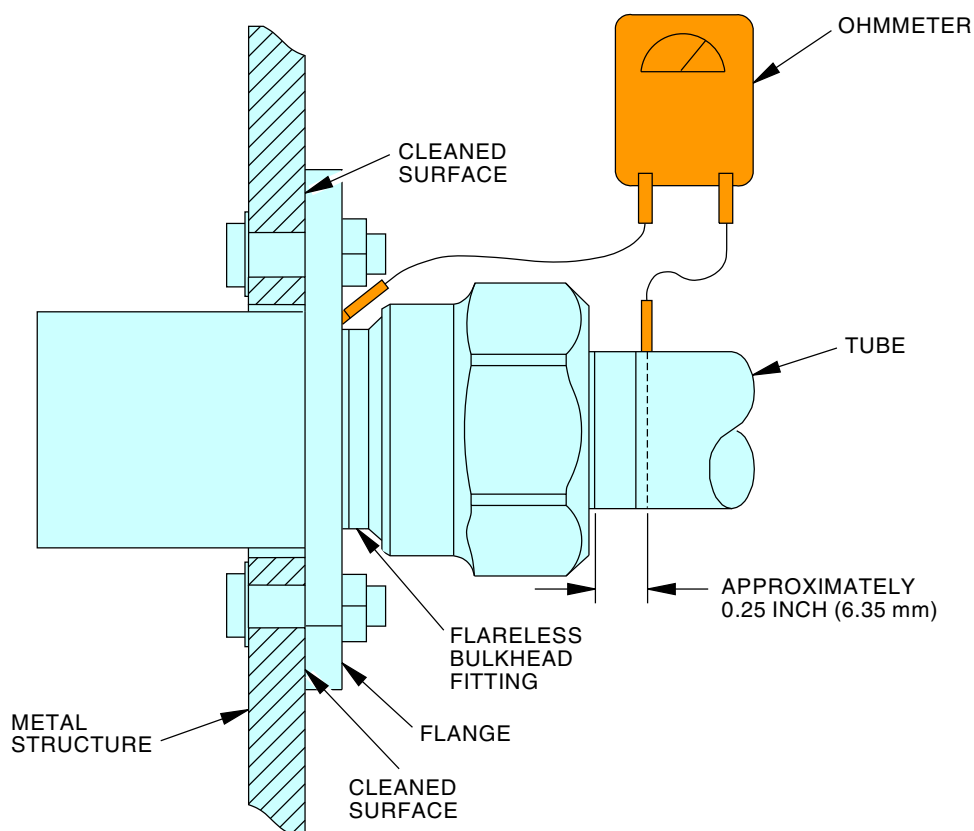
**Resistance Measurement from Bulkhead Fitting to Hydraulic Tube
Figure 401/20-10-09-990-907 (Sheet 1 of 2)**

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2178217 S0000480712_V2

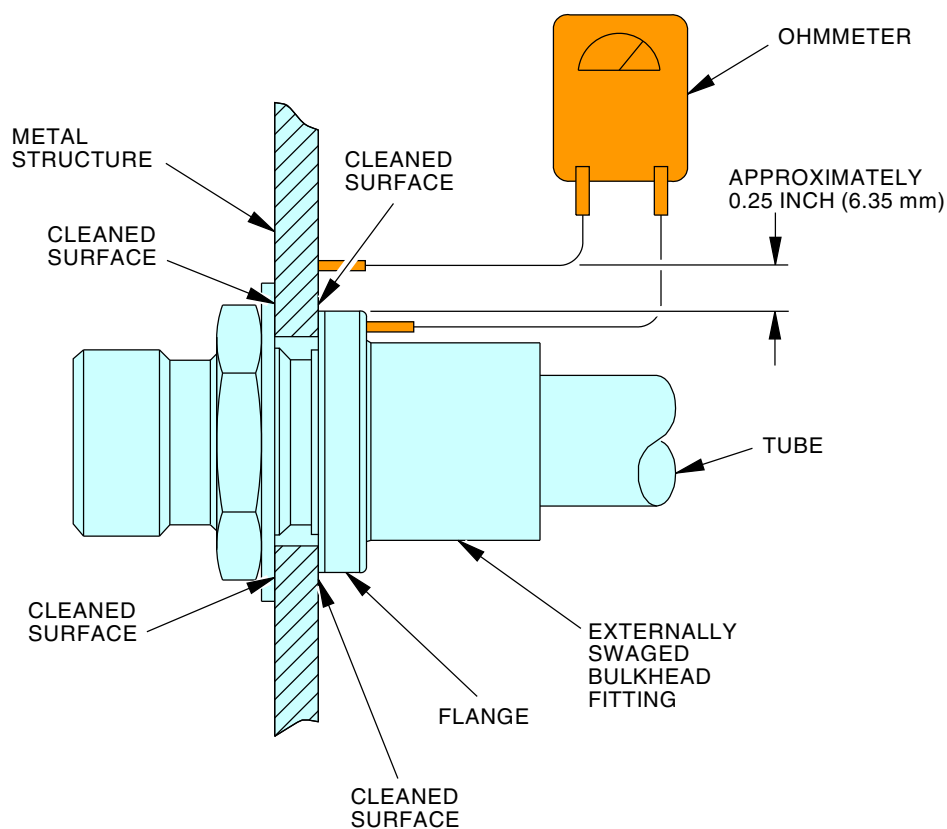
Resistance Measurement from Bulkhead Fitting to Hydraulic Tube
Figure 401/20-10-09-990-907 (Sheet 2 of 2)

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2167498 S0000477040_V2

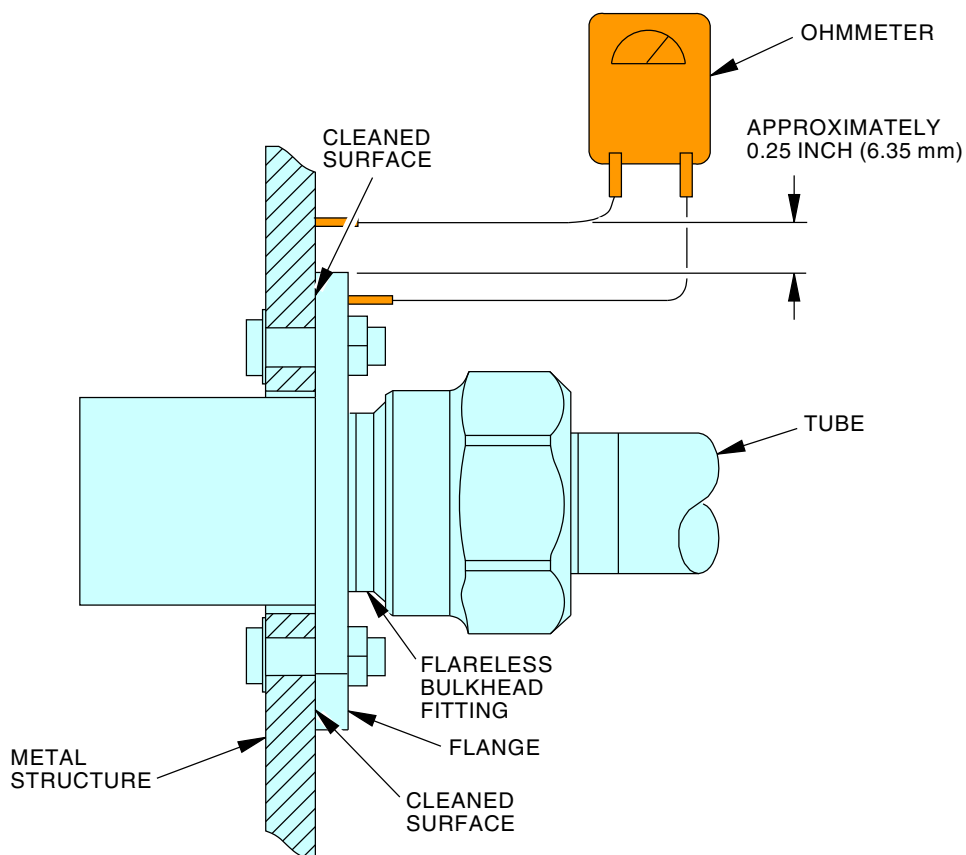
Resistance Measurement from Bulkhead Fitting to Structure
Figure 402/20-10-09-990-908 (Sheet 1 of 2)

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2178242 S0000480713_V2

Resistance Measurement from Bulkhead Fitting to Structure
Figure 402/20-10-09-990-908 (Sheet 2 of 2)

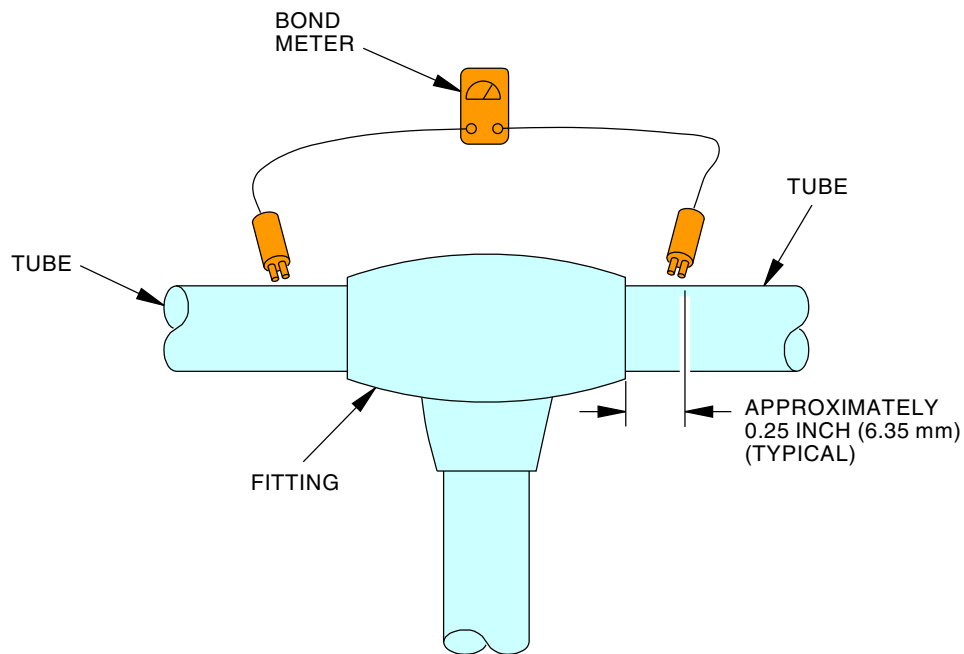
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2167532 S0000477041_V2

Resistance Measurement Across Tee/Union Fittings
Figure 403/20-10-09-990-909

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EXAMPLE OF ALUMINUM TUBE
(PART NUMBER IS RUBBER STAMPED WITH CLEAR OVERCOAT ON TUBE)



EXAMPLE OF TITANIUM TUBE
(PART NUMBER IS ELECTRO-ETCHED ON TUBE)

2338835 S0000533054_V2

Examples of Aluminum and Titanium Tubes
Figure 404/20-10-09-990-938

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TASK 20-10-09-000-802

5. Flareless Fittings in Pressurized, Strut, Fuel Tank, and Cargo Areas Installation

A. References

Reference	Title
20-10-09-300-801	Tube Repair (P/B 801)

B. Procedure

SUBTASK 20-10-09-300-001

- (1) Make the necessary repairs to the flareless tubing assembly; do this task: Tube Repair, TASK 20-10-09-300-801.

SUBTASK 20-10-09-420-029

- (2) Tighten the flareless fittings with the BACS13AP sleeves two times (tighten, loosen, and tighten again).

NOTE: Be careful to make sure that the fittings will not have leaks after you tighten the fittings.

SUBTASK 20-10-09-420-030

- (3) Tighten flareless fittings with BACS13BX, welded-on, or NAS1760-type sleeves as follows:
 - (a) Tighten the fitting to the applicable torque shown in (Table 404, Table 405, Table 406)
 - (b) Loosen the fitting to release the torque.
 - (c) Tighten the fitting to the torque shown in (Table 406, Table 405, Table 404).

SUBTASK 20-10-09-760-004

- (4) If you install flareless fittings in the fuel tanks, do this task: Electrical Resistance Specifications in the Fuel Tank Check, TASK 20-10-09-760-801

SUBTASK 20-10-09-790-001

- (5) Do a leak test on the repair installations of the flareless fittings in pressurized areas as follows:
 - (a) Pressurize the system for a minimum of 15 minutes.
 - (b) With the system pressurized, use a clean white cloth to do a check on the tube-to-fitting interface for signs of hydraulic leakage.

NOTE: You can tighten the tube again to the torque value shown above, if you find leakage. If leakage occurs in subsequent leak tests, you must replace the repair installation.

SUBTASK 20-10-09-710-003

- (6) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

SUBTASK 20-10-09-710-004

- (7) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

————— **END OF TASK** —————

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TASK 20-10-09-200-801

6. Tubing Clearances Check

A. General

- (1) This task gives you the minimum clearances necessary between tubes and all other components (hoses, fittings, structure, and other tubes). These clearances prevent tube damage in all positions of operation.

B. Procedure

SUBTASK 20-10-09-420-031

- (1) Make sure the installed tubing and fittings meet these minimum clearance requirements.

NOTE: Install the tubes with a minimum of force on the clamps or the tubing.

(a) Supported Locations

- 1) 0.10 in. (2.54 mm) from adjacent structure, fixed and moving equipment, other tubing, and fitting connectors.

NOTE: Clearance may be cushion or clamp thickness where tubing is clamped directly to supporting structure

NOTE: Supported locations are locations within 3 in. (76.20 mm) of a clamp.

- 2) Make sure that you do not clamp the tube at the repair fitting location.

NOTE: Clamps are sized to fit standard tube diameters. If a repair swage is clamped, the clamp can move off of the uniform surface because the tube can migrate or flex.

(b) Unsupported Locations

- 1) 0.20 in. (5.08 mm) from adjacent structure, fixed and moving equipment, other tubing, and fitting connectors.

NOTE: Unsupported locations are locations more than 3 in. (76.20 mm) from a clamp.

(c) Fuel Systems

- 1) 2.00 in. (50.80 mm) from electrical wiring.

(d) Hydraulic Systems

- 1) 0.50 in. (12.70 mm) from electrical wiring
- 2) 0.25 in. (6.35 mm) under adverse conditions resulting from relative motion of adjoining components.

SUBTASK 20-10-09-430-001

- (2) If tubes go through or across each other or are parallel, make sure there are sufficient clamps attached. Clearance must be 0.25 in. (6.35 mm) minimum or the thickness caused by back-to-back clamping.

NOTE: You can use more back-to-back clamping than that on the supplied airplane to get the necessary clearance.

- (a) Make sure that you do not clamp the tube at the repair fitting location.

NOTE: Clamps are sized to fit standard tube diameters. If a repair swage is clamped, the clamp can move off of the uniform surface because the tube can migrate or flex.

SUBTASK 20-10-09-420-032

- (3) For loop-type clamps do these checks:

NOTE: Do not use NAS42 or NAS43 clamps on hydraulic tubes.

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- (a) To get the necessary clearances with the loop-type clamps, use BACS18AF3 or BACS18AF4 spacers to get the necessary height.

NOTE: On the U-type clamps, use BACS18AN spacers.

- 1) Do not use more than four spacers together. If more than four spacers are necessary, find the cause and correct the problem.

- (b) Make sure that you do not clamp the tube at the repair fitting location.

NOTE: Clamps are sized to fit standard tube diameters. If a repair swage is clamped, the clamp can move off of the uniform surface because the tube can migrate or flex.

SUBTASK 20-10-09-220-005

- (4) Make sure the tubes are clear of the control cables between the break points or the fairleads and the control cable linkage.

SUBTASK 20-10-09-220-006

- (5) Make sure the minimum clearance between the tubes in the clampblocks and the channels on the clampblocks is 0.060 in. (1.524 mm).

NOTE: If this clearance is less, correct the spacer tube length (NAS43003-) or correct the force on the tubes in the clamp block.

————— **END OF TASK** —————

TASK 20-10-09-200-802

7. Space Between Tubing Clamps Check

A. Procedure

SUBTASK 20-10-09-220-007

- (1) Make sure the space between the tubing clamps are within the limits shown in (Table 409), unless it is specified differently.

Table 409/20-10-09-993-847 Maximum Space Between Tubing Clamps

TUBE OD	MATERIAL	CLAMP SPACE - VISUAL	CLAMP SPACE - SPECIAL ^{*[1]}
¼ in. (6.350 mm)	Steel, Titanium	16 in. (406 mm)	12 in. (305 mm)
⅜ in. (9.525 mm)	Steel, Titanium	20 in. (508 mm)	15 in. (381 mm)
⅜ in. (9.525 mm)	Aluminum	16.5 in. (419.1 mm)	12 in. (305 mm)
0.500 in. (12.700 mm)	Steel, Titanium	23 in. (584 mm)	17 in. (432 mm)
0.500 in. (12.700 mm)	Aluminum	19 in. (483 mm)	14 in. (356 mm)
⅝ in. (15.875 mm)	Steel, Titanium	22 in. (559 mm)	18.5 in. (469.9 mm)
⅝ in. (15.875 mm)	Aluminum	22 in. (559 mm)	16.5 in. (419.1 mm)
¾ in. (19.050 mm)	Steel, Titanium	27.5 in. (698.5 mm)	20.5 in. (520.7 mm)
¾ in. (19.050 mm)	Aluminum	24 in. (610 mm)	18 in. (457 mm)

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Table 409/20-10-09-993-847 Maximum Space Between Tubing Clamps (Continued)

TUBE OD	MATERIAL	CLAMP SPACE - VISUAL	CLAMP SPACE - SPECIAL ^{*[1]}
1.000 in. (25.400 mm)	Steel, Titanium	30 in. (762 mm)	22.5 in. (571.5 mm)
1.000 in. (25.400 mm)	Aluminum	26.5 in. (673.1 mm)	19.5 in. (495.3 mm)
1¼ in. (31.750 mm)	Steel, Titanium	31.5 in. (800.1 mm)	23.5 in. (596.9 mm)
1¼ in. (31.750 mm)	Aluminum	28.5 in. (723.9 mm)	21 in. (533 mm)

^{*[1]} Special: Wing Rear Spar, Engine Strut, Engine Aft Fairing.

———— **END OF TASK** ————

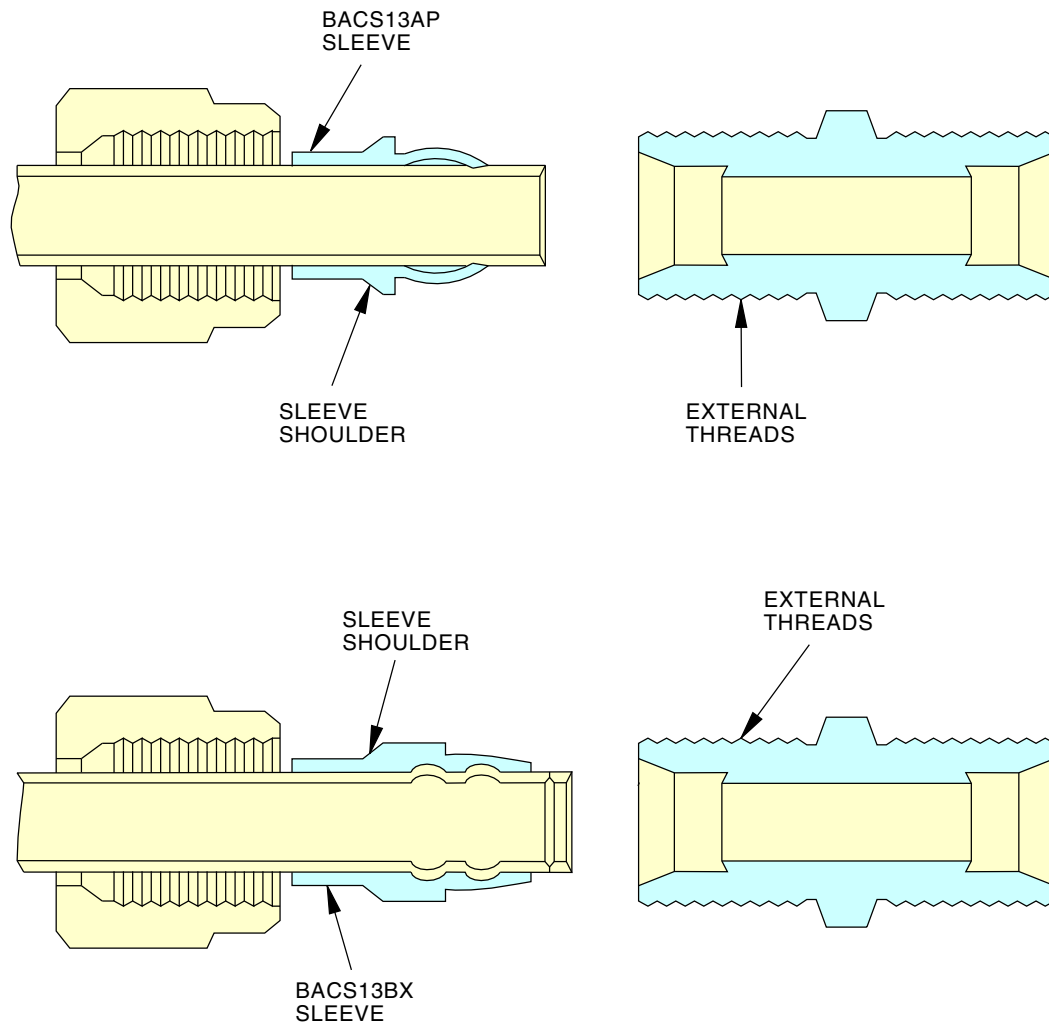
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LUBRICATION POINTS

C28550 S0006402363_V2

Flareless Tubing Assembly Lubrication Points
Figure 405/20-10-09-990-801

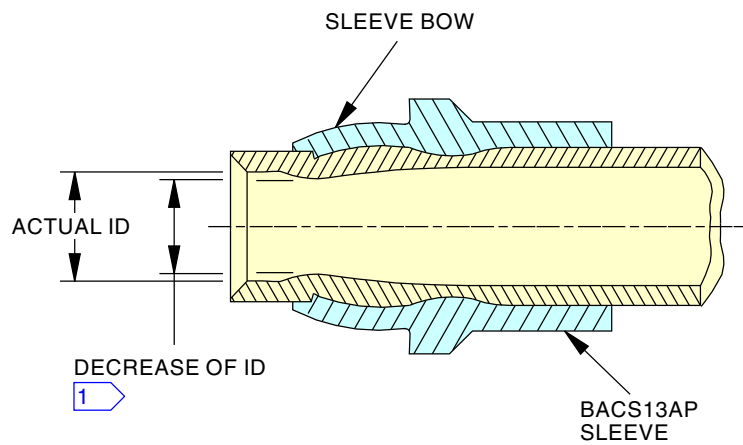
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- 1 MAKE SURE THE DECREASE OF ID IS NOT MORE THAN 0.005 INCH AFTER PRESET OR 0.015 INCH AFTER MANY TIGHTENINGS

K22743 S0006402364_V2

Maximum Collapse of Preset Flareless Sleeve
Figure 406/20-10-09-990-802

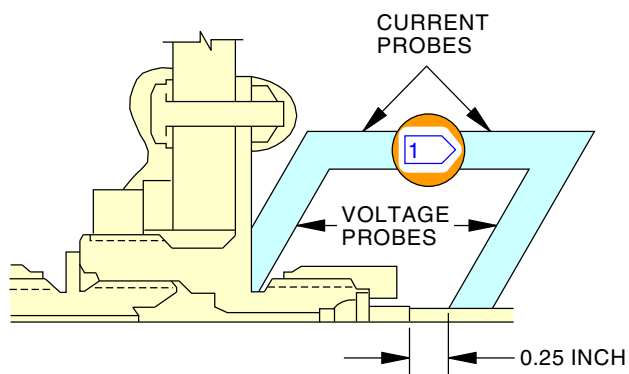
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SCREW TOGETHER WELD-ON BULKHEAD FITTING

 MICRO-OHMMETER

K22746 S0006402365_V2

Bulkhead Fittings
Figure 407/20-10-09-990-803

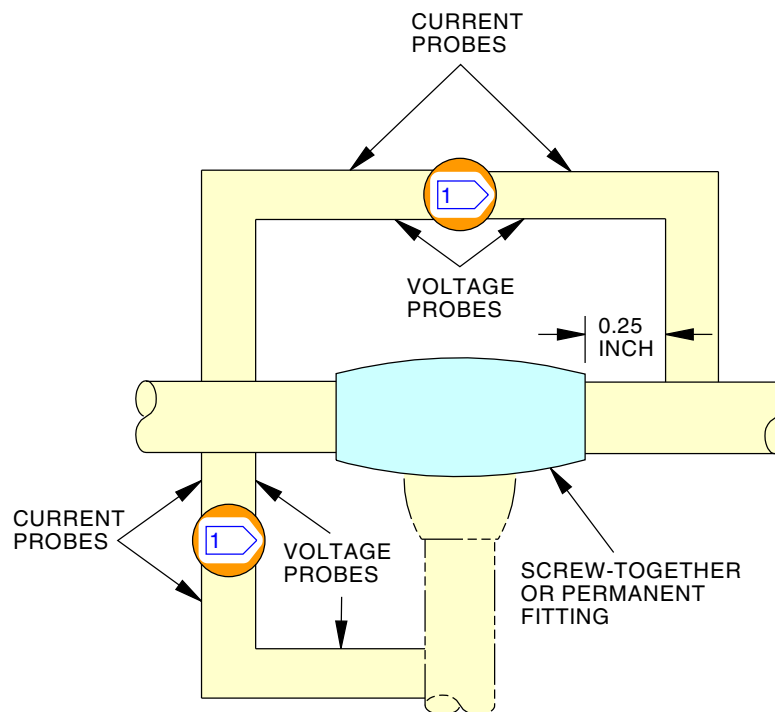
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 MICRO-OHMMETER

C52170 S0006402366_V2

Union/Tee Fittings
Figure 408/20-10-09-990-804

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FLARELESS TUBING ASSEMBLY - REPAIRS

1. General

- A. These procedures do not apply to the Oxygen System Tubing. The customer should consult Boeing before performing any such repairs.
- B. This procedure has these tasks:
 - (1) Tube Fitting and Leakage
 - (2) Retightening of Fitting Joints with Persistent Hydraulic Leaks.
 - (3) Tube Repair
 - (4) Titanium Hydraulic Tubing, 3000 psi - Roll Swaging Harrison 53211 Sleeves and 53212 Unions using the Harrison 6777 Swage Machine
 - (5) Install the CRYOLIVE Flareless Sleeve Assembly
 - (6) BACS13BX Flareless Sleeve Swaging with the Harrison Swagers 5175, 5570, and 5720
 - (7) BACS13BX Flareless Sleeve Swaging with the 6633K01 Harrison Roller Swaging Kit
 - (8) BACS13AP Flareless Sleeve Preset
 - (9) BACC42W H-Coupling Installation
 - (10) 3P02111/3PHS111 Cryofit Coupling Installation
 - (11) Externally Swaged (Permaswage) Fittings Installation
 - (12) Axial Swage Fitting Union Installation (8,000 psi Rated - Rynglok)
 - (13) Axial Swage Fitting Installation (5,000 psi rated - Union) or Male/Female Adapter Fitting
 - (14) Hydraulic Tubing Repair with Flexible Hoses
 - (15) Repair Size 16 (1 inch) and Size 20 (1-1/4 inch) 6061-T4 Aluminum Tubing in the Hydraulic System of the Airplane.
 - (16) Part Marking of Flareless Tubing Assemblies
 - (17) Fire resistant Silicone Tape to Nose Landing Gear Alternate Extension Hydraulic Tube - Installation
- C. This procedure gives the approved repairs for hydraulic, pneumatic, water, electrical rigid conduit, pitot/static tubing, cargo fire protection tubing, and other tube assemblies.
 - (1) Repair procedures include the replacement of damaged tube ends or the replacement of small damaged tube parts. You can use flareless tubes and sleeves, H-Coupling assemblies, Cryofit couplings, Permaswage fittings, Cryolive assemblies, or Rynglok unions.
 - (2) For repair of electrical flexible conduit, do this task: SWPM 20-10-91.
- D. You can repair 6061-T4 aluminum tubes using 6061-T4 or 6061-T6 aluminum tube and flareless fittings. It is not acceptable to repair 6061-T6 aluminum tube with 6061-T4 aluminum tube or use 6061-T4 tube in place of 6061-T6 aluminum tube. The replacement lines should be marked with a part number similar to, but not the same as, the original tube. (Refer to the task for Part Marking of Flareless Tubing Assemblies.)
- E. You can use approved 304-1/8 Hard or 21-6-9 corrosion-resistant steel tube material for replacement or repair of titanium tube assemblies. You can also use approved 304-1/8 Hard corrosion-resistant steel tube material for replacement or repair of 21-6-9 corrosion-resistant steel tube assemblies. When a new tube is fabricated to replace an existing tube assembly, the replacement tube assembly should be marked with a part number similar to, but not the same, as the original tube. (Refer to the task for Part Marking of Flareless Tubing Assemblies.)

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USE CADMIUM PLATED STEEL FITTINGS WHEN REPLACING ALUMINUM LINES WITH CORROSION RESISTANT STEEL LINES. GALVANIC CORROSION MAY OCCUR IF CADMIUM PLATED STEEL IS NOT USED.

- F. Replacements for aluminum lines may be made from corrosion resistant steel material. The replacement lines should be marked with a part number similar to, but not the same as, the original tube. (Refer to the task for Part Marking of Flareless Tubing Assemblies.)
- G. When you do repairs, the type of flareless tube sleeves will tell you the installation method to use.
 - (1) Use the approved power swaging equipment, or roller swaging, to do all swaged-on sleeves and fittings.
 - (2) You can preset BACS13AP flareless sleeves by machine. Preset by hand only when a hydraulic or pneumatic-operated presetting tool is not available. If you must preset by hand, we recommend you preset some samples. Cut the samples into sections longitudinally and make an inspection of the ring cut depth before you preset the part to be repaired.
 - (3) You can install the Cryolive sleeve assembly, consisting of Cryolive sleeve, coupling nut and protective cover/inspection tool, by removing the assembly from liquid nitrogen and sliding it onto the tube end. Note that the size 10, 12, and 16 coupling nuts used with the Cryolive sleeve are slightly longer than standard MS type coupling nuts and are not interchangeable with MS type coupling nuts.
- H. The H-coupling assembly is a repair coupling which has a union coupling, a slide, and a nut. You can install the H-coupling assembly in straight sections of the tube. Use two end wrenches of applicable size. This assembly is approved for fuel and hydraulic high pressure lines of 21-6-9, titanium 3AL-2.5V, and 304-1/8 hard CRES tubing. The H-coupling assembly is also approved for the repair of 304 CRES annealed and 6061-T6 aluminum tubing lines of 1500 psi (10,342 kPa) or less.
- I. You can use a Cryofit coupling for the inline repair of 3AL-2.5V titanium tubing. To install the Cryofit coupling in a straight tube section, shrink fit the coupling in its position.
- J. You can use the Permaswage coupling for inline repair of 6061-T6 aluminum, 21-6-9 CRES or 304-1/8 hard CRES, and 3AL-2.5V titanium tubing.
- K. You can use the Rynglok union for inline repair of 6061-T6 aluminum, 21-6-9 CRES or 304-1/8 hard CRES, and 3AL-2.5V titanium tubing. Rynglok unions are made of lightweight 6AL-4V titanium alloy and are not to be used in oxygen systems or in fuel cells.



DO NOT USE FITTING NUTS TO ALIGN THE FITTINGS. FITTING NUTS USED TO ALIGN FITTINGS DURING THE TUBE INSTALLATION WILL INCREASE THE RISK OF LEAKAGE, BLOWOFF, OR OTHER FAILURE.

- L. When you repair a section of a tube, correctly align the tube and the fittings. Make sure the fittings touch the bottom at the two ends of the repaired section.
- M. Do a pressure test on completed repairs in all general areas. In pressurized areas, pressurize the system for 15 minutes minimum to do a leak test. To make sure there are no signs of hydraulic leakage, rub the area with a finger or a white cloth.
- N. When you remove, install, or do work with hydraulic tube assemblies, obey the guidelines that follow:
 - (1) When you remove tubes, make sure the tubes and the port fittings have tags that identify the correct connection locations.



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- (2) Do not move or change the tube bends. If you move or change the bend in the tube, these bad effects can occur:
- (a) If you move or change the bend in the tube, it can become possible that the tube will align with the incorrect port. If this occurs, incorrect reconnection or cross-connection of the tubes can become possible.
 - (b) If you move or change the bend in the tube, it can become possible that the tube will have too much stress. Stress can cause cracks in the tubes.
- (3) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more components to which the tubes are connected as a check.
- (4) If you disconnected electrical wires to get access to the hydraulic tube and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more components to which the wires are connected as a check.
- O. Hydraulic system pressure specifications are below:
- (1) Maximum working pressure:
 - (a) Anytime repairs to the tubes are made on the airplane, or when any hydraulic component is to be checked.
 - (2) Proof pressure:
 - (a) If the tubes are repaired and to be tested in the shop.
 - (3) Burst pressure:
 - (a) This is for design reference only.
- P. B-Nut torquing:
- (1) The correct torquing can be applied to B-nut only if the tubing material is identified correctly (aluminum, titanium or steel).
 - (2) If the normal finish color of the B-nut is covered by the gray drilube coating, a color-coded ring is applied on the back side of the B-nut (Table 801).

Table 801/20-10-09-993-902

TUBE MATERIAL	TUBE FINISH	COLOR	B-NUT (MAY BE COVERED WITH DRILUBE)
ALUMINUM	Primer or Primer plus Enamel	Green or White	Gold or Brown
CRES	None or Primer	Natural or Green	Silver, Bright
TITANIUM	None	Natural	Dull Gray

- (3) If a steel or titanium B-nut connects to a aluminum tube or fitting, use the lower torque value (aluminum).

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DO NOT ALLOW PUMPS, VALVES, ACTUATORS OR OTHER COMPONENTS TO HANG FROM KEVLAR HOSES. KEVLAR HYDRAULIC HOSES KINK EASILY AND MAY CAUSE LEAKAGE.

- Q. When you do repairs to Kevlar hydraulic hoses, remember Kevlar hoses kink more easily than CRES (steel) wire braided hoses.

TASK 20-10-09-360-801

2. Tube and Fitting Leakage

A. General

- (1) Use this procedure to help find and repair hydraulic leaks in tubes and fittings.
 - (a) Leakages and Failures in Tubes can be caused by the following:
 - 1) Fatigue cracks that start because of damage from an external impact.
 - 2) Fatigue cracks that start from vibration as a result of incorrect support.
 - 3) Fatigue cracks that start because of a preload that is induced during installation.
 - 4) Fatigue because of loss of the tube wall from chafing contact with another tube, structure or other component.
 - 5) Fatigue from stress because of excess ovality at a tube bend.

B. References

Reference	Title
20-10-09 P/B 401	FLARELESS TUBING ASSEMBLY - REMOVAL/INSTALLATION
20-10-09-400-801	Flareless Tubing Assembly Installation (P/B 401)
20-10-16 P/B 401	RECESSED BOSS SEAL FITTINGS - REMOVAL/INSTALLATION
20-10-19 P/B 401	O-RINGS - REMOVAL/INSTALLATION

C. Procedure

SUBTASK 20-10-09-790-005

- (1) Do a leak check to check for the location of the leak.
 - (a) Pressurize the system for a minimum of 15 minutes.
 - (b) With the system pressurized, do a check of the tubes and fittings for signs of hydraulic leakage.
 - 1) Use a clean white cloth to find hydraulic leakage.
 - 2) Record the location of the leak.
 - a) If the hydraulic tube is pressurized, some leaks will be easy to find because the fluid will spray some distance from the source. [See Figure 801, sheet 1]
 - b) If the hydraulic tube is not pressurized, the source of the leak may not be clear. In this condition, examine areas above and around the fluid for the possible source.
 - NOTE: The source of the leak may be some distance away from the visible fluid.
 - c) For aluminum tubes examine at or below the end sleeve for signs of corrosion that can cause a leak. [See Figure 801, sheet 2]

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SUBTASK 20-10-09-860-008

- (2) Depressurize the system.

SUBTASK 20-10-09-211-002

- (3) Do a visual inspection of the tube installation that is the source of the leakage.
- (a) Check for the following:
 - 1) Worn clamps.
 - 2) Missing clamps.
 - 3) Interference.
 - 4) Dents.
 - 5) Chafing.
 - (b) Repair/Replace the tube assembly if necessary.
 - 1) Use this procedure to replace the tube assembly: FLARELESS TUBING ASSEMBLY - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-09/401.
 - 2) Use this procedure to repair the tube assembly: Tube Repair, TASK 20-10-09-300-801.
 - (c) Correct the cause of the chafing if present and replace any worn or missing clamps..

SUBTASK 20-10-09-211-003

- (4) If the leak is at a Hydraulic joint, examine for the following:
- (a) Damage to joints, for example rough seal surfaces, cracked fittings or cracks in tubing. [see Figure 801, sheet 3].
 - 1) Replace damaged parts.
 - (b) Incorrectly torqued or swaged connections. [See Figure 801, sheet 4]
 - 1) To repair or replace these parts, refer to procedures:
 - a) Flareless Tubing Assembly Installation, TASK 20-10-09-400-801
 - b) Retightening of Fitting Joints with Persistent Hydraulic Leaks, TASK 20-10-09-300-808
 - c) FLARELESS TUBING ASSEMBLY - REPAIRS, 20-10-09/801
 - (c) Insufficient or incorrect support of hydraulic lines.
 - 1) To reposition existing clamps or install additional clamps if necessary use procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.
 - (d) Foreign material in the join.
 - 1) Remove and clean off the foreign material as necessary, then reassemble and retorqued the joint.
 - (e) Incorrectly installed, mismatched or pre-loaded parts.
 - 1) For correcting the fit-up or installation of parts, refer to procedure: Retightening of Fitting Joints with Persistent Hydraulic Leaks, TASK 20-10-09-300-808.
 - (f) Seized or galled threads. [See Figure 801, sheet 5]
 - 1) Replace damaged parts.
 - (g) Stress corrosion cracking from over-torque on the fitting joint, put together with the effects of external contaminants. [See Figure 801, sheet 6]

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- 1) Replace damaged parts.

NOTE: Install hydraulic fittings carefully, take care when applying torque to mating fittings. Retightening or applying a higher torque than recommended to a mating part can introduce stresses to the fitting that can contribute to cracks. If a crack already exists and a higher torque is applied to stop a leak, it will make the crack and leakage worse.

SUBTASK 20-10-09-211-004

- (5) If the leak is at a threaded 'boss' joint [See Figure 801, sheet 7] that uses o-rings this most commonly occurs due to mistakes during assembly, check for the following:
 - (a) Incorrect positioning of the o-ring on the fitting.
 - (b) Damaged o-ring seal.
 - (c) Insufficient wrench torque to squeeze the o-ring and make the seal.
 - (d) Incorrect o-ring selection.
- 1) To correct these leaks refer to procedure: RECESSED BOSS SEAL FITTINGS - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-16/401 and O-RINGS - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-19/401.

———— **END OF TASK** ————

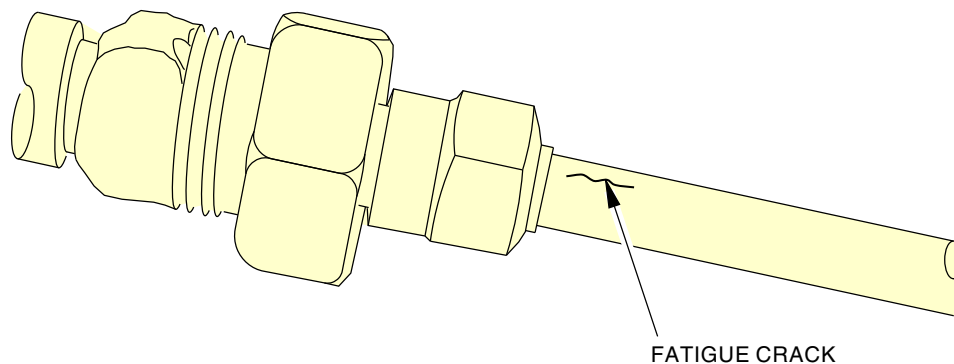
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PRESSURIZED TUBE LEAK

NOTE:

EXAMPLE OF LEAK FROM FATIGUE CRACK ADJACENT TO WELD SLEEVE (TUBE SIDE OF WELD) ON TITANIUM HYDRAULIC TUBE ASSEMBLY.

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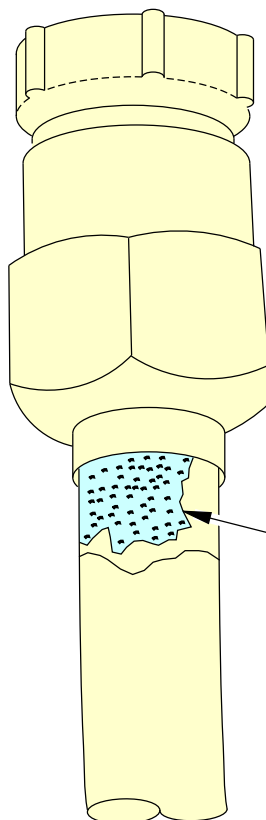
Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 1 of 7)

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EXAMPLE OF TUBE CORROSION
AT FLARELESS SLEEVE ON
ALUMINUM TUBE MATERIAL

ALUMINUM TUBE CORROSION

2324211 S0000527014_V2

**Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 2 of 7)**

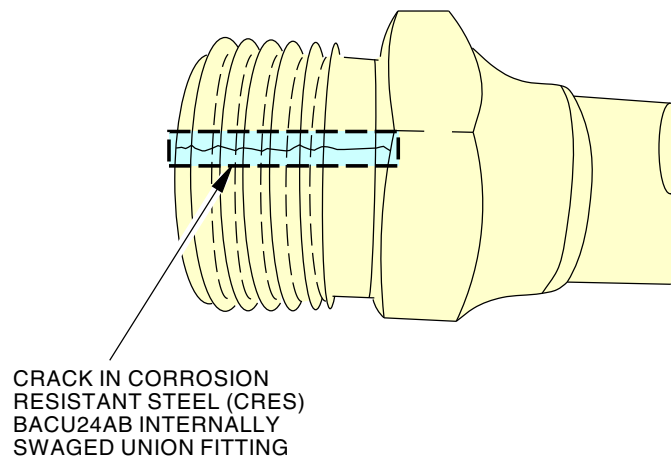
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CRACKED FITTINGS

2324326 S0000527015_V2

Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 3 of 7)

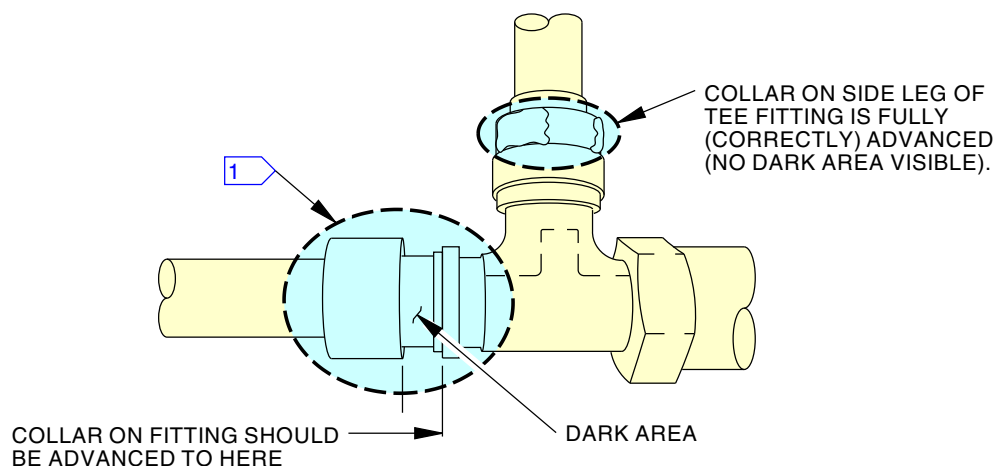
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**COMBINATION AXIALLY SWAGED/FLARELESS TEE FITTING WITH
INCOMPLETELY SWAGED END**

1 POSITION OF COLLAR ON TEE FITTING THAT LEAKED IN SERVICE DUE TO INCOMPLETE SWAGE (DARK AREA SHOWS THAT COLLAR IS NOT FULLY ADVANCED - FOR COMPARISON, SEE SIDE LEG).

2324353 S0000527017_V2

**Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 4 of 7)**

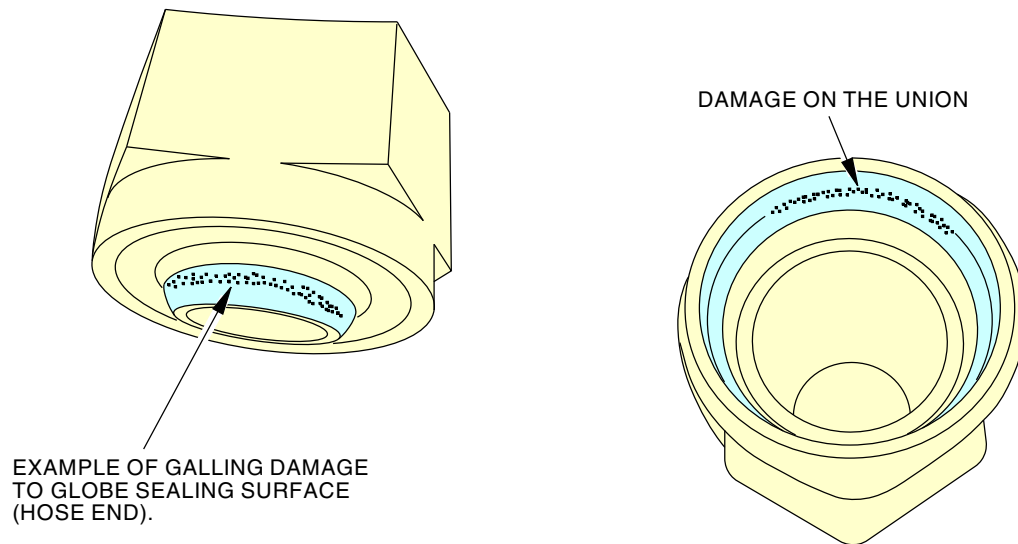
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GALLING DAMAGE

2324433 S0000527018_V2

Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 5 of 7)

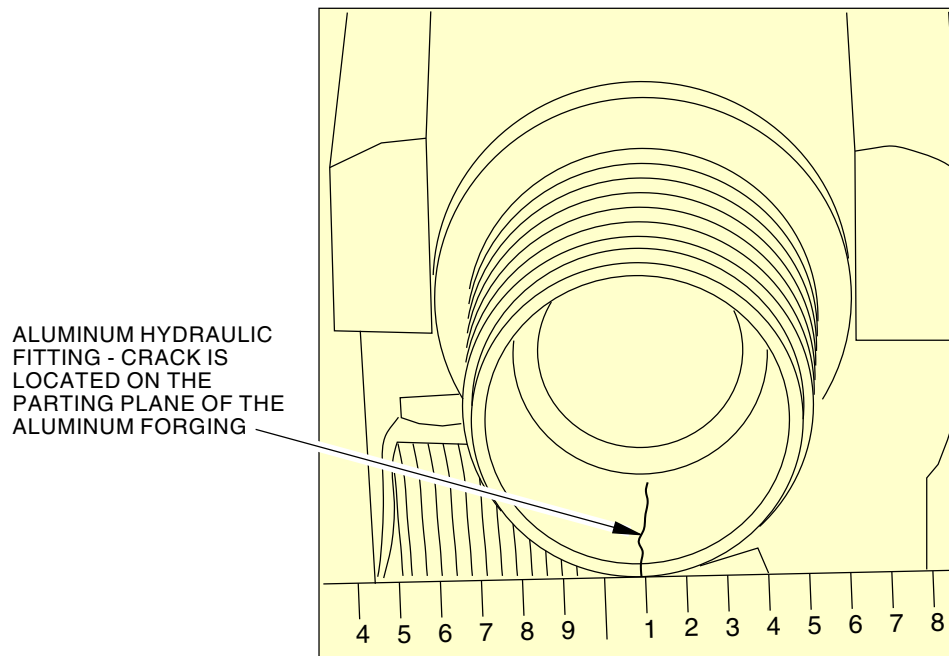
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STRESS CORROSION CRACKING

2324455 S0000527019_V2

Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 6 of 7)

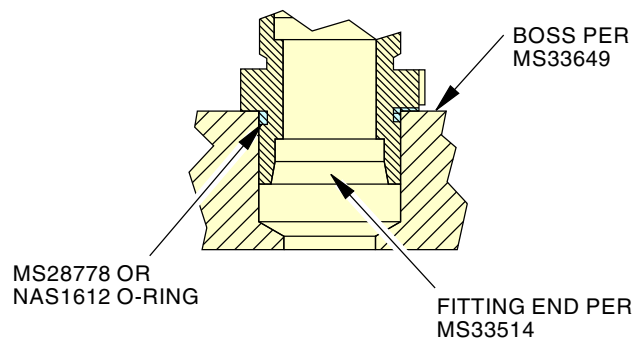
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MS33649
SINGLE SEAL BOSS STRAIGHT
THREADED "BOSS" JOINT

2324602 S0000527020_V2

Tube and Fitting Leakage Identification
Figure 801/20-10-09-990-937 (Sheet 7 of 7)

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TASK 20-10-09-300-808

3. Retightening of Fitting Joints with Persistent Hydraulic Leaks

A. General

- (1) Use this procedure to help resolve a persistent hydraulic leak at a tube joint that is not located in a pressurized area, a strut, a fuel tank, or a cargo area.
 - (a) For joints located in a pressurized area, a strut, a fuel tank, or a cargo area, use this tightening procedure: Flareless Fittings in Pressurized, Strut, Fuel Tank, and Cargo Areas Installation, TASK 20-10-09-000-802.
- (2) Use this procedure only for flareless joints that have continual leakage that cannot be resolved.
 - (a) Do not use this procedure as a routine torque tightening method for flareless fittings.
- (3) For repairs and replacements of the flareless tubing assemblies, refer to the applicable flareless tubing assembly approved repairs above.

B. References

Reference	Title
20-10-09-000-802	Flareless Fittings in Pressurized, Strut, Fuel Tank, and Cargo Areas Installation (P/B 401)
20-10-09-200-802	Space Between Tubing Clamps Check (P/B 401)
20-10-09-400-801	Flareless Tubing Assembly Installation (P/B 401)
20-10-09-993-838	Table: Thread Compounds (P/B 401)
20-10-09-993-841	Table: Tubing Assembly - Installation Torque (P/B 401)

C. Procedure

SUBTASK 20-10-09-280-001

- (1) Do a leak check to confirm the location of the leak.
 - (a) Pressurize the system for a minimum of 15 minutes.
 - (b) With the system pressurized, do a check of the tube-to-fitting interface for signs of hydraulic leakage.
 - 1) Use a clean white cloth to find hydraulic leakage.
 - 2) Record the location of the leak.

SUBTASK 20-10-09-860-007

- (2) Depressurize the system.

SUBTASK 20-10-09-211-001

- (3) Do a visual inspection of the tube installation that is the source of the leakage.
 - (a) Check for the external damage that follows:
 - 1) Worn clamps.
 - 2) Missing clamps.
 - 3) Interference.
 - 4) Dents.
 - (b) If external damage is found, replace the tube assembly.
 - 1) Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.

SUBTASK 20-10-09-020-007

- (4) Loosen the flareless fittings to check for preload on the tube assembly.

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- (a) Check for side-to-side or end-to-end preload in the line.
 - 1) If there is preload, adjust the tube assembly. Do this procedure: Space Between Tubing Clamps Check, TASK 20-10-09-200-802.
 - a) If the preload cannot be relieved, replace the tube assembly.
 - <1> Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.

SUBTASK 20-10-09-020-008

- (5) Remove the tube assembly that is the source of the leakage to check for sealing surface damage on mating fittings.
 - (a) Check the mating surfaces of the tube-to-fitting interface for damage.
 - 1) Examples of such damage are as follows:
 - a) Machining flaws.
 - b) Galling or scratches.
 - c) Dimples.
 - d) Cracks.
 - (b) If damage is found, replace the damaged part.
 - 1) Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.

SUBTASK 20-10-09-420-034

- (6) If flareless fittings with BACS13AP preset sleeves are used (Figure 802), do the steps that follow.
 - (a) Apply the appropriate lubricant to the BACS13AP sleeves, found in Table 20-10-09-993-838.
 - (b) Tighten the flareless fittings with BACS13AP sleeves two times (tighten, loosen, and tighten again) to nominal torque shown in Table 20-10-09-993-841

SUBTASK 20-10-09-420-035

- (7) If the flareless fittings with internally swaged BACS13BX (Figure 803), internally swaged BACS13BD (Figure 803), or welded-on NAS1760-type sleeves (Figure 804) are used, do the steps that follow.
 - (a) Apply the appropriate lubricant to the BACS13BX, BACS13BD, or welded-on NAS1760-type sleeves, found in Table 20-10-09-993-838.
 - (b) Tighten the flareless fittings with BACS13BX, BACS13BD, or welded-on NAS1760-type sleeves as follows:
 - 1) Tighten the fitting to the torque shown in Table 20-10-09-993-841.
 - 2) Loosen the fitting to release the torque.
 - 3) Tighten the fitting to the torque value specified in Flareless Fittings in Pressurized, Strut, Fuel Tank, and Cargo Areas Installation, TASK 20-10-09-000-802.

SUBTASK 20-10-09-280-002

- (8) Do a leak test on the installations of the flareless fittings.
 - (a) Pressurize the system for 15 minutes minimum.
 - (b) With the system pressurized, do a check at the tube-to-fitting interface for signs of hydraulic leakage.
 - 1) Use a clean white cloth to find hydraulic leakage.

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- 2) If you find leakage, do the steps that follow.
 - a) De-pressurize the system.
 - b) Loosen the fitting.
 - c) Check the mating surfaces of the tube-to-fitting interface for signs of damage.
 - <1> Examples of such damage are as follows:
 - <a> Machining flaws.
 - Galling or scratches.
 - <c> Dimples.
 - <d> Cracks.
 - <2> If damage is found, replace any damaged assemblies.
 - <a> Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.
 - d) If no signs of damage are found on the mating surfaces of flareless fittings with BACS13AP sleeves, retighten the fittings using the steps that follow.
 - <1> Use the appropriate lubricant found in Table 20-10-09-993-838.
 - <2> Tighten the fittings two times (tighten, loosen, and tighten) to nominal torque shown in Table 20-10-09-993-841.
 - <3> Re-pressurize the system.
 - <4> Repeat the leak test.
 - <5> If you find leakage, replace one or both of the mating fittings and tube assemblies.
 - <a> Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.
 - e) If no signs of damage are found on the mating surfaces of flareless fittings with BACS13BX, BACS13BD, or welded-on NAS1760-type sleeves, retighten the fittings using the steps that follow.
 - <1> Use the appropriate lubricant found in Table 20-10-09-993-838.
 - <2> Tighten the fitting to the torque shown in Table 20-10-09-993-841.
 - <3> Loosen the fitting to release the torque.
 - <4> Tighten the fitting to the torque value specified in Flareless Fittings in Pressurized, Strut, Fuel Tank, and Cargo Areas Installation, TASK 20-10-09-000-802.
 - <5> Re-pressurize the system.
 - <6> Repeat the leak test.
 - <a> If you find leakage, replace one or both of the mating fittings and tube assemblies. Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-09-400-801.

————— **END OF TASK** —————

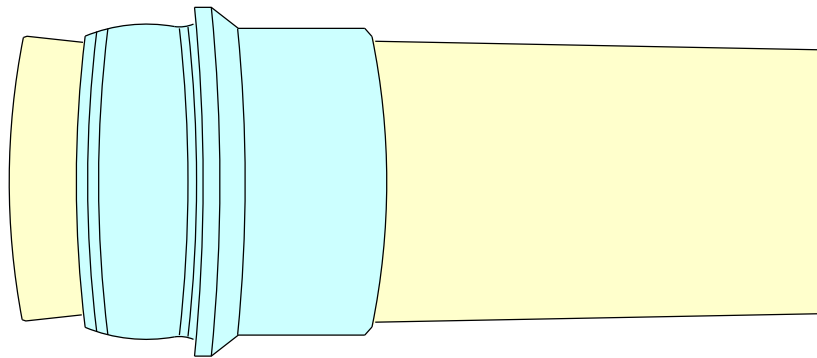
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BACS13AP Flareless Preset Sleeve
Figure 802/20-10-09-990-862

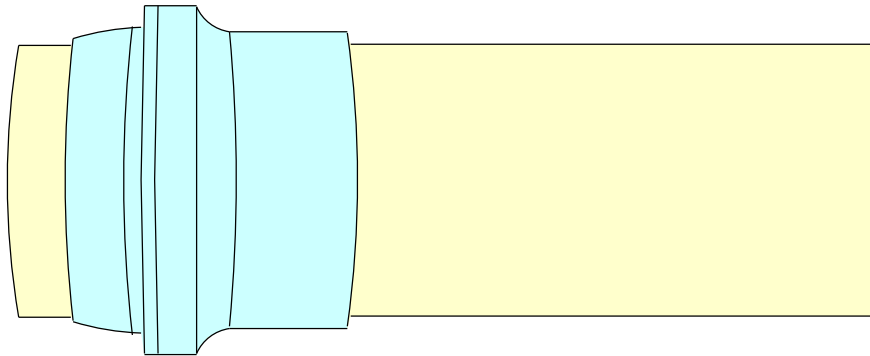
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1847485 S0000328863_V2

BACS13BX/BACS13BD Flareless Internally Swaged Sleeve
Figure 803/20-10-09-990-863

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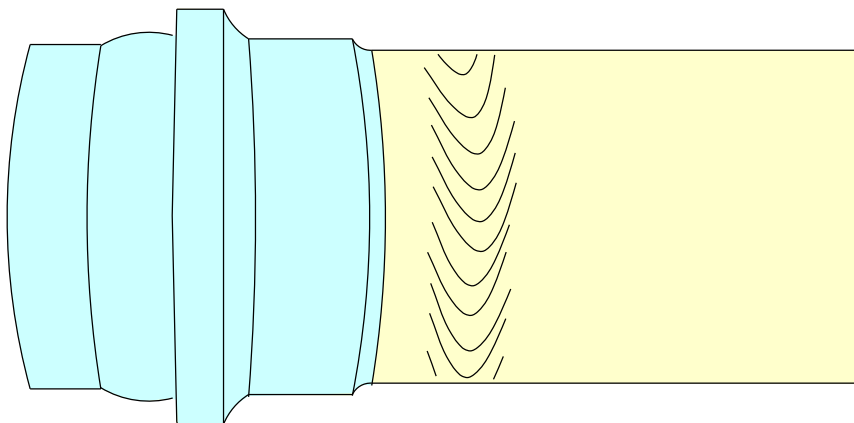
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NAS1760 Flareless Weld Sleeve
Figure 804/20-10-09-990-864

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TASK 20-10-09-300-801

4. Tube Repair

A. General



DO NOT REPAIR COILED TUBES. NORMAL MOVEMENT OF COIL MAY BE RESTRICTED BY REPAIR.

- (1) You can repair tubes if you obey the permitted repair limits. When it is possible do the following:
 - (a) Replace the damaged tube.
 - (b) Replace the damaged part with a tube splice.
 - (c) Repair the damaged tube with a fitting if the damaged area is sufficiently small.
 - (d) Completely remove all corrosion and treat affected surface as described in the Corrosion Prevention Manual.
- (2) When you remove, install or do work with hydraulic tube assemblies, obey the guidelines that follow:
 - (a) When you remove tubes, make sure that the tubes and port fittings have tags that clearly identify the correct connection locations.
 - (b) Do not move or change the tube bends. If you move or change the bends in the tube, these bad effects can occur:
 - 1) If you move or change a bend in the tube, it can become possible that the tube will align with the incorrect port. If this occurs, incorrect reconnection or cross-connection of the tubes can become possible.
 - 2) If you move or change the bend in the tube, it can become possible that the tube will have too much stress when it is connected. Stress can cause cracks in the tubes.
 - (c) If you must bend the tube assemblies to fit the installation, do not bend more than permitted by the ovality limits in (Figure 805, Table 802). We recommend that you use a bend block or tool equivalent to the Parker G-824 hand bender. Make sure the bend block supports the tube bend beyond the neutral axis of the bend, as shown in (Figure 805, Table 802), and that the bend-ovality allowables are not exceeded.

Table 802/20-10-09-993-883 Permitted Ovality and Wrinkle of Hydraulic Tube Bends

SYSTEM OPERATING PRESSURE	TUBE OUTER DIAMETER (OD)	TUBE MATERIAL	ALLOWABLE WRINKLE HEIGHT	ALLOWABLE OVALITY (PERCENTAGE OF SPECIFIED OD) ^{*[1][2]}
Liquid: 1000 psi to 3000 psi (including return lines)	All Sizes	Stainless Steel	0.010 in. (0.254 mm)	5
		Aluminum	0.010 in. (0.254 mm)	5
		3AL-2.5V Titanium	None visible	3

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Table 802/20-10-09-993-883 Permitted Ovality and Wrinkle of Hydraulic Tube Bends (Continued)

Pneumatic and Oxygen: Pressure above 1500 psi or Temperature above 60°F (16°C)	All Sizes	Stainless Steel	0.010 in. (0.254 mm)	5
Other Liquid Systems: Pressure less than 1000 psi Pneumatic and Oxygen Systems	Less than 1.0	Stainless Steel	0.040 in. (1.016 mm)	10
		Aluminum Alloy & Copper	0.020 in. (0.508 mm)	10
	1.0 to 2.0	Stainless Steel	0.060 in. (1.524 mm)	10
		Aluminum Alloy & Copper	0.030 in. (0.762 mm)	10
	2.0 to 3.0	Stainless Steel	0.080 in. (2.032 mm)	5
		Aluminum Alloy & Copper	0.040 in. (1.016 mm)	5
	3.0 or over	Stainless Steel	0.100 in. (2.540 mm)	5
		Aluminum Alloy & Copper	0.050 in. (1.270 mm)	5

*[1] Specified diameter is the drawing specified tube diameter.

*[2] Percent (ovality) = $([OD \text{ Max} - OD \text{ Min}] / OD \text{ Specified}) \times 100$. The OD is measured in the same plane.

- (d) Do not repair dents or chafed areas. Replace the tube or tube section if the defect depth is more than the values in Table 803. It is not necessary for you to repair or replace the tubes with defect depth less than these values.

Table 803/20-10-09-993-884 Permitted Tube Problem Depth - Hydraulic Pressure (3,000 psi) and Return Lines (1,500 psi)

TUBE MATERIAL (PRESSURE)	PROBLEM TYPE	TUBE OUTER DIAMETER*[2]						
		1/4	3/8	1/2	5/8	3/4	1	1-1/4
Ti-3Al-2.5V 21-6-9 (3,000 psi)	CHAFED	0.006	0.007	0.008	0.010	0.011	0.012	0.030 (Ti)
	DENT	0.005	0.007	0.010	0.015	0.018	0.020	0.030 (Ti)
Ti-3Al-2.5V 21-6-9 (1500 psi)	CHAFED	0.006	0.007	0.008	0.010	0.011	0.012	0.050 (Ti)
	DENT	0.005	0.007	0.010	0.015	0.018	0.020	0.030
304 1/8 HARD (3,000 psi)	CHAFED	0.006	0.007	0.008	0.010	0.011	0.012	N/A
	DENT	0.005	0.010	0.020	0.03	0.040	0.040	N/A

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Table 803/20-10-09-993-884 Permitted Tube Problem Depth - Hydraulic Pressure (3,000 psi) and Return Lines (1,500 psi) (Continued)

6061-T6 (1,000 psi) except ^{*[1]}	CHAFED	0.015	0.015	0.010	0.005	0.004 0.015 ^{*[1]}	0.003 0.015 ^{*[1]}	0.003 0.015 ^{*[1]}
	DENT	0.015	0.015	0.010	0.005	0.005	0.005	0.005

*[1] Suction line, 150 psi.

*[2] The limits were verified by hydraulic impulse fatigue and burst testing (for additional information, see SAE-AIR 1388).

(3) Electrical rigid conduit repair.

(a) Smooth dents are permitted to the electrical rigid conduit with these limits (Table 804)

Table 804/20-10-09-993-885 Smooth Dent Damage Limits for Electrical Rigid Conduits

CONDUIT SIZE (OD)	MAXIMUM DENT DEPTH
0.25 in. (6.35 mm)	0.050 in. (1.270 mm)
0.31 in. (7.87 mm)	0.063 in. (1.600 mm)
0.38 in. (9.65 mm)	0.075 in. (1.905 mm)
0.50 in. (12.70 mm)	0.100 in. (2.540 mm)
0.63 in. (16.00 mm)	0.125 in. (3.175 mm)
0.75 in. (19.05 mm)	0.150 in. (3.810 mm)
0.88 in. (22.35 mm)	0.175 in. (4.445 mm)
1.00 in. (25.40 mm)	0.200 in. (5.080 mm)
1.25 in. (31.75 mm)	0.250 in. (6.350 mm)
1.50 in. (38.10 mm)	0.300 in. (7.620 mm)
1.75 in. (44.45 mm)	0.350 in. (8.890 mm)
2.00 in. (50.80 mm)	0.400 in. (10.160 mm)

- 1) Dent depth damage is not more than 20 percent of outer diameter.
 - 2) The conduit is not dented or has a crack that causes it to have kinks, to rub, or to show the inner wire.
 - 3) The dent is smooth and does not make a sharp wrinkle on the outer surface of the conduit.
 - 4) There are no cracks in the conduit.
 - 5) Dents are not permitted on rigid electrical conduits in the fuel tanks.
- (b) Repair or replace electrical rigid conduits if the damage is more than the limits.
- (c) If you must form the electrical rigid conduit tube to fit an installation, do not bend more than permitted by the forming limits (Figure 813, Table 805)

Table 805/20-10-09-993-886 Permitted Forming Limits for Electrical Rigid Conduits

CONDUIT SIZE (OD)	CONDUIT MATERIAL	ALLOWABLE WRINKLE HEIGHT	ALLOWABLE OVALITY (PERCENT OF SPECIFIED OD)

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Table 805/20-10-09-993-886 Permitted Forming Limits for Electrical Rigid Conduits (Continued)

1.0 OR LESS	STAINLESS STEEL	0.040 in. (1.016 mm)	10
	ALUMINUM ALLOY	0.020 in. (0.508 mm)	10
OVER 1.0	STAINLESS STEEL	0.060 in. (1.524 mm)	10
	ALUMINUM ALLOY	0.030 in. (0.762 mm)	10

- (4) To repair a damaged tube section, cut out the damaged tube section and replace it with a fitting or with an assembled tube and fitting assembly.
- (5) To replace a BACU24AB swage union, cut out the damaged fitting and replace it with a B-nut, BACS13AP sleeve or BACS13BX sleeve or a CRYOLIVE flareless sleeve assembly and an MS21924 bulkhead union, using the procedures in Figure 810 and Table 806.

Table 806/20-10-09-993-887 Procedure to Replace a BACU24AB Union

FITTINGS REPLACING BACU24AB				TUBE CUTOUT LENGTHS REQUIRED (IN.)							
SLEEVE PART NO.	SWAGE METHOD	UNION PART NO.	DIM.	04	06	08	10	12	16	20	24
BACS13BX	Harrison Roller Swage Kit 66330K01	MS21924	A (Fig. 805)	1.562	1.705	1.886	2.100	2.341	2.319	N/A	N/A
35211	Harrison Swage Machine 6777	MS21924	A (Fig. 805)	1.562	1.705	1.886	2.100	2.341	2.319	N/A	N/A
BACS13BX	Harrison Portable Swagers 5175, 5720, or equivalent stationary 5570	MS21924	B (Fig. 805)	0.487	1.612	1.791	1.965	2.199	2.122	2.119	2.049
BACS13AP	Hand or Machine Preset	MS21924	C (Fig. 805)	1.422	1.547	1.726	1.900	2.134	N/A	N/A	N/A
CRYOIVE Assembly	N/A	MS21924	B (Fig. 805)	1.487	1.612	1.791	1.965	2.100	2.122	N/A	N/A

NOTE: You need to replace a damaged BACU24AB swage union. You will cut out the fitting and replace it with a BACS13BX or BACS13AP sleeve, a coupling nut, and MS21924 flareless bulkhead union of the same or equivalent material as the union you are replacing. See Figure 806 for sleeve/tube material limitations.

- (a) Cut the tube adjacent to the damaged union to dimension A, B, or C.

NOTE: The cut dimension depends on the sleeve and sleeve installation method you will use.

- (b) Slide a flareless coupling nut onto the tube.

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- 1) See BACS13BX Flareless Sleeve Swaging with the Harrison Swagers 5175, 5570, and 5720, TASK 20-10-09-300-802, BACS13BX Flareless Sleeve Swaging with the 6633K01 Harrison Roller Swaging Kit, TASK 20-10-09-300-803, or BACS13AP Flareless Sleeve Preset, TASK 20-10-09-300-804 for presetting a BACS13AP sleeve or swaging a BACS13BX sleeve to the tube end.
- (c) Install the MS21924 flareless bulkhead union between the two tube ends.
- (d) Tighten the nuts.
- (6) To replace a BACA14BP fitting, you must use another BACA14BP fitting. To install the new BACA14BP or D10203 fitting on the new tube section, use this procedure: do this task: Externally Swaged (Permaswage) Fittings Installation, TASK 20-10-09-400-804 do this task: Electrical Resistance Specifications in the Fuel Tank Check, TASK 20-10-09-760-801 for verifying electrical resistance where required.
NOTE: Use BACA14BP fittings only for replacement of other BACA14BP fittings unless approved by The Boeing Company on a case-by-case basis. The MS flareless screw-together ends on this fitting are prone to deformation and galling from repeated assembly and disassembly and may leak.
- (7) To make tube repairs, use tube sections of the same material and use the fittings as shown in (Figure 806). You can make splice a repair of 21-6-9 and Ti-3AL-2.5V tube with 304-1/8 Hard tube of the wall thickness shown in Table E of (Figure 806) You can also make a splice repair of a Ti-3AL-2.5 tube with 21-6-9 tube of the wall thickness shown in (Figure 806) or in Table E of (Figure 806).
- (8) The permitted limits of hydraulic line tubing damage caused by dents, chafes, or the corrosion removal process per the Corrosion Prevention Manual are shown in (Table 803).
- (9) A repair of a tube section can be in one of three groups. The groups have a relation to the location of the tube damage and the quantity of damage. The three groups are as follows:
 - (a) Replace a tube end section that has a flareless end fitting you can move apart, with an assembled tube and fitting assembly (Figure 809)
 - (b) Replace a tube center section that has a short damaged segment with a single union (Figure 808, Table 807)

Table 807/20-10-09-993-888 Tube Cutout Lengths (Inches)

UNION PART NO.	SLEEVE PART NO.	TUBE SIZE								
		04	05	06	08	10	12	16	20	24
MS21902	BACS13AP	.59	.56	.68	.76	.86	1.05	N/A	N/A	N/A
MS21902	BACS13BX (Harrison Elastomer Swager) CRYOLIVE Assembly	.63	.60	.72	.80	.90	1.09	.96	.96	.96

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Table 807/20-10-09-993-888 Tube Cutout Lengths (Inches) (Continued)

MS21902	BACS13BX (Harrison Roller Swager) 35212 (Harrison Roller Swager 6777)	.82	N/A	.95	1.03	1.21	1.40	1.40	N/A	N/A
MS21924	BACS13AP	1.18	1.18	1.29	1.42	1.55	1.78	N/A	N/A	N/A
MS21924	BACS13BX (Harrison Elastomer Swager) CRYOLIVE Assembly	1.22	1.22	1.33	1.46	1.59	1.82	1.68	1.67	1.67
MS21924	BACS13BX (Harrison Roller Swager) 35211 (Harrison Roller Swager 6777)	.41	N/A	1.56	1.69	1.90	2.13	2.13	N/A	N/A
Axial Swage Union 8010T - Rynglok (8,000 psi rated)	None Necessary	.30	N/A	.30	.35	.35	.35	.40	.40	N/A
Axial Swage Union AS5969T/ DAS5969T (5,000 psi rated)	None Necessary	.30	N/A	.30	.375	.375	.375	.40	N/A	N/A
Permswage Cryofit H-Coupling	None Necessary	0.15 INCH MAXIMUM								

- (c) Replace a tube center section that has very much damage with an assembled tube and fitting assembly (Figure 811)
- (10) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:
- NOTE: Use your own judgement to determine if a check is necessary.

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- (a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.
- (11) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

B. References

Reference	Title
20-10-09-760-801	Electrical Resistance Specifications in the Fuel Tank Check (P/B 401)
20-11-00-910-801	Standard Torque Values (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1794	Swager - Portable Tube, Hand Swaging, 1/4 - 1" Dia. Stainless Steel or Titanium Tubing Part #: 6633K-01 Supplier: 08199

D. Procedure

SUBTASK 20-10-09-350-009

- (1) For hydraulic tubing specifications and wall thicknesses, (Table 808).

NOTE: Table 801 applies to hydraulic tubing outside of the engine fire zones, and more than 18 inches (457 mm) from the engine firewall. For tubing inside the engine fire zones, and within 18 inches (457 mm) of the engine firewall, refer to the propulsion maintenance manual for tubing specifications.

NOTE: You can replace damaged titanium tubing or aluminum tubing with 21-6-9 CRES (BMS 7-185) or 304 1/8 Hard CRES (MIL-T-6845).

Table 808/20-10-09-993-855 Tubing Specifications and Wall Thickness for 777 Hydraulic Tubes

	-4	-6	-8	-10	-12	16	-20	-24
Aluminum 6061-T6 AMS 4083 (R)	*[1]	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]	0.049*[3]	0.049*[3]
CRES 21-6-9 BMS 7-185 (P,R)	0.016	0.020	0.026	0.033	0.039	0.052	*[2]	*[2]
TITANIUM 3AL-2.5V AMS 4945 (P,R)	0.016	0.019	0.026	0.032	0.039	0.051	0.070	*[2]
304 1/8 Hard CRES	0.020	0.028	0.035	0.035*[3] 0.049	0.035*[3] 0.049*[3] 0.058	0.035*[3] 0.065	--	--
321 Annealed CRES per AMS 5556, AMS 5557	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]	0.035*[3]

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*[1] NU = This tubing size is "Not Used" in the 777 hydraulic systems. P = Use in pressure lines (3,000 psi or 20,684 kPa). R = Use in return lines (600 psi or 4,137 kPa).

*[2] NA = This tubing size is not available

*[3] * Not qualified for 3000 psi (20,684 kPa)

SUBTASK 20-10-09-800-001

(2) Use the tube materials shown in (Table 809)

Table 809/20-10-09-993-848 Cross Reference of Tubing to BMS/MIL Specification

TUBING MATERIAL	BMS	MIL	OTHER
ALUMINUM 6061-T4,T6	---	WW-T-700/6 WW-T-7081*[1]	AMS4083
CRES 21-6-9	7-185	---	---
1/8 HARD CRES 304-1/8h	---	T-6845	AMS 5566
ANNEALED CRES 304	---	T-8504	AMS 5567
ANNEALED CRES 321 ANNEALED CRES 321	---	T-8808 T-8808	AMS 5556 AMS 5557
TITANIUM 3AL-2.5V	7-234	---	AMS 4945

*[1] Low Pressure, Non-Hydraulic Systems Only

SUBTASK 20-10-09-800-014

(3) Use the Hydraulic System Design Pressure shown in (Table 810) during the repairs.

Table 810/20-10-09-993-849 Hydraulic System Design Pressures

COMPONENT	Design Operating Pressure (psi)	Proof Pressure (psi)	Burst Pressure (psi)
Pressure lines, fittings and units with air under full system pressure.	3000	4500	9000
Pressure hoses	3000	6000	12000
Accumulators	3000	6000	12000
Return and case drain lines, fittings and units	600	900	1800
Return line hoses	600	1200	2400
Pump Supply reservoirs, units, lines and fittings	65	100	200
Airbleed Line (Upstream of regulator)	250	500	1000
Drains and vents open to atmosphere	15	50	75

SUBTASK 20-10-09-940-001

(4) Make a decision about the type of repair necessary.

(a) Use (Figure 806) to make a decision about the group the repair is in.

SUBTASK 20-10-09-940-002

(5) Refer to Table 807 and Table 811 to find the necessary tube cutout length when you use a single union to replace a damaged tube area.

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Table 811/20-10-09-993-889 Tube Cutout Dimensions for Installing DAS5792T/DAS5793T Adapter Fittings

AXIAL SWAGE ADAPTER FITTING P/N	SLEEVE PART NO.	TUBE SIZE					
		04	06	08	10	12	16
"J" AS5792T/ DAS5792T Female Flareless (5,000 psi rated)	None Necessary	0.669 ±0.030 in.	0.694 ±0.030 in.	0.810 ±0.030 in.	0.979 ±0.030 in.	1.003 ±0.030 in.	1.134 ±0.030 in.
"K" AS5793T/ DAS5793T Male Flareless (5,000 psi rated)	None Necessary	0.665 ±0.150 in.	0.694 ±0.150 in.	0.811 ±0.150 in.	0.878 ±0.175 in.	0.954 ±0.175 in.	0.969 ±0.200 in.

SUBTASK 20-10-09-420-020

- (6) To use assembled tube ends or a center section to do a repair, find the cutout length and install as follows:
- (a) Make an estimate of the total length (L1) of the repair section necessary to replace the damaged tube (Figure 809, Figure 811)
 - (b) Cut and trim the repair tube as follows (Figure 807):
 - 1) Use the correct size ratchet chipless cutter.
 - 2) Turn the cutter drive screw counter clockwise to retract the cutter wheel.
 - 3) Put the cutter over the tube.
 - 4) Turn the screw clockwise until the cutter touches the tube at the necessary cut location.
 - 5) Turn the screw 1/8 to 1/4 turn and rotate the cutter until the cutter is easy to rotate.
 - 6) Cut the tube.
 - 7) Remove the tool.
 - 8) To deburr the tube use the correct stem subassembly and deburring tool.
 - a) To assemble the tool refer to (Figure 807)
 - 9) Push down on the plunger and install the tool into the end of the tube.
 - 10) Release the plunger.
 - 11) Let the plug fill the inside of the tube.
 - 12) Rotate the deburring tool until the inside burr is removed.
 - 13) Remove the tool with the plug expanded

NOTE: The expanded plug should remove metal particles from the inside of the tube. Make sure no metal particles fall inside the tube.

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- (c) Install the necessary flareless sleeves to the repair tube as told in the following applicable tasks:
 - 1) Do this task: (BACS13BX Flareless Sleeve Swaging with the Harrison Swagers 5175, 5570, and 5720, TASK 20-10-09-300-802)
 - 2) Do this task: (BACS13BX Flareless Sleeve Swaging with the 6633K01 Harrison Roller Swaging Kit, TASK 20-10-09-300-803)
 - 3) Do this task: (BACS13AP Flareless Sleeve Preset, TASK 20-10-09-300-804)
- (d) Assemble and tighten the flareless fittings which are part of the repair section.
- (e) Measure all of the tube assembly length (L1) (Figure 809, Figure 811)
- (f) To find the necessary cutout length (L2) as shown in (Figure 809, Figure 811), use the procedure given in (Table 812)

Table 812/20-10-09-993-890 Procedure to Find the Tube Cutout Length L2

FITTINGS USED FOR REPAIR TUBE ASSEMBLY			L2 CUTOUT LENGTH FORMULA*[1]	
FLARELESS SLEEVE		UNION PART NO.	FOR TUBE END SECTION	FOR TUBE CENTER SECTION
PART NO.	SWAGE METHOD			
BACS13BX	Harrison Portable Swagers 5175 and 5720 or equivalent stationary swager 5570	MS21902 or equivalent	L1 minus 2P	L1 minus 2P
BACS13BX	Harrison Roller Swage Kit 6633K01	MS21902 or equivalent	L1 minus 2[Z1]	L1 minus 2[Z2]
BACS13AP	Hand or Machine Preset	MS21902 or equivalent	L1 minus 2H	L1 minus 2H
CRYOLIVE Assembly 921721	N/A	MS21902 or equivalent	L1 minus 2P	L1 minus 2P
35211	Harrison Roller Swage Machine 6777	MS21902 or equivalent	L1 minus 2[Z2]	L1 minus 2[Z2]
BACS13BX	Harrison Portable Swagers 5175 or 5720 or equivalent stationary swager 5570	Permaswage Cryofit H-Fitting	L1 minus (P+0.10)	N/A
BACS13BX	Harrison Roller Swage Kit 6633K01	Permaswage Cryofit H-Fitting	L1 minus (Z1+0.10)	N/A
BACS13AP	Hand or Machine Preset	Permaswage Cryofit H-Fitting	L1 minus (H+0.10)	N/A
CRYOLIVE Assembly 921721	N/A	Permaswage Cryofit H-Fitting	L1 minus (P+0.10)	N/A
35211	Harrison Roller Swage Machine 6777	Permaswage Cryofit H-Fitting	L1 minus 2[Z2]	L1 minus 2[Z2]
N/A	N/A	Rynglok Permaswage Cryofit H-Coupling		L1 plus 0.20

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*[1] See the Figure for Flareless Sleeve Tube End Values in the procedure to Install the CRYOLIVE Flareless Sleeve Assembly for values for H, P, Z1, and Z2.

NOTE: You will remove a tube end section and replace it with a prefabricated tube assembly as shown in Figure 809.

- 1) Measure the repair tube assembly total length L1 (Figure 811).
- 2) Observe the cutout length L2 formula in table Table 812.
- 3) Find the flareless sleeve tube end value (Figure 816).
- 4) Use the formula in Table 812 to calculate the cutout length L2.
- (g) Remove the pressure from the systems where you will do the repairs.
- (h) Cut out the damaged tube (L2).
- (i) Trim the tube ends as shown in (Figure 807).
- (j) When you make the installation, refer to the applicable section as follows:
 - 1) To use the Harrison Elastomer Swager to install BACS13BX flareless sleeves, refer to this task: (TASK 20-10-09-300-802)
NOTE: Make sure the correct P dimension (position of the BACS13BX sleeve on the tube) is used. A different value applies to Size 20 and 24 sleeves when used with short flareless fittings.
 - 2) Do this task: (TASK 20-10-09-300-803) to use the tube swager, COM-1794 for installation of BACS13BX flareless sleeves.
 - 3) To use the Harrison 6777 Roller Swage Machine for installing 35211 sleeves or 35212 unions, refer to "Swage Harrison 35211 sleeves and 35212 unions with the Harrison 6777 Roller Swage Machine".
 - 4) Do this task: BACS13AP Flareless Sleeve Preset, TASK 20-10-09-300-804. to install the BACS13AP flareless sleeves.
 - 5) Do this task: BACC42W H-Coupling Installation, TASK 20-10-09-400-802 to install H-couplings (BACC42W).
 - 6) Do this task: 3P02111/3PHS111 Cryofit Coupling Installation, TASK 20-10-09-400-803 to install Cryofit unions (3P02111) or (3PHS111).
 - 7) Do this task: (TASK 20-10-09-400-804) for installation of Permaswage fittings (BACU24BS).
 - 8) Do this task: Axial Swage Fitting Union Installation (8,000 psi Rated - Rynglok), TASK 20-10-09-400-806. for installation of Rynglok unions R80101T.
- (k) Install the repair section.
 - 1) Do this task: Standard Torque Values, TASK 20-11-00-910-801 to tighten the nuts.
- (l) When you use a Cryofit union or an H-Coupling in the repair section, install it after you tighten the flareless fittings in their positions.
- (m) When you use a Permaswage union in the repair section, you must make allowance for swage growth.

NOTE: Tighten the repair section in position after installation of the Permaswage union.

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- (n) When you replace a tube bend section, make sure you keep the minimum straight length specifications for all fittings (Figure 812)
- (o) To install the Cryolive flareless sleeve assembly, do this task: Install the CRYOLIVE Flareless Sleeve Assembly, TASK 20-10-09-400-805

NOTE: Use only the complete Cryolive flareless sleeve assembly, consisting of a Cryolive sleeve, coupling nut and plastic cap. The Cryolive flareless sleeve assembly, in sizes 10, 12, and 16, requires use of a longer length coupling nut. The longer length coupling nuts are not interchangeable with standard BACN10- and MS21921 coupling nuts. See (Table 813) for approved Cryolive sleeve, coupling nut and plastic cap combinations.

- (p) When you use a Cryolive flareless sleeve/coupling nut in conjunction with a permanent Cryofit, H-Coupling, Permaswage, or Rynglok union, tighten the flareless coupling nut hand tight before installing the permanent fitting to minimize axial preload on the Cryolive sleeve.
- (q) To install the Rynglok union, do this task: Axial Swage Fitting Union Installation (8,000 psi Rated - Rynglok), TASK 20-10-09-400-806

SUBTASK 20-10-09-710-005

- (7) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

———— **END OF TASK** ————

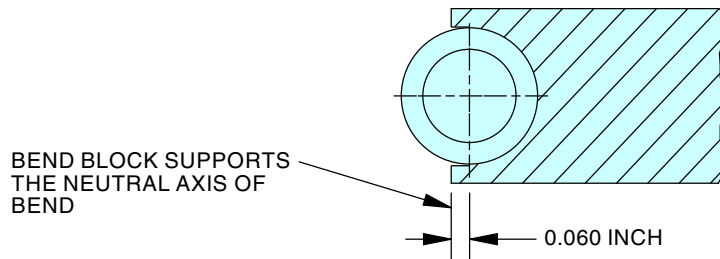
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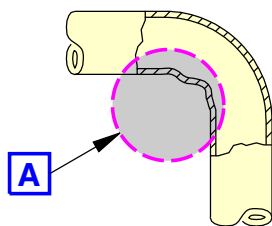
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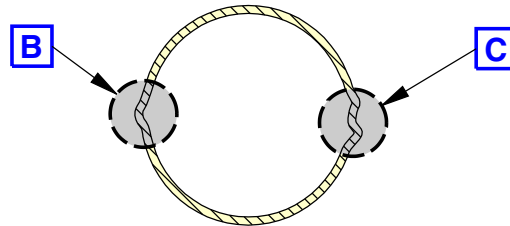
NOTE:

IF THE OVALITY OF ANY PART OF THE BEND IS MORE THAN THE MAXIMUM PERMITTED OVALITY, DISCARD THE TUBE.

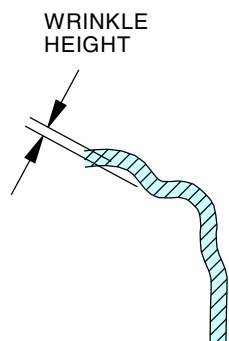
TUBE BEND BLOCK



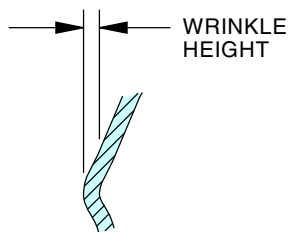
**RADIAL
WRINKLE**



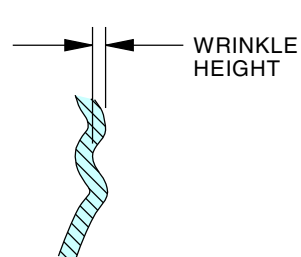
**LONGITUDINAL
WRINKLE**



A



B



C

WRINKLE MEASUREMENTS

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**Permitted Ovality and Wrinkle of Hydraulic Tube Bends
Figure 805/20-10-09-990-865**

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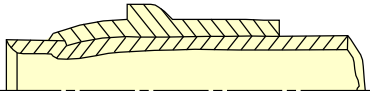
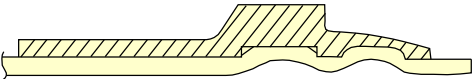
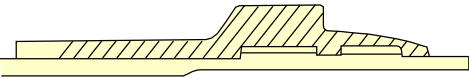
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CAUTION: DO NOT USE CADMIUM PARTS ON TITANIUM TUBES. CORROSION WILL OCCUR IF YOU USE CADMIUM PARTS ON TITANIUM TUBES.

TUBE JOINING		TUBE MATERIAL	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER*			
	BACS13AP (BITE-Type) 1	6061T6	B,C	04, 06, 08, 10, 12
		304 ANN.	B,C	04, 06, 08, 10, 12
		304 1/8 Hard	B,C	04, 06, 08, 10, 12
	BACS13BX (Elastomer Swage) 2 3	6061T6	A	06, 08, 10, 12, 16, 20 4, 24 4
		304 ANN.	A	16, 20
		304 1/8 Hard	A	06, 08, 10, 12, 16, 20 4, 24 4
		21-6-9	A	04, 06, 08, 10, 12, 16
	BACS13BX (Roller Swage) 2	21-6-9	D	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	D	04, 06, 08, 10, 12, 16, 20

REPAIR METHOD - RECONNECTABLE WITH FLARELESS FITTING SLEEVES
TABLE A

L19633 S0006402388_V2

Tube Material and Fitting Selection Tables
Figure 806/20-10-09-990-866 (Sheet 1 of 8)

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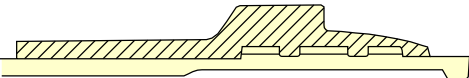
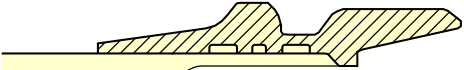
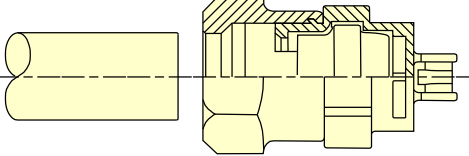
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CAUTION: DO NOT USE CADMIUM PARTS ON TITANIUM TUBES. CORROSION WILL OCCUR IF YOU USE CADMIUM PARTS ON TITANIUM TUBES.

TUBE JOINING		TUBE MATERIAL 8	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER*			
	35211 SLEEVE (Roller Swage)	Ti-3Al-2.5V	D(1)	04, 06, 08, 10, 12, 16, 20
	35212 UNION (Roller Swage)	Ti-3Al-2.5V	D(1)	04, 06, 08, 10, 12, 16, 20
	CRYOLIVE Assembly 921721	6061T6	G	04, 06, 08, 10, 12, 16
		21-6-9	G	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	G	04, 06, 08, 10, 12, 16
		304 1/8 Hard	G	04, 06, 08, 10, 12, 16

* SEE TABLE D FOR ASSOCIATED APPROVED FITTINGS.

REPAIR METHOD - RECONNECTABLE WITH FLARELESS FITTING SLEEVES TABLE A

L19634 S0006402389_V2

Tube Material and Fitting Selection Tables Figure 806/20-10-09-990-866 (Sheet 2 of 8)

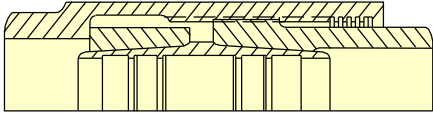
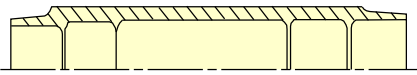
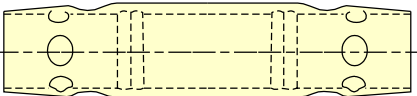
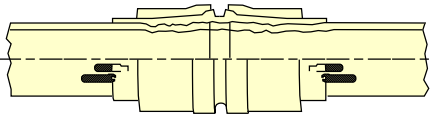
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TUBE JOINING		TUBE MATERIAL 8	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER			
	BACC42W Repair H-Coupling BACC42W-T	6061T6	G	04, 06, 08, 10
		304 ANN.	G	04, 06, 08, 10, 12, 16
		304 1/8 Hard	G	04, 06, 08, 10, 12, 16
		21-6-9	G	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	G	04, 06, 08, 10
	3P02111 or 3PHS111 Cryofit	Ti-3Al-2.5V	F	04, 06, 08, 10, 12, 16
	Permaswage D10282-D (Al)	6061T6	E	04, 06, 08, 10, 12, 16
	Permaswage D10282 - (Cres)	Ti-3Al-2.5V	E	04, 06, 08, 10, 12, 16
		304 1/8 Hard	E	04, 06, 08, 10, 12, 16
		21-6-9	E	04, 06, 08, 10, 12, 16
	Rynglok 80101T - (TITANIUM)	6061T6	H	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	H	04, 06, 08, 10, 12, 16, 20
		304 1/8 Hard	H	04, 06, 08, 10, 12, 16
		21-6-9	H	04, 06, 08, 10, 12, 16

REPAIR METHOD - PERMANENT UNIONS, TUBE-TO-TUBE
TABLE B

L19640 S0006402390_V2

Tube Material and Fitting Selection Tables
Figure 806/20-10-09-990-866 (Sheet 3 of 8)

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REF LETTER FOR TABLES A AND B	TOOL REQUIRED
A	Harrison Portable Swagers No. 5175 and 5720 or equivalent stationary Swager No. 5570
B	Pressure Presetting Tools ST878D
C	Hand Presetting Tools ST879A
D	Harrison Roller Swage Tool Kit 6633K01
D (1)	Harrison Roller Swaging Machine 6777
E	DMC Permaswage Kits: • DLT Series – Refer to Fig. 825 for individual tool numbers – Consult DMC for tool kit numbers – One pump unit, DLT02MAPP1000 (pneumatic, 10,000 psi) or – DLT05MAPM1000 (manual, 10,000 psi) is necessary for swaging with the tool kits shown.
F	AMCI: # TS3P02111
G	None necessary - hand tools only.
H	Aeroquip Rynglok Kit RTS8-02-006 for sizes 04, 06, 08, 10, 12, 16, 20.

**TOOL REQUIRED FOR REPAIR METHOD
TABLE C**

L19644 S0006402391_V3

**Tube Material and Fitting Selection Tables
Figure 806/20-10-09-990-866 (Sheet 4 of 8)**

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PART NUMBER	ASSOCIATED APPROVED FITTINGS	
	FITTING NUTS 5 7	UNIONS 6
BACS13AP (BITE-Type) BACS13BX (Elastomer Swage) BACS13BX (Roller Swage)	For <u>Aluminum</u> tubes less than size 20, use: • BACN10YL-Alum • MS21921-Alum or Steel • BACN10CS-Alum or Steel For size 20 and 24 Aluminum tubes used with short flareless fittings, use: • AS4660-Alum	For <u>Aluminum</u> tubes less size 20, use: • MS21902-Alum or Steel • M21924-Alum or Steel For size 20 and 24 Aluminum tubes used with short flareless fittings, use: • AS4663-Alum
	For <u>Cres</u> tubes, use: • BACN10YE-Cres • MS21921-Cres, Steel or Ti • BACN10CS-Cres, Steel • BACN10YA-Ti	For <u>Cres</u> tubes, use: • MS21902-Cres, Steel or Ti • MS21924-Cres, Steel or Ti
	For <u>Ti</u> tubes, use: • BACN10YA-Ti • BACN10YE-Cres • MS21921-Ti, Cre • AS4660-Ti (sizes 20 and 24 only)	For <u>Ti</u> tubes, use: • MS21902-Cres or Ti • MS21924-Cres or Ti • AS4660-Ti (sizes 20 and 24 only) • 35212 swaged union
35211 Sleeve (Roller Swage)	For <u>Ti</u> tubes, use: • BACN10YA-Ti • BACN10YE-Cres • MS21921-Ti, Cres • AS4660-Ti (sizes 20 and 24 only)	For <u>Ti</u> tubes, use: • MS21902-Cres or Ti • MS21924-Cres or Ti • AS4660-Ti (sizes 20 and 24 only) • 35212 swaged union
35212 Union (Roller Swage)	N/A	N/A
CRYOLIVE Assembly 921721	For <u>Aluminum</u> tubes, use: • 921721W- (sizes 04 thru 12 only) For Cres tubes, use: .921721J- For Ti tubes, use: .921721T-	For <u>Ti</u> tubes, use: • MS21902-Cres or Ti • MS21924-Cres or Ti

**ASSOCIATED APPROVED FITTINGS
TABLE D**

L19645 S0006402392_V2

**Tube Material and Fitting Selection Tables
Figure 806/20-10-09-990-866 (Sheet 5 of 8)**

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MATERIAL	TUBE SIZES								
	04	05	06	08	10	12	16	20	24
	0.250	0.312	0.375	0.500	0.625	0.750	1.000	1.250	1.500
21-6-9	0.016	0.020	0.020	0.026	0.033	0.039	0.052		
3A1-2.5V	0.016		0.019	0.026	0.032	0.039	0.052	0.070	
6061-T6	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.049	0.049
304 1/8 H	0.020	0.020	0.028	0.035	0.049	0.058	0.065*	0.035*	0.049*
304/321 ANNEALED CRES	0.035*		0.035*	0.035*	0.035*	0.035*	0.035*	0.035*	0.035*

* NOT QUALIFIED FOR 3000 PSI SYSTEMS, LOWER PRESSURES ONLY.

TABLE E

NOTE:

ALTERNATIVE WALL THICKNESSES FOR TUBE REPAIRS OF 3000 PSI AND LOWER SYSTEM PRESSURE APPLICATIONS PER FLAGNOTE [8](#)

CRES 321 TUBING PER MIL-T-8808 MAY BE USED AS A SUBSTITUTE FOR 304 TUBING PER MIL-T-8504, 6061-T6 ALUMINUM TUBING PER MIL-T-7081 OR AMS 4083. 6061-T6 ALUMINUM PER MIL-T-7081 OR AMS 4083 MAY BE USED AS A SUBSTITUTE FOR 6061-T6 ALUMINUM TUBING PER 22-T-700/6. CONTACT THE BOEING COMPANY WHEN CONSIDERING USE OF TUBE MATERIALS OTHER THAN THOSE SPECIFIED.

L19647 S0006402393_V3

Tube Material and Fitting Selection Tables
Figure 806/20-10-09-990-866 (Sheet 6 of 8)

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TUBING MATERIAL	LOCATION ON AIRPLANE	TUBING SURFACE	FINISH RECOMMENDATION AND OPTIONS	FINISH CODE FOR COMMERCIAL AIRPLANES
Titanium	ALL	Inside	None	F-25.01
		Outside	None	F-25.01
CRES	ALL	Inside	Passivate	F-17.25
		Outside	Passivate Optional: Passivate + Primer (Green) Passivate + Primer (Green) + Paint (White)	F-17.25 F-17.25 + F-20.02 or F-20.49 F-17.25 + F-20.02 or F-20.49 + F-21.30
Aluminum	Fuel Tanks	Inside and Outside	Alodine (Transparent Gold)	F-17.08 or F-17.27 (F-17.08 and F-17.27 cover application of alodine to inside and outside of tube)
	All Other (See NOTE)	Inside and Outside	Alodine (Transparent Gold)	F-17.08 or F-17.27 (F-17.08 and F-17.27 cover application of alodine to inside and outside of tube)
		Outside Only	+ Primer (Green) Optional: + Primer (Green) + Paint (White)	+ F-20.02 or F-20.49 + F-20.02 or F-20.49 + F-21.30
NOTE: Some earlier airplane models were delivered with aluminum tubes having anodize finish (F-17.19 - now an inactive finish) in combination with primer (F-20.02). Current airplane models are delivered with aluminum tubes having alodine finish, some in combination with primer and paint, as shown.				

TYPICAL FINISHES FOR HYDRAULIC TUBING

TABLE F

L08177 S0006604335_V3

**Tube Material and Fitting Selection Tables
Figure 806/20-10-09-990-866 (Sheet 7 of 8)**

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NOTE:

REFER TO FIG. 824 TO MAKE AN ORDER FOR PARTS.

- 1 STANDARD CADMIUM-PLATED SLEEVE BACS13AP (SIZE)
- 2 STANDARD CADMIUM-PLATED SLEEVE:
BACS13BX (SIZE) HP
- 3 BACS13BD20H.HP AND BACS13BD24H.HP HAVE BEEN SUPERSEDED BY BAC13BX20H.HP AND BAC13BX24H.HP.
- 4 THE BACSBX SLEEVE CAN BE USED TO REPAIR SIZE 20 AND 24 ALUMINUM TUBES WITH SHORT FLARELESS FITTINGS. IT CAN ALSO BE USED TO REPAIR SIZE 20 ALUMINUM TUBES AND SIZE 20 AND 24 CRES TUBES WITH STANDARD FLARELESS FITTINGS. MAKE SURE YOU DETERMINE THE APPLICATION BEFORE SWAGGING. SHORT FLARELESS FITTINGS REQUIRE A SHORTER "Z " DIMENSION (FIG. 811).
- 5 DO NOT USE ALUMINUM NUTS OR UNIONS ON TUBE MATERIALS OTHER THAN ALUMINUM.
- 6 ASSOCIATED APPROVED FITTINGS FOR OTHER UNIONS, REDUCERS, ELBOWS, AND TEES WITH MS33514 OR MS33515 FITTING ENDS; AND FOR SHORT FLARELESS FITTING APPLICATIONS, OTHER UNIONS, REDUCERS, ELBOWS AND TEES WITH AS4658 OR AS465 FITTING ENDS.
- 7 USE ONLY THE CRYOLIVE FLARELESS SLEEVE ASSEMBLY, CONSISTING OF THE CRYOLIVE SLEEVE, COUPLING NUT AND PLASTIC CAP. THE CRYOLIVE FLARELESS SLEEVE ASSEMBLY, IN SIZES 10, 12 AND 16, REQUIRES USE OF A LONGER LENGTH AMCI P/N 9211699 (MATERIAL CODE)(SIZE) N COUPLING NUT. THE LONGER LENGTH COUPLING NUTS ARE NOT INTERCHANGEABLE WITH STANDARD BACN10- AND MS21921 COUPLING NUTS.
- 8 WHEN PERFORMING A HYDRAULIC TUBE REPAIR WITH THE SAME TUBE MATERIAL, THE ALTERNATE TUBE WALL THICKNESSES LISTED IN FIG. 802 (SHEET 6) MAY BE USED IN PLACE OF WALL THICKNESSES DELIVERED WITH THE AIRPLANE WHEN PERFORMING A REPAIR ON TUBES IN SYSTEMS WITH 3000 PSI OR LESS OPERATING PRESSURE.

L19649 S0006402395_V2

Tube Material and Fitting Selection Tables Figure 806/20-10-09-990-866 (Sheet 8 of 8)

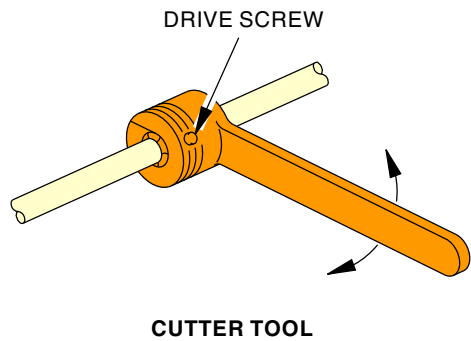
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TUBE SIZE	CHIPLESS CUTTER PART NUMBER	CUTTER WHEEL PART NUMBER
04	D12530-001	D12530-009
06	D12530-001	D12530-009
08	D12531-001	D12531-009
10	D12531-001	D12531-009
12	D12531-001	D12531-009

**DMC CHIPLESS CUTTERS AND CUTTER WHEELS
TABLE A**

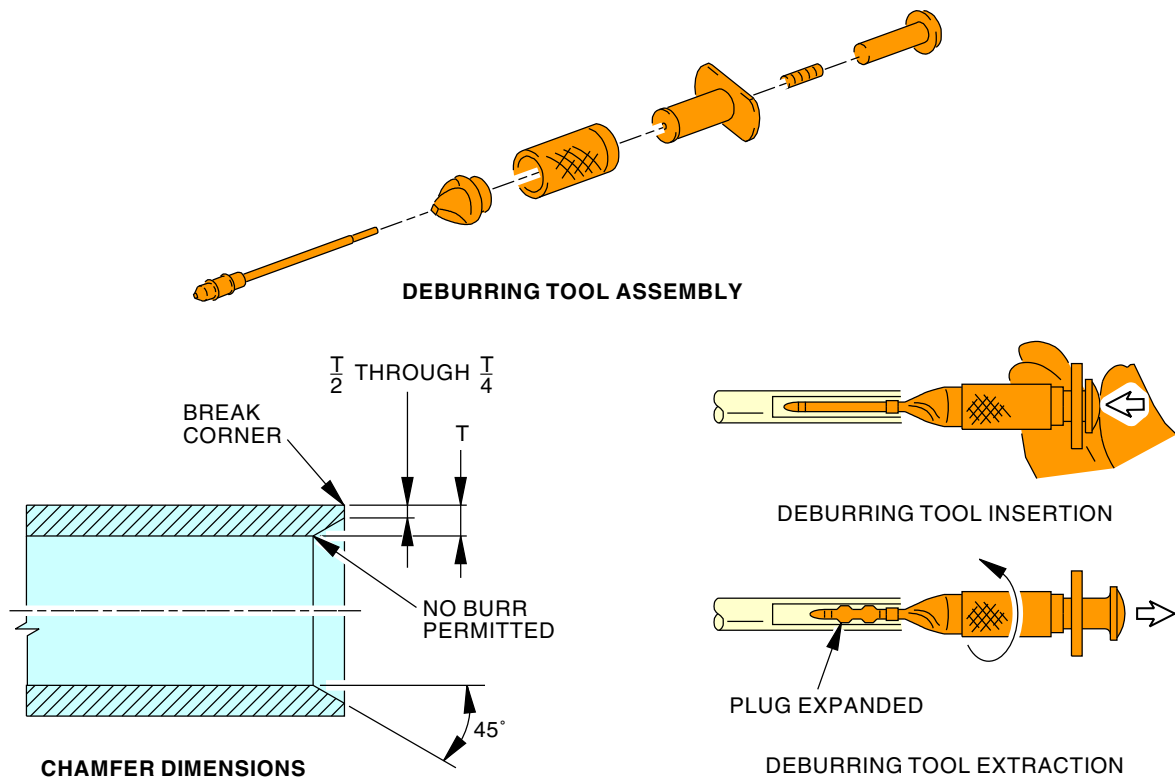
L19653 S0006402397_V3

DMC Tools
Figure 807/20-10-09-990-868 (Sheet 1 of 2)

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TUBE SIZE	TUBE WALL THICKNESS (INCHES)	STEM SUBASSEMBLY PART NUMBER	DEBURRING TOOL PART NUMBER
04	0.016-0.028	D9851-13-04	D9851
04	0.028-0.050	D9851-13-03	D9851
06	0.016-0.035	D9851-13-06	D9851
06	0.035-0.058	D9851-13-07	D9851
08	0.016-0.042	D9850-13-08	D9850
10	0.016-0.058	D9850-13-10	D9850
12	0.016-0.058	D9850-13-12	D9850
16	0.016-0.058	D9849-13-16	D9849
20	0.016-0.058	D9849-13-20	D9849

**DMC STEM SUBASSEMBLIES, DEBURRING TOOLS, AND
 REQUIRED CHAMFER DIMENSIONS**
TABLE B

L19654 S0006402398_V3

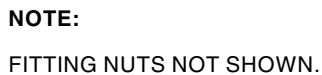
DMC Tools
Figure 807/20-10-09-990-868 (Sheet 2 of 2)

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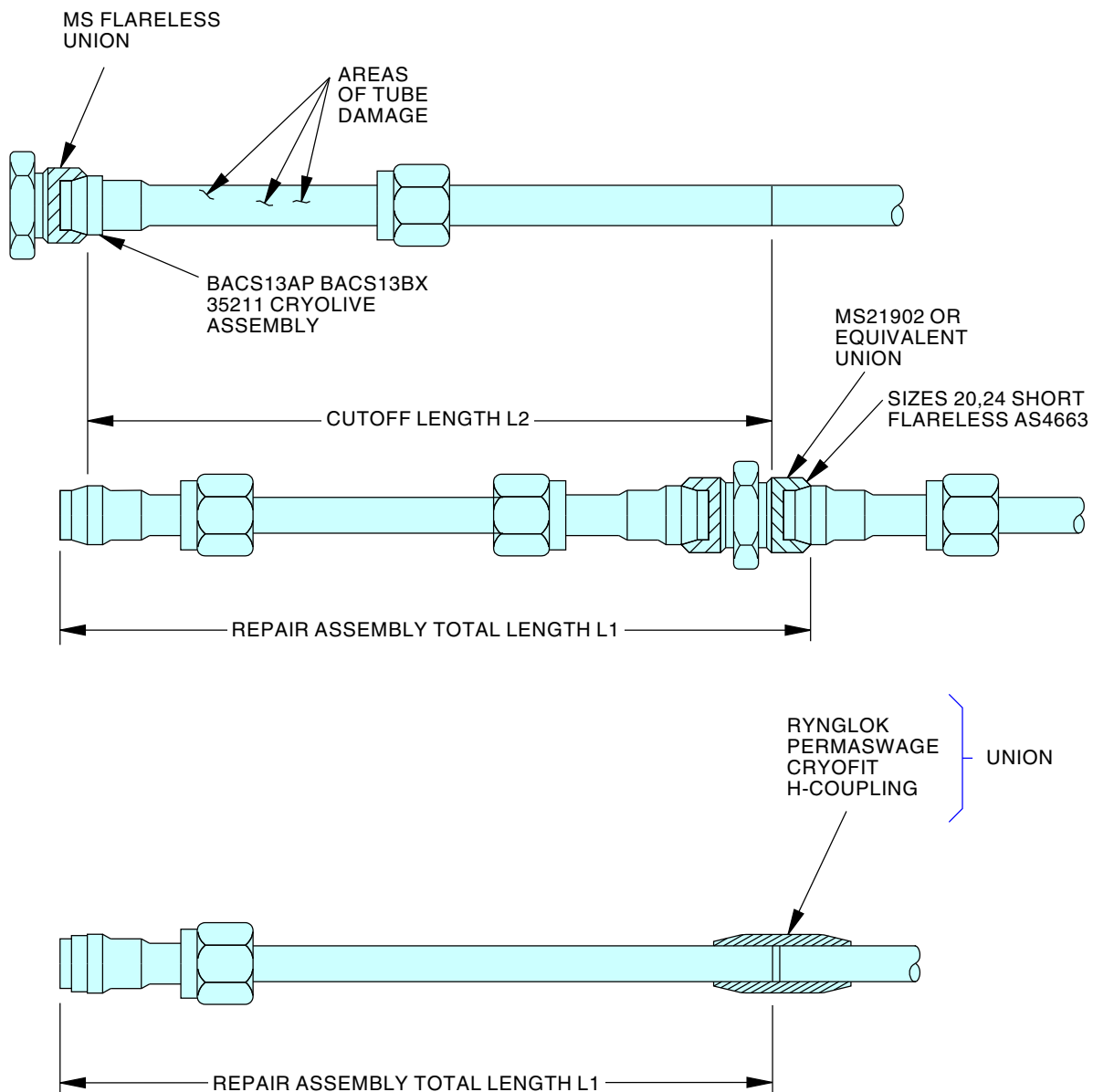


Tubing Repair with Unions - Short Damage

Figure 808/20-10-09-990-933

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NOTE:

REFER TO FIG. 810 (SHEET 1) FOR THE LENGTHS L1 AND L2.

L19665 S0006402401_V2

**Tubing Repair by End Replacement
Figure 809/20-10-09-990-870 (Sheet 1 of 2)**

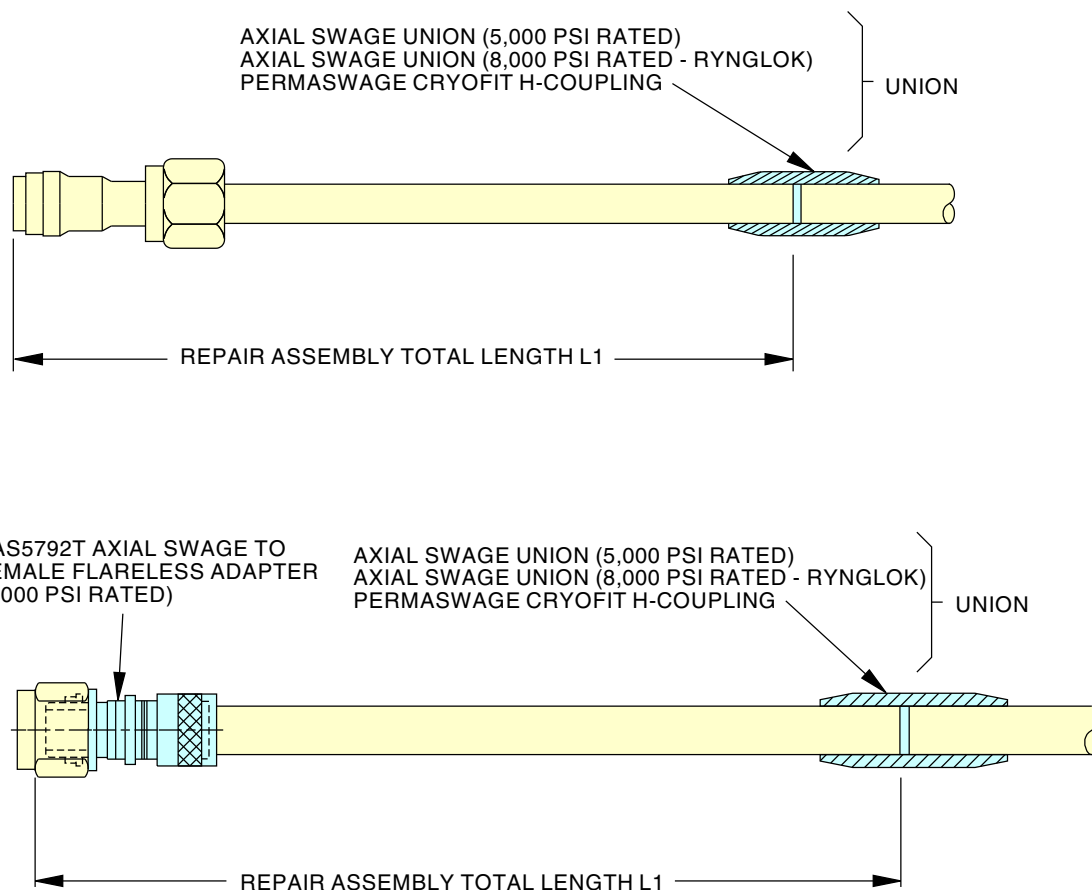
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NOTE:
REFER TO FIG. 810 FOR MINIMUM LENGTHS L1 AND L2.

2069547 S0000430357_V2

**Tubing Repair by End Replacement
Figure 809/20-10-09-990-870 (Sheet 2 of 2)**

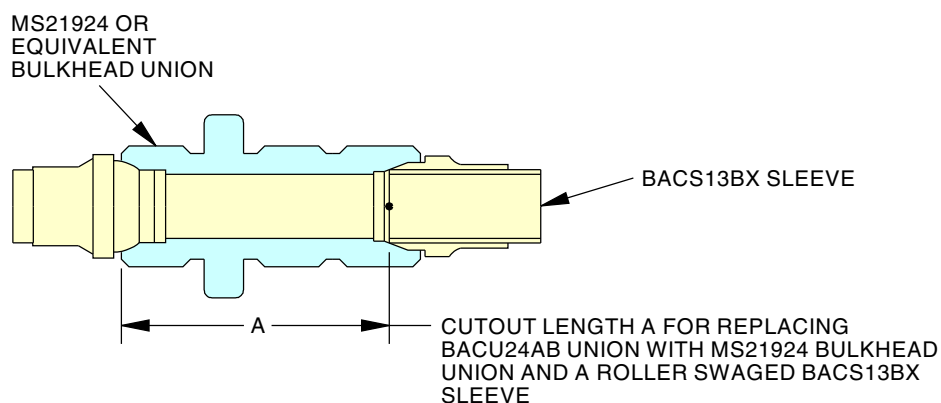
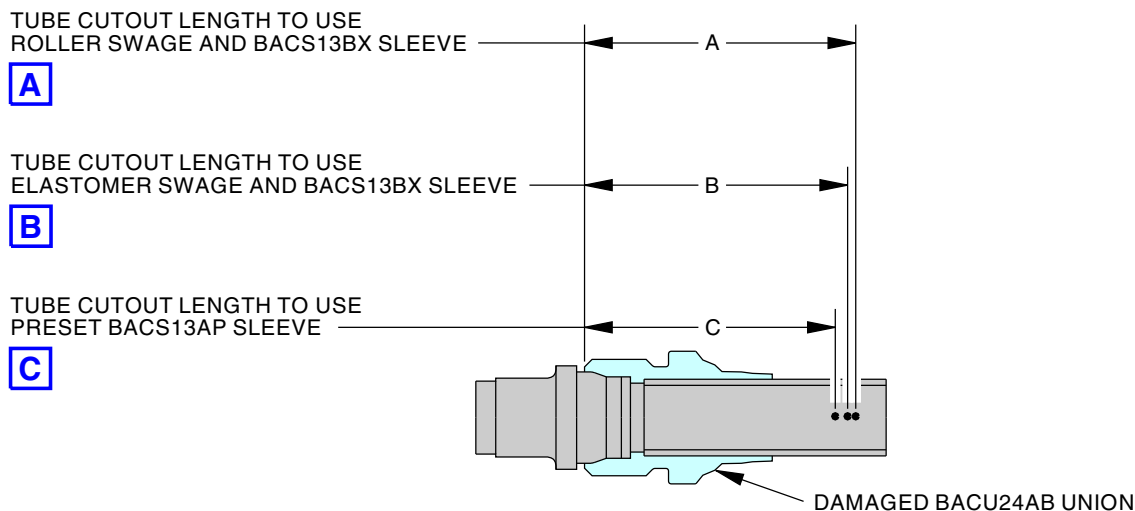
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A

NOTE:

REFER TO FIG. 808 FOR THE LENGTHS A,B AND C.
COUPLING NUTS NOT SHOWN.

F15978 S0006561969_V3

**Tube Cutout Lengths for Replacement of Damaged BACU24AB Swage Unions
Figure 810/20-10-09-990-871 (Sheet 1 of 3)**

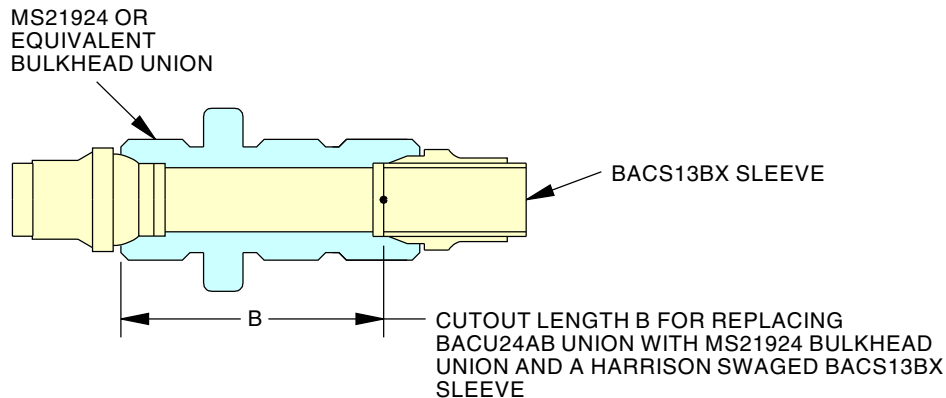
EFFECTIVITY
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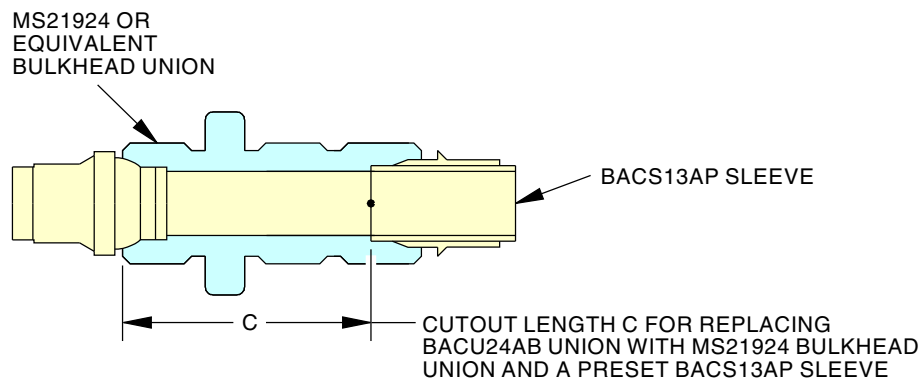
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B



C

NOTE:

REFER TO FIG. 808 FOR THE LENGTHS A, B, AND C.
COUPLING NUTS NOT SHOWN.

F15979 S0006561970_V3

**Tube Cutout Lengths for Replacement of Damaged BACU24AB Swage Unions
Figure 810/20-10-09-990-871 (Sheet 2 of 3)**

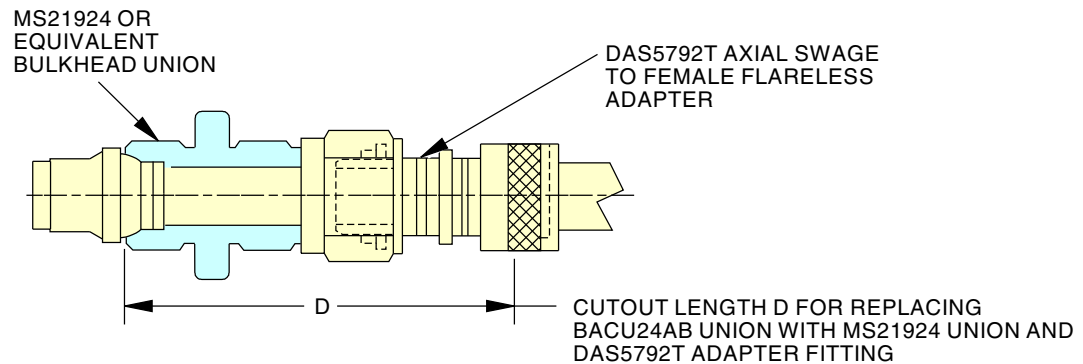
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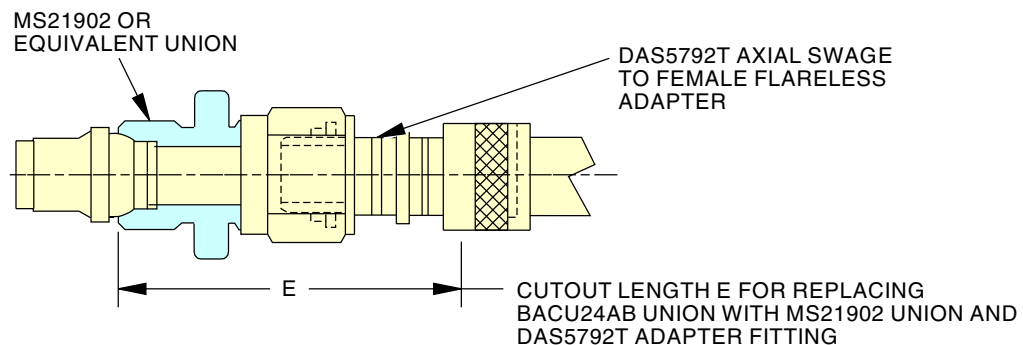
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D



E

NOTE:
REFER TO TABLE 805 FOR THE LENGTHS D AND E.

2070625 S0000430370_V3

**Tube Cutout Lengths for Replacement of Damaged BACU24AB Swage Unions
Figure 810/20-10-09-990-871 (Sheet 3 of 3)**

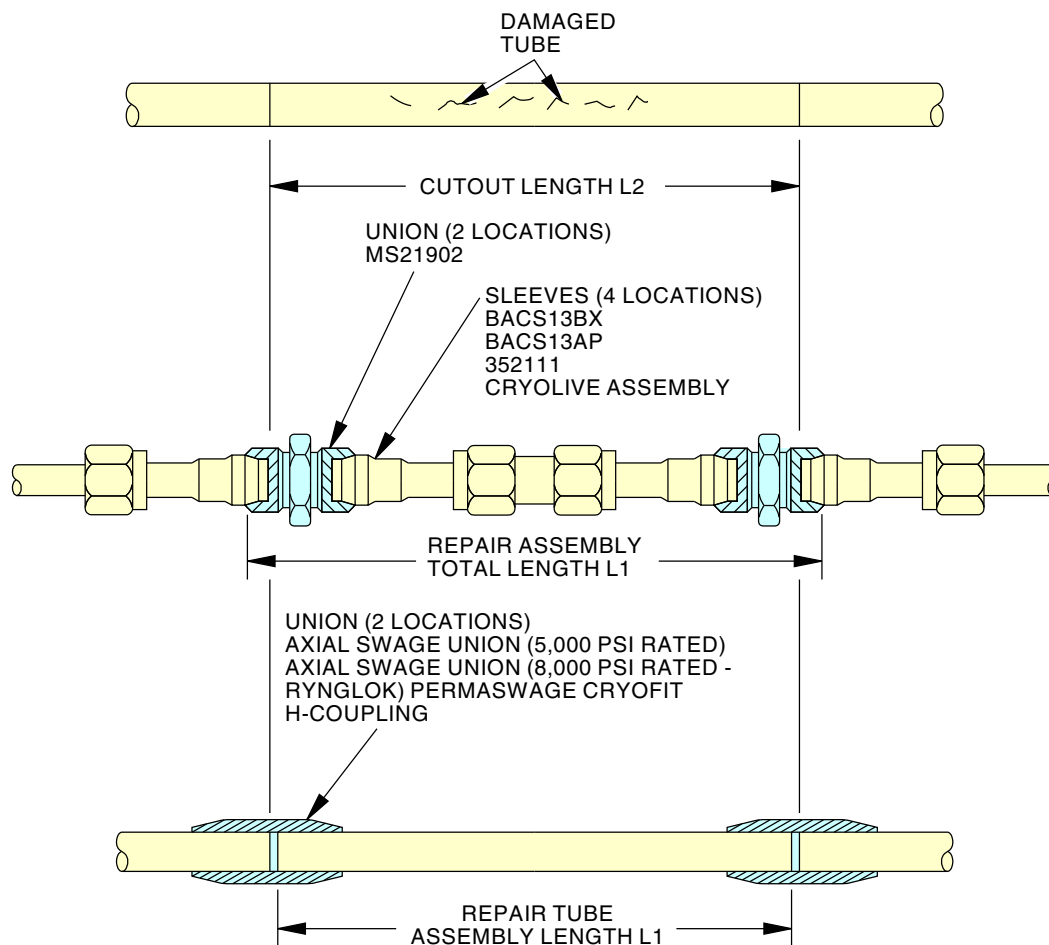
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NOTE:

REFER TO FIG. 810 FOR MINIMUM LENGTHS L1 AND L2.

F15981 S0006561972_V5

**Tubing Repair by Section Replacement, Straight or Bend - Extensive Damage
Figure 811/20-10-09-990-873 (Sheet 1 of 2)**

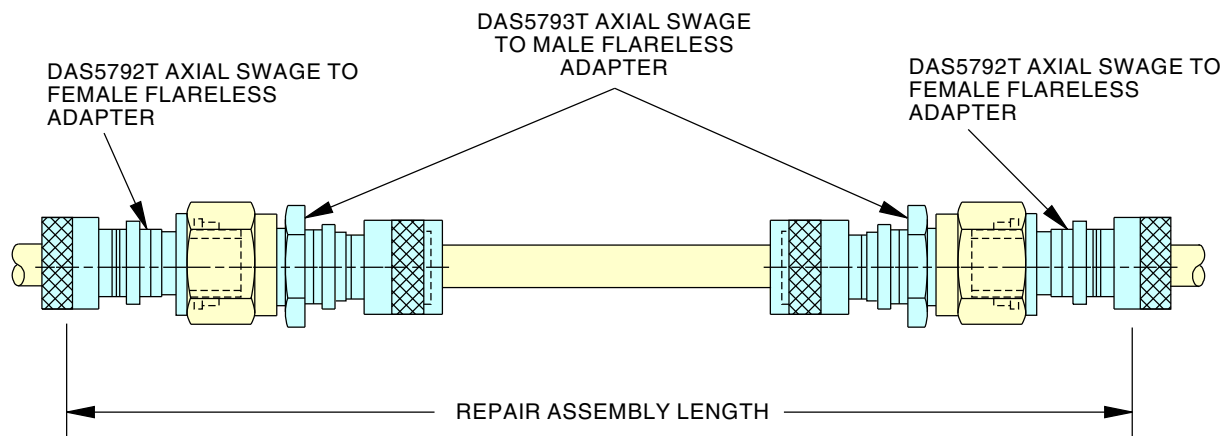
EFFECTIVITY
ARO ALL

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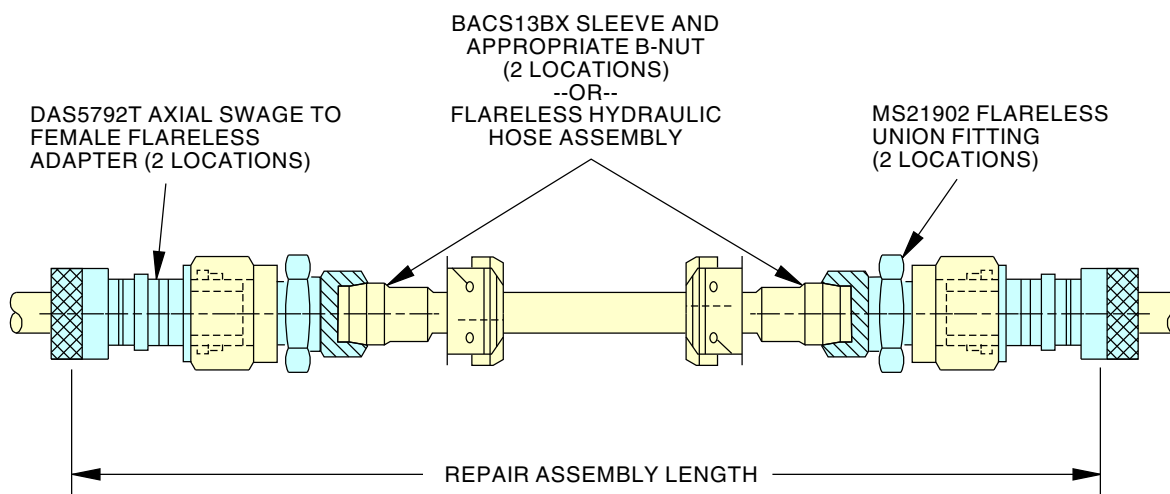
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REPAIR ASSEMBLY TOTAL LENGTH = 2 X TUBE CUTOUT LENGTHS FOR DAS5792T FROM TABLE 812 + 2 X TUBE CUTOUT LENGTHS FOR DAS5793T FROM TABLE 812 + REMAINING FREE TUBE LENGTH. OBSERVE MINIMUM TUBE LENGTHS REQUIRED FOR AXIALLY SWAGED FITTINGS FROM FIGURE 810.



REPAIR ASSEMBLY TOTAL LENGTH = 2 TUBE CUTOUT LENGTHS FOR DAS5792T FROM TABLE 812 + 2 TWO "P" DIMENSION VALVES FOR BACS13BX SLEEVE FROM FIGURE 809 + TWO DIMENSION "D" FOR MS21902 FLARELESS UNION FROM TABLE 805 + FREE TUBE LENGTH. OBSERVE MINIMUM TUBE LENGTHS REQUIRED FOR AXIALLY SWAGED FITTINGS FROM FIGURE 810.

NOTE:

REFER TO FIG. 810 FOR MINIMUM LENGTHS L1 AND L2.

2069883 S0000430477_V3

Tubing Repair by Section Replacement, Straight or Bend - Extensive Damage Figure 811/20-10-09-990-873 (Sheet 2 of 2)

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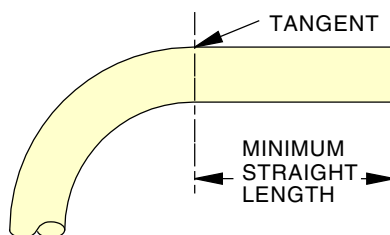
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FITTING TYPE	TUBE END MINIMUM STRAIGHT LENGTH - INCHES								
	04	05	06	08	10	12	16	20	24
BACS13BX (Harrison Elastomer Swager) and CRYOLIVE Flareless Sleeve Assembly	1.23	1.25	1.28	1.39	1.48	1.51	1.47	1.46	1.46
BACS13BX (Harrison Roller Swager)	2.25	2.25	2.25	2.25	2.25	2.25	2.25	N/A	N/A
BACS13AP (BITE Type)	0.80	0.90	1.00	1.10	1.15	1.15	N/A	N/A	N/A
D10282 * (Permaswage)	1.07	N/A	1.15	1.65	1.70	1.80	1.90	2.15	N/A
BACC42W * (H-Coupling)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	N/A	N/A
3p02111 * (Cryofit)	0.71	0.81	0.90	0.98	1.17	1.35	1.76	N/A	N/A
35211 Sleeve (Harrison Roller Swager)	1.30	N/A	1.30	1.38	1.42	1.40	1.40	N/A	N/A
35212 Union (Harrison Roller Swager)	1.22	N/A	1.30	1.48	1.46	1.50	1.50	N/A	N/A
80101T Axial Swage Fitting (8,000 psi rated 8010T - Rynglok)	1.236	N/A	1.362	1.480	1.628	1.777	2.109	2.143	N/A
DAS5969T, DAS5792T, DAS5793T, DAS5801T, DAS5803T, DAS5804T, DAS5806T, DAS5972T and other Axial Swage Fittings (5,000 psi rated)	0.90	N/A	1.12	1.54	1.69	1.84	2.17	N/A	N/A

* Based on 1/2 fitting length

F15988 S0006561976_V5

Minimum Straight Length Specifications for Repair Fitting Installations Adjacent to Tube Bends Figure 812/20-10-09-990-876

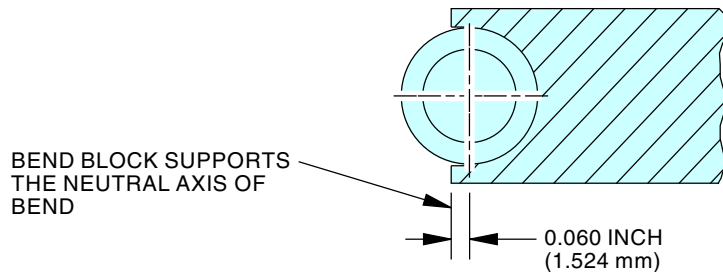
EFFECTIVITY
ARO ALL

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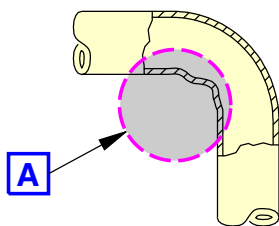
**777-200/300
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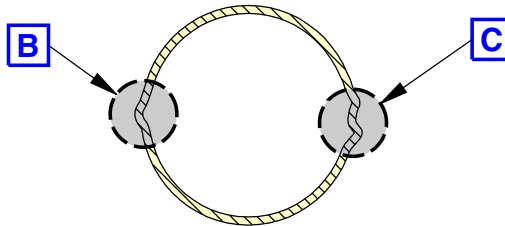
NOTE:

IF THE OVALITY OF ANY PART OF THE BEND IS MORE THAN THE MAXIMUM PERMITTED OVALITY, DISCARD THE TUBE.

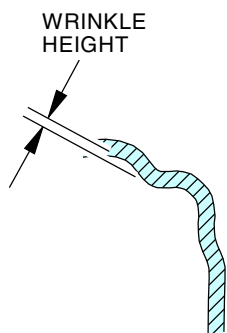
TUBE BEND BLOCK



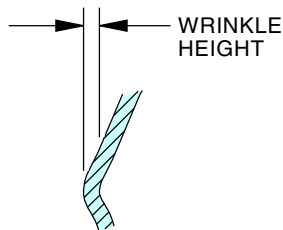
**RADIAL
WRINKLE**



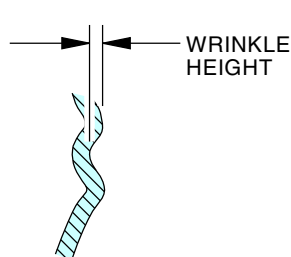
**LONGITUDINAL
WRINKLE**



A



B



C

WRINKLE MEASUREMENTS

L97117 S0006402450_V2

**Permitted Forming Limits for Electrical Rigid Conduits
Figure 813/20-10-09-990-906**

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TASK 20-10-09-300-805

5. Titanium Hydraulic Tubing, 3000 psi - Roll swaging Harrison 53211 Sleeves and 53212 Unions using the Harrison 6777 Swage Machine.

A. General

- (1) The sleeves, unions, and nuts used for this repair are listed in (Figure 806, Figure 808, and Table 807)
- (2) Get the necessary tools and dies as listed in the operating manual with the Harrison 6777 Swage Machine.

NOTE: This procedure does not apply to the repair of aluminum or CRES tubing.

B. Procedure.

SUBTASK 20-10-09-300-006

- (1) Do the repair:
 - (a) Cut and chamfer tubes as shown in (Figure 807), and to length requirements shown in (Table 812, Figure 808, and Table 807) as applicable. Correct for swage growth according to data provided in the manufacturer's operating manual.
 - (b) Clean the tube with Methyl Ethyl Ketone or an equivalent cleaning agent and blow air through the tube to remove particles.
 - (c) Use swage dies as shown in (Figure 814).
 - (d) Use swage torques as shown in (Figure 815).
 - (e) After swaging the tube ends, inspect the after-swage inside diameter of the tube end to the values specified in (Figure 815). Also, inspect swage area for any signs of roller wear or defective rollers.
 - (f) Make sure that there are no scratches or other damage on the seal areas of the sleeve and union.
 - (g) Conduct a proof pressure test of the tube assembly:
 - 1) Connect the Harrison sleeve and union of the tube and torque it to the specified value.
 - 2) Pressurize the tube to 6000 psi.
 - 3) There shall be no leakage in proof testing.
 - 4) If there is leakage, loosen and retighten the fitting. If leakage persists, remove the tube and inspect tube end and test fittings for defects.

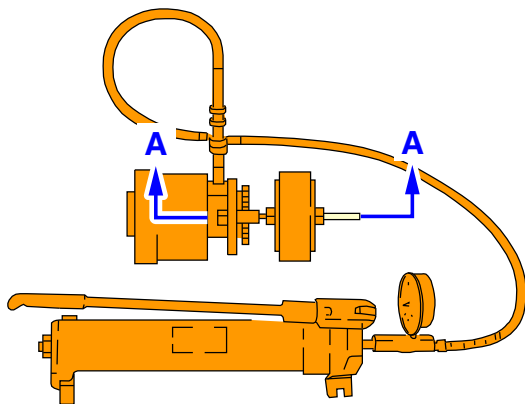
———— **END OF TASK** ————

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ARO ALL

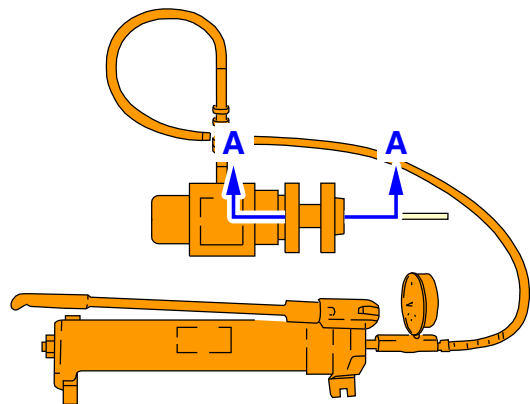
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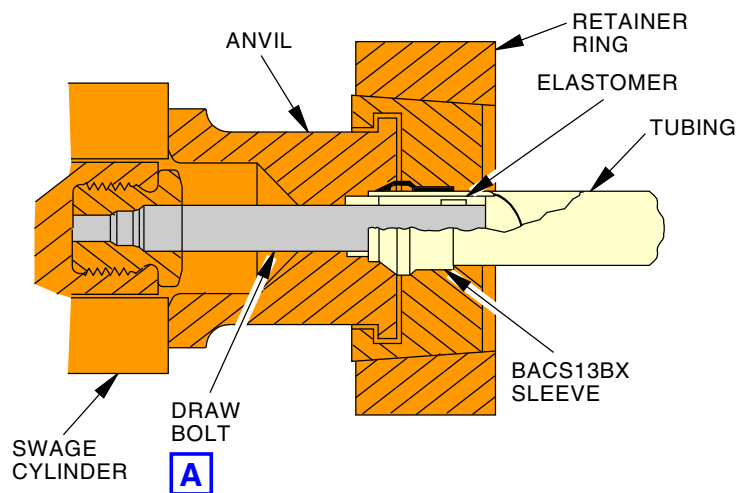
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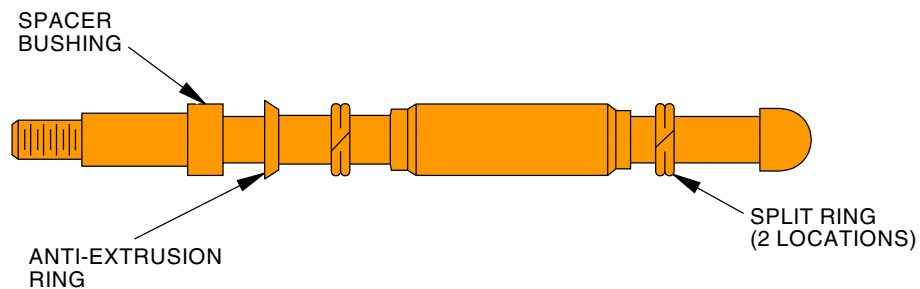
HARRISON MODEL 5720



HARRISON MODEL 5175



A-A



DRAW BOLT ASSEMBLY
(SHOWN EXTENDED)

A

L19677 S0006402410_V2

Harrison Portable Swagers for BACS13BX Sleeves
Figure 814/20-10-09-990-921 (Sheet 1 of 5)

EFFECTIVITY
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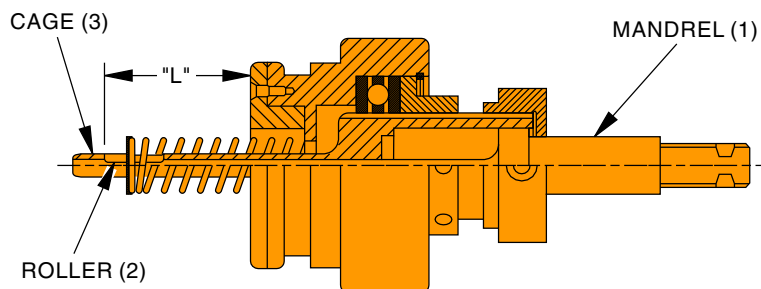
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SIZE	EXPANDER ASSEMBLY	MANDREL (1)	ROLLERS (2)	CAGE (3)
-04	7320-04016	7321-04016	7322-04016	7323-04016
-06	7320-06019	7321-06019	7322-06019	7323-06019
-08	7320-08026	7321-08026	7322-08026	7323-08026
-10	7320-10032	7321-10032	7322-10032	7323-10032
-12	7320-12039	7321-12039	7322-12039	7323-12039
-16	7320-16051	7321-16051	7322-16051	7323-16051

**EXPANDERS P/N AND SPARE PARTS P/N REQUIRED TO ROLLER
SWAGE 35211 AND 35212 TO 3AI-2.5V TITANIUM TUBING**

TUBE O.D.	SET LENGTH "L" (INCHES) $\pm .005$
-04	1.010
-06	1.205
-08	1.310
-10	1.382
-12	1.474
-16	1.600

TOOL ADJUSTMENT

HARRISON 6777 MACHINE

L19678 S0006402411_V2

**Harrison Portable Swagers for BACS13BX Sleeves
Figure 814/20-10-09-990-921 (Sheet 2 of 5)**

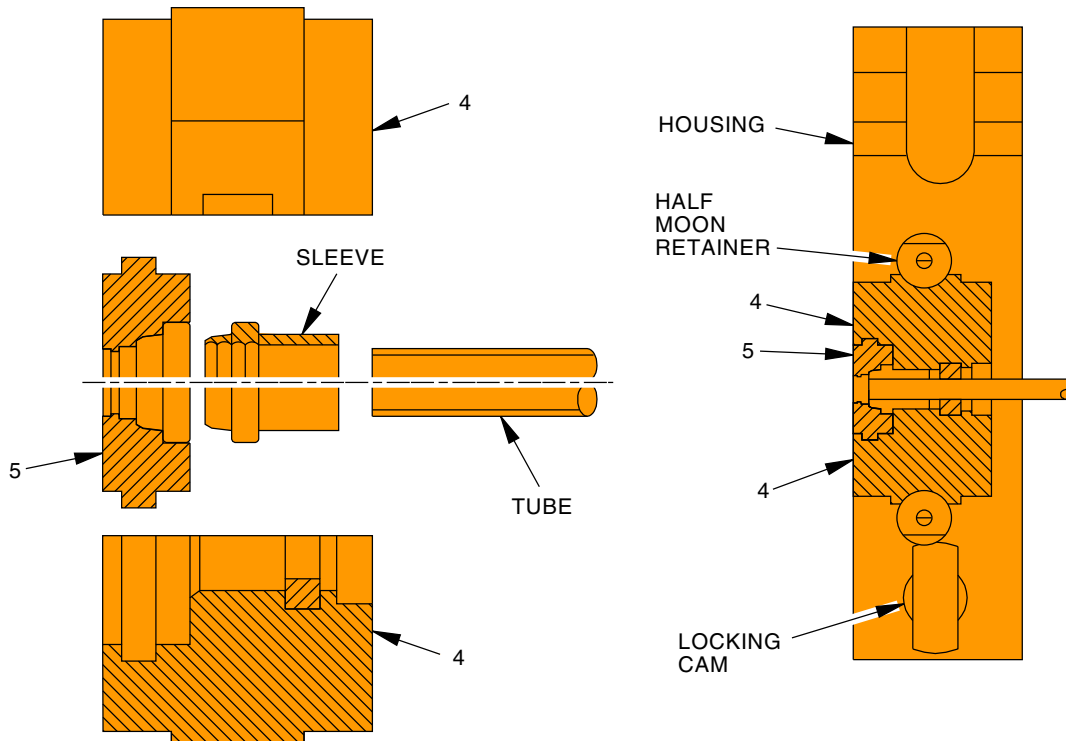
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TUBE AND SLEEVE DIA.	TWO HALF JAWS (4)	RETAINER (5)
INCHES		
1/4	6884-04	6885-104
3/8	6884-06	6885-106
1/2	6884-08	6885-108
5/8	6884-10	6885-110
3/4	6884-12	6885-112
1	6884-16	6885-116

HARRISON 6777 MACHINE

L19679 S0006402412_V2

Harrison Portable Swagers for BACS13BX Sleeves
Figure 814/20-10-09-990-921 (Sheet 3 of 5)

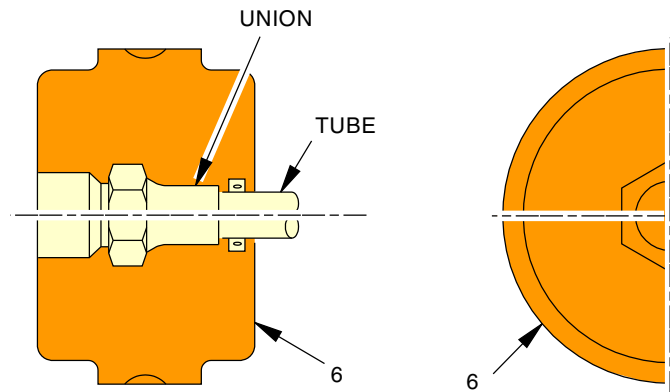
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TUBE AND UNION DIA.	TWO HALF JAWS (6)
INCHES	
1/4	6886-04
3/8	6886-06
1/2	6886-08
5/8	6886-10
3/4	6886-12
1	6886-16

EXTERNAL ROLLER SWAGE TOOLS FOR UNIONS

L19680 S0006402413_V2

Harrison Portable Swagers for BACS13BX Sleeves
Figure 814/20-10-09-990-921 (Sheet 4 of 5)

EFFECTIVITY

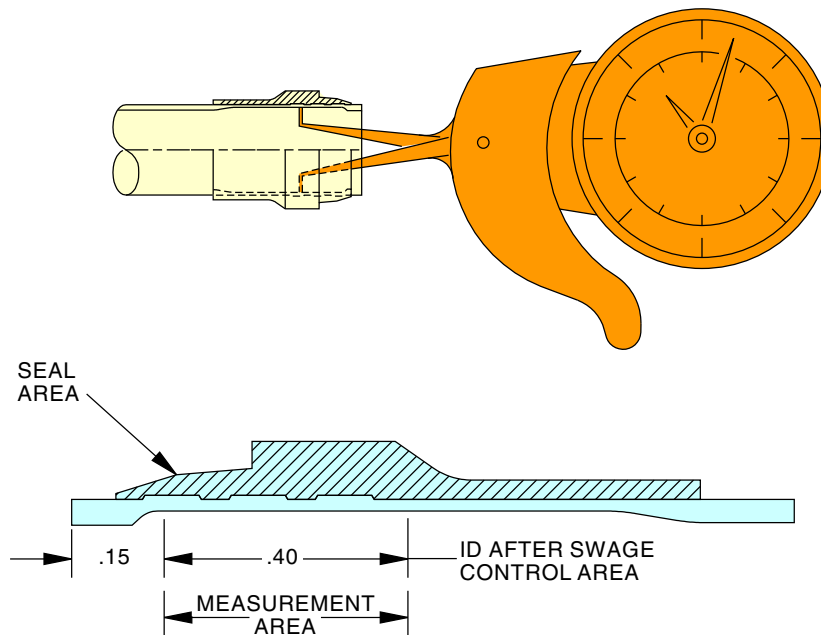
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NOTE:

I.D. AFTER SWAGE REQUIREMENTS-MEASURING METHOD FOR 35211 SLEEVE AND 35212 UNION

TUBE O.D./DASH NO.	TUBE WALL	TORQUE	I.D. AFTER SWAGE
TUBE MATERIAL: 3AI-2.5V TITANIUM PER AS5620			
0.250/-04	0.016	6-7	0.225-0.232
0.375/-06	0.019	11-12	0.347-0.354
0.500/-08	0.026	20-22	0.458-0.465
0.625/-10	0.032	40-43	0.575-0.587
0.750/-12	0.039	40-43	0.684-0.695
1.000/-16	0.051	65-68	0.913-0.919

SWAGING TORQUE AND I.D. AFTER SWAGE REQUIREMENTS FOR 35211 SLEEVE AND 35212 UNIONS

L19681 S0006402414_V3

Harrison Portable Swagers for BACS13BX Sleeves
Figure 814/20-10-09-990-921 (Sheet 5 of 5)

EFFECTIVITY
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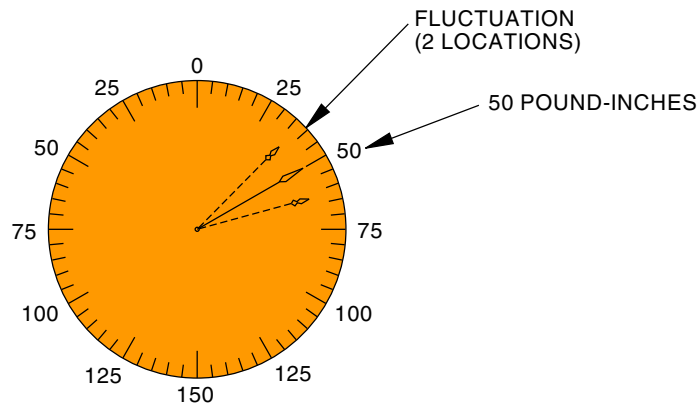
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TORQUE WRENCH DIAL - PROCEDURE TO READ TORQUE

TUBE SIZE	MATERIAL		SWAGE TORQUE (POUNDS-INCH)	
	WALL THICKNESS - INCHES			
	3AL-2.5V TITANIUM 1	21Cr-6Ni-9Mn CRES 2	MIN	MAX
04	0.016	0.016	4	5
06	0.019	0.020	12	15
08	0.026	0.026	20	25
10	0.032	0.033	40	45
12	0.039	0.039	40	45
16	0.051	0.052	80	85

**SWAGE TORQUES NECESSARY TO ROLLER SWAGE
BACS13BX SLEEVES TO Ti-3AL-2.5V CWSR OR
21-6-9 CRES TUBE USING HARRISON 6633K01
ROLLER SWAGING KIT**

- 1 AS SPECIFIED IN SPECIFICATION AS5620/BMS 7-234
2 AS SPECIFIED IN SPECIFICATION BMS 7-185

L19690 S0006402419_V3

**Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging
Figure 815/20-10-09-990-920 (Sheet 1 of 3)**

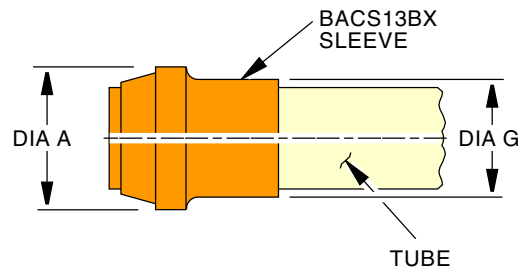
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DIAMETER	TUBE SIZE					
	04	06	08	10	12	16
A MAX	0.374	0.493	0.673	0.789	0.964	1.214
G MAX	0.298	0.423	0.550	0.686	0.822	1.070

MAXIMUM PERMITTED SHOULDER AND SKIRT DIAMETERS (INCH)

L19691 S0006402420_V2

Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging
Figure 815/20-10-09-990-920 (Sheet 2 of 3)

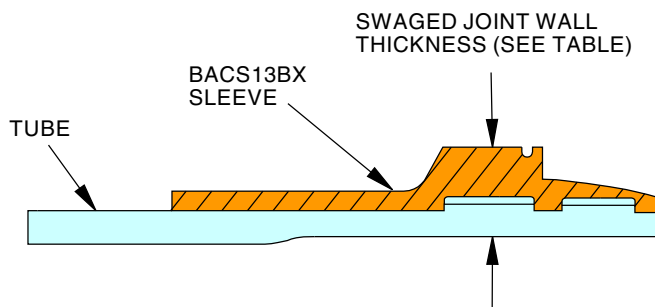
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SECTION OF ROLLER SWAGED JOINT

TUBE SIZE	TUBE DIMENSIONS		SWAGED JOINT WALL THICKNESS FOR "NOMINAL" TUBE WALLS - INCHES	
	"NOMINAL" WALL THICKNESS - INCHES			
	Ti-3AL-2.5V	21-6-9 CRES		
04	0.016	0.016	0.068	TOLERANCE +0.002 -0.003
06	0.019	0.020	0.066	
08	0.026	0.026	0.100	
10	0.032	0.033	0.101	
12	0.039	0.039	0.132	
16	0.051	0.052	0.143	

SWAGED JOINT WALL THICKNESS SPECIFICATION ¹ ²

- ¹ "NOMINAL" WALL THICKNESS DEFINITION: TUBE WALL THICKNESS WITHOUT TOLERANCES AS SPECIFIED BY TUBE SPECIFICATION: AS5620 FOR Ti-3AL-2.5V AND BMS 7-185 FOR 21-6-9 CRES.
- ² IF THE THICKNESS OF A MEASURED TUBE WALL IS DIFFERENT THAN THE "NOMINAL", ADD OR SUBTRACT THE DIFFERENCE FROM THE NECESSARY SWAGED JOINT WALL THICKNESS FOR "NOMINAL" TUBE WALLS.

EXAMPLE: 1. MEASURED 10 SIZE TITANIUM 3AL-2.5V TUBE WALL = 0.035 INCH
 2. WALL DIFFERENCE IS 0.035 INCH, MINUS 0.032 INCH = 0.003 INCH
 3. ADD 0.003 INCH TO 0.101 INCH = 0.104 INCH

L19692 S0006402421_V3

Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging Figure 815/20-10-09-990-920 (Sheet 3 of 3)

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TASK 20-10-09-400-805

6. Install the CRYOLIVE Flareless Sleeve Assembly

A. General



WARNING

USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO. PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.



WARNING

SLOWLY AND CAREFULLY SUBMERGE WARM ITEMS IN LIQUID NITROGEN TO PREVENT RAPID BOILING OFF AND SPLASHING. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

- (1) The CRYOLIVE flareless sleeve, shown in (Figure 806) and (Figure 817), is installed as part of an assembly consisting of the sleeve, a coupling and nut and plastic cap that acts as an assembly tool and a protective cover for the tube end until the tube is installed in the airplane. The assembly is stored in liquid nitrogen until ready for use. During installation, the assembly is removed from the liquid nitrogen, slipped onto the tube end and allowed to warm to room temperature. The sleeve shrink fits into position at the correct distance from the tube end as it warms to room temperature.

NOTE: Do not use CRYOLIVE flareless sleeve assemblies on any oxygen lines or on fluid lines inside the fire zones on engines or APU's. The CRYOLIVE flareless sleeve assembly is not qualified for these applications.

- (2) The CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 can be used, as shown in (Figure 806) and (Figure 817), with 304 1/8 hard CRES, Ti-3Al-2.5V and 21-6-9 CRES tube and 6061-T6 aluminum tube. Titanium coupling nuts (part of CRYOLIVE assembly 921721T-) or CRES coupling nuts (part of CRYOLIVE assembly 921721J-) can be used with the CRYOLIVE sleeve on 304 1/8 hard CRES, Ti-3Al-2.5V or 21-6-9 CRES tube. Aluminum coupling nuts (part of CRYOLIVE assembly 921721W-) and aluminum mating fittings must be used to avoid galvanic corrosion when the CRYOLIVE flareless sleeve assembly is installed on 6061-T6 aluminum tube.
- (3) The coupling nut used with the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 in sizes 10, 12, and 16 is longer than the standard MS21921/BACN10-coupling nut in the same sizes and is not interchangeable with the MS21921/BACN10-nuts. See (Table 813) for approved Cryolive sleeve, coupling nut and plastic cap combinations.
- (4) Ensure that the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 is installed so that the joint will not be subjected to axial preload during final torquing of the joint.

B. References

Reference	Title
20-30-80-910-801	General Cleaning of Metal (Series 80) (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
COM-1355	Gloves, Insulated Part #: OE-GLOVE Supplier: 30974 Opt Part #: EO-GLOVE-LINER- (S-M-L) Supplier: 30974
COM-1356	Work Box, Insulated Part #: WB910825-01 Supplier: 30974
STD-1058	Container - Oil Resistant, 1 Gallon, (4 Liter)
STD-1353	Assembly - Cryolive, Flareless Sleeve/Coupling Nut/Protective Cap
STD-1354	Tongs

D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal	
G00262	Nitrogen - Liquid	A-A-59503 Type II, MIL-PRF-27401 Type II

E. Equipment

SUBTASK 20-10-09-940-016

- (1) CRYOLIVE Flareless Sleeve/Coupling Nut/Protective Cap Assemblies see (Advanced Metal Components Incorporated, 1374 Willow Road, Menlo Park, California 94025).

SUBTASK 20-10-09-940-017

- (2) Tongs (Any suitable, also available from Advanced Metal Components, Incorporated by part number AT911067-01).

SUBTASK 20-10-09-940-018

- (3) Insulated Gloves (Available from Advanced Metal Components, Incorporated by part number OE-Glove-Liner, S-M-L or from Damart Corporation, 1811 Woodbury Avenue, Portsmouth, New Hampshire 03805 by part number 264E).

SUBTASK 20-10-09-940-019

- (4) Work Box, Insulated (Available from Advanced Metal Components, Incorporated by part number WB910825-01).

F. Procedure

SUBTASK 20-10-09-040-001

- (1) Remove pressure from the system where you will do repairs and allow the hydraulic fluid to drain into a suitable container, example oil resistant container 1 gal, (4 l), STD-1058.

SUBTASK 20-10-09-800-016

- (2) Make sure that the tube end where you will install the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 is round, smooth and free of scratches and burrs.

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SUBTASK 20-10-09-110-012



WARNING

DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (3) Use Series 80 solvent, B01000 (TASK 20-30-80-910-801) to clean the tube in the area where you will install the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353.

SUBTASK 20-10-09-800-017

- (4) Put on the insulated gloves, COM-1355.

SUBTASK 20-10-09-880-001



WARNING

USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO. PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.



WARNING

SLOWLY AND CAREFULLY SUBMERGE WARM ITEMS IN LIQUID NITROGEN TO PREVENT RAPID BOILING OFF AND SPLASHING. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

- (5) Put nitrogen, G00262, into a small, insulated work box, COM-1356. Remove the CRYOLIVE flareless sleeve/coupling nut/protective cap cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 from the main storage container and put it into the liquid nitrogen. Make sure the assembly is fully covered by the liquid nitrogen.

SUBTASK 20-10-09-510-001

- (6) Move the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 which is in the liquid nitrogen to the repair location.

SUBTASK 20-10-09-420-026

- (7) Install the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353:
- (a) Using tongs, STD-1354, remove the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 from the liquid nitrogen and allow the excess liquid nitrogen to run off.



WARNING

DO NOT PUT GLOVED HAND IN LIQUID NITROGEN. THE LIQUID NITROGEN CAN "WICK" INTO THE GLOVE MATERIAL AND CAUSE INJURY TO YOUR HAND.

- (b) Grasp the CRYOLIVE flareless sleeve with the gloved hand and immediately slide it onto the tube end until the assembly bottoms on the tube. Ensure that the tube end is visible in the slotted end of the protective cap.

SUBTASK 20-10-09-880-002

- (8) Allow the CRYOLIVE flareless sleeve to warm and shrink on to the tube.

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SUBTASK 20-10-09-540-001



CAUTION

THE TUBE END MUST BE FULLY BOTTOMED AGAINST THE INSIDE END OF THE CAP SO THAT THE SLEEVE IS CORRECTLY POSITIONED ON THE TUBE END. IF THE TUBE END IS NOT BOTTOMED AGAINST THE INSIDE END OF THE CAP, REMOVE THE PLASTIC CAP AND MEASURE THE TUBE PROTRUSION PER THE "P" DIMENSION REQUIREMENT OF (FIGURE 816). IF THE "P" DIMENSION IS INCORRECT, THE INSTALLATION MUST BE REPLACED.

- (9) When ready to complete final joining/torquing of the coupling nut/CRYOLIVE flareless sleeve to the mating fitting, remove and discard the plastic cap by unscrewing the coupling nut. (Table 813).

NOTE: The plastic caps are manufactured from polycarbonate material and can be recycled.

Table 813/20-10-09-993-891 CRYOLIVE Flareless Sleeve/Coupling Nut/Plastic Cap Combinations

TUBE SIZE	COUPLING NUT MATERIAL	COMBINATION - SLEEVE/COUPLING NUT/PLASTIC CAP PART NO. ^{*[1]}
04	304 CRES 7075-T73 Al 6AL-4V Ti	921721J04 921721W04 921721T04
06	304 CRES 7075-T73 Al 6AL-4V Ti	921721J06 921721W06 921721T06
08	304 CRES 7075-T73 Al 6AL-4V Ti	921721J08 921721W08 921721T08
10	304 CRES 7075-T73 Al 6AL-4V Ti	921721J10 921721W10 921721T10
12	304 CRES 7075-T73 Al 6AL-4V Ti	921721J12 921721W12 921721T12
16	304 CRES 7075-T73 Al 6AL-4V Ti	921721J16 (Combination not Approved) 921721T16

^{*[1]} Do not replace coupling nuts included with the CRYOLIVE flareless sleeve/coupling nut/plastic cap combinations. Use only the coupling nut provided with the assembly.

————— **END OF TASK** —————

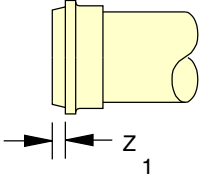
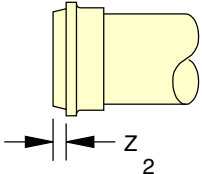
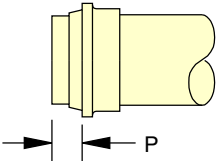
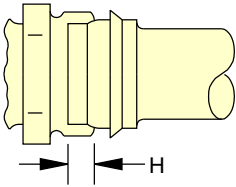
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FLARELESS SLEEVE JOINT TYPE	TUBE SIZES								
	04	05	06	08	10	12	16	20	24
BACS13BX (Roller Swaged) 	0.140	N/A	0.137	0.190	0.195	0.195	0.195	N/A	N/A
35211 (Harrison Roller Swaged) 	0.210	N/A	0.207	0.250	0.255	0.255	0.255	N/A	N/A
BACS13BX (Elastomer Swaged) 	0.214	0.230	0.230	0.285	0.330	0.330	0.392	0.395  0.355 	0.465  0.350 
BACS13AP (Preset) 	0.234	0.250	0.250	0.305	0.350	0.350	N/A	N/A	N/A

-  ALL EXCEPT SHORT FLARELESS
 SHORT FLARELESS

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Flareless Sleeve Tube End Values
Figure 816/20-10-09-990-911

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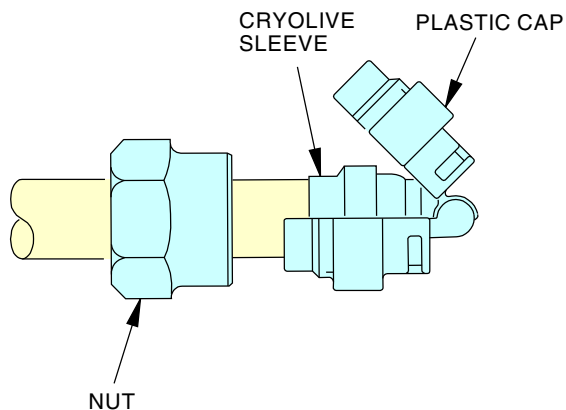
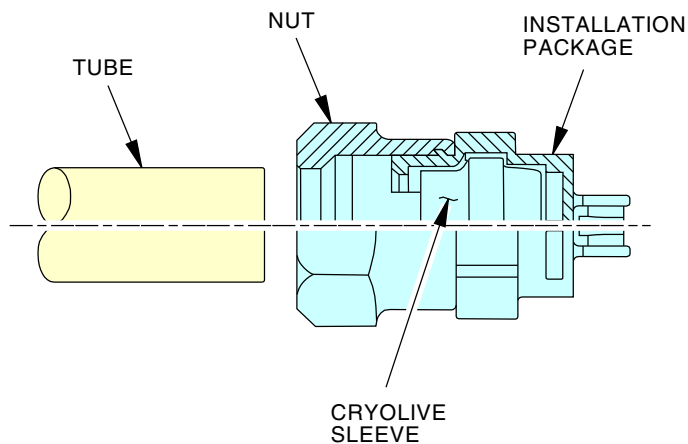
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NOTE:
REMOVAL OF PLASTIC CAP AFTER INSTALLATION.

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CRYOLIVE Flareless Sleeve Assembly
Figure 817/20-10-09-990-932

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TASK 20-10-09-300-802

7. **BACS13BX Flareless Sleeve Swaging with the Harrison Swagers 5175, 5570, and 5720**
(Figure 814)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1388	Kit, Power Swaging - Stationary Automatic (1/4 - 3/4 Tube Size) Part #: 6520 Supplier: 08199 Opt Part #: 5570 Supplier: 08199
COM-1789	Kit - Hand Swaging, Portable (1/4-1/2 Inch Tube Size) Part #: 5175K-200 Supplier: 08199
COM-1790	Kit - hand Swaging, Portable (5/8 to 1-1/2 Tube Size) Part #: 5720K-200 Supplier: 08199

B. Procedure

SUBTASK 20-10-09-940-003



POINT THE TUBE AWAY FROM PERSONS AND EQUIPMENT WHEN YOU SWAGE. DRAW-BOLTS CAN BREAK AND COME QUICKLY OUT OF THE TUBE. THE DRAW-BOLTS CAN HIT PERSONS OR EQUIPMENT AND CAUSE INJURY OR DAMAGE.

- (1) Get the necessary tools as shown in the instruction manual supplied with portable (1/4-1/2 inch tube size) hand swaging kit, COM-1789, swaging kit, COM-1388, or portable (5/8 to 1-1/2 tube size) hand swaging kit, COM-1790.

SUBTASK 20-10-09-640-002

- (2) Apply a light layer of antiscoring lubricant to the outer surfaces of the bushings and expanders of the drawbar assemblies.

NOTE: Do not let the lubricant go into the grooves of the sleeve. Lubricant in the grooves will prevent correct swaging.

- (a) Make sure the tube and sleeve are clean and dry.

SUBTASK 20-10-09-340-001

- (3) Apply the necessary swage pressure, shown in (Table 814), and hold the pressure for a minimum of two seconds.

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Table 814/20-10-09-993-892

TUBE SIZE	SWAGER MODEL NO.	21-6-9 CRES PER BMS7-185		6061T AL PER WW-T-700/6 OR MIL-T-7081 OR AMS4083		6061-T4 AL PER MIL-T-7081 OR AMS4081		304 AND 321 ANNEALED CRES PER MIL-T-8504 AND MIL-T-8808		304-1/8 HARD CRES PER MIL-T-6845	
		Wall (in.)	Swage Pressure (PSI) ^[1]	Wall (in.)	Swage Pressure (PSI) ±5%	Wall (in.)	Swage Pressure (PSI) ±5%	Wall (in.)	Swage Pressure (PSI) ^[1]	Wall (in.)	Swage Pressure (PSI) ^[1]
			BACS13BX		BACS13BX		BACS13BX		BACS13BX		BACS13BX
04	5175 (portable)	0.016	475	N/A	N/A	N/A	N/A	N/A	N/A	0.020	475 ^[2]
05	5175 (portable)	0.020	1000	0.035	450 ^[3]	N/A	N/A	N/A	N/A	N/A	N/A
06	5175 (portable)	0.020	1150	0.028 0.035	500 ^[3]	N/A	N/A	0.035	940 ^[3]	0.035	1150 ^[2]
08	5175 (portable)	0.026	2000	0.035	950 ^[3]	N/A	N/A	N/A	N/A	0.35	2000 ^[2]
10	5570 (stationary)	0.033	1000	0.020 0.028 0.035	280 ^[3] 320 ^[3] 355 ^[3]	0.035	250	N/A	N/A	0.049	1000
10	5720 (portable)	0.033	850	0.035	375	N/A	N/A	0.035 0.049	425	0.035 0.049	850 ^[2]
12	5570 (stationary)	0.039	900	0.035	400 ^[3]	N/A	N/A	N/A	N/A	N/A	N/A
12	5720 (portable)	0.039	1600	0.035	600	N/A	N/A	N/A	N/A	0.035 0.049 0.058	1300 1350 1600
16	5720 (portable)	0.052	3050	0.035	950 ^[3]	0.035	750 ^[3]	N/A	N/A	0.035 0.065	1650 ^[3] 3050
20	5570 (stationary) 5720 (portable)	N/A	N/A	0.049	N/A	0.035	700 ^[3]	0.035	1650 ^{[3][4]}	N/A	N/A
24	5720 (portable)	N/A	N/A	0.049	N/A	N/A	N/A	0.035 0.049	2550 ^{[3][4]} 2280 ^{[3][5]}	N/A	N/A

*[1] Minimum swage pressure - if you must swage again, increase in 5% increments.

*[2] Swage pressures necessary to install BACS13BX flareless sleeves on tube materials with the Harrison portable and stationary swager.

*[3] Not qualified for 3000 psi (20,684 kPa). Use for lower pressures only.

*[4] Swage pressure for BACS13BX sleeves with standard or shortened "P" dimensions.

*[5] Swage pressure for BACS13BX sleeves with shortened "P" dimensions only.

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SUBTASK 20-10-09-220-008

- (4) Do a check of the groove depth with a Tiplar or Mueller bore gage (Figure 819).

SUBTASK 20-10-09-220-009

- (5) Do a check on the external dimensions of the swaged fitting (Figure 818).

SUBTASK 20-10-09-220-010

- (6) Make sure the tooling die marks on the outside diameter of the tube do not have a height or depth larger than 10% of the tube wall specified thickness.

NOTE: Other permitted defects include marks or scratches on the outer tube which are less than 0.20 inch in length and 0.002 inch in depth.

SUBTASK 20-10-09-210-003

- (7) Make sure the seal areas of the sleeves and unions are not scratched or damaged during fabrication.

SUBTASK 20-10-09-210-004

- (8) Make sure each seal area keeps the usual finish specifications.

SUBTASK 20-10-09-220-011

- (9) Make sure the tool and die marks on the external skirt and shoulder areas of the sleeves and unions are not more than 0.002 inch in height.

SUBTASK 20-10-09-220-012

- (10) Make sure the tool and die marks on the external skirt and shoulder areas of the sleeves and unions do not touch the nut.

————— **END OF TASK** —————

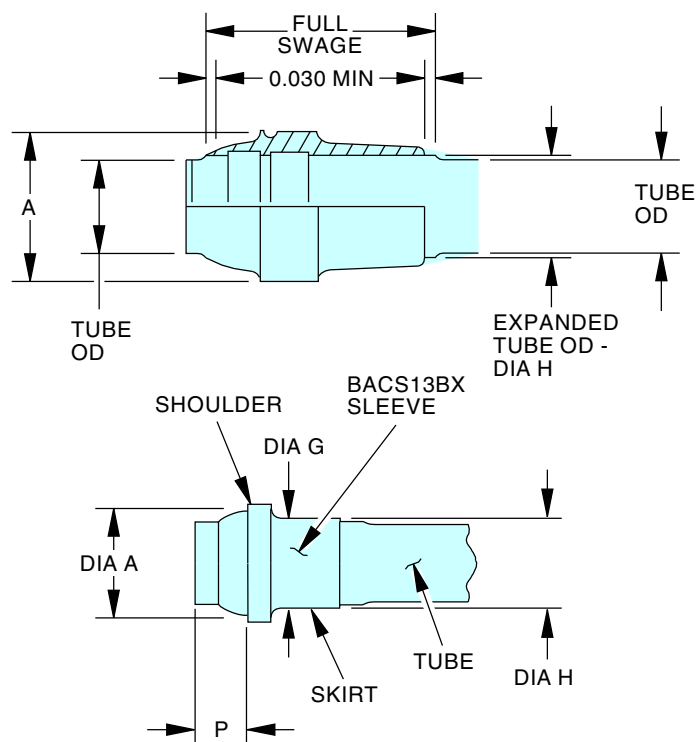
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DIMENSION	SIZE								
	04	05	06	08	10	12	16	20	24
P ±0.010	0.214	0.230	0.230	0.285	0.330	0.330	0.392	0.395 1 0.355 2	0.465 1 0.350 2
A max	0.374	0.437	0.493	0.673	0.789	0.964	1.214	1.474	1.723
G max	0.298	0.364	0.423	0.550	0.686	0.822	1.070	1.323	1.573
H max	0.260	0.322	0.385	0.511	0.636	0.761	1.011	1.262	1.517

DIMENSIONS OF FLARELESS TUBE ENDS AND BACS13BX SLEEVES AFTER ELASTOMERIC SWAGING

NOTE:

ALL DIMENSIONS ARE IN INCHES.

1 ALL EXCEPT SHORT FLARELESS

2 SHORT FLARELESS

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BACS13BX Flareless Sleeve Dimensions After Elastomeric Swaging Figure 818/20-10-09-990-914

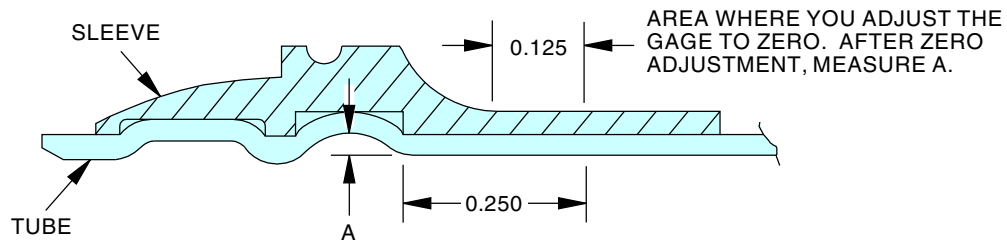
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BACS13BX (TWO GROOVES)

TUBE SIZE	DEPTH 2A - INCHES	
	MINIMUM	MAXIMUM
04	0.020	0.032
05	0.020	0.032
06	0.020	0.032
08	0.020	0.032
10	0.022	0.034
12	0.026	0.038
16	0.028	0.040
20	0.026	0.042
24	0.026	0.042

**BACS13BX SWAGE
GROOVE DEPTH LIMITS**

NOTE:

ALL DIMENSIONS ARE IN INCHES (mm).

L19685 S0006402418_V3

**Groove Depth Measurement for BACS13BX Sleeves
Figure 819/20-10-09-990-915**

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TASK 20-10-09-300-803

8. BACS13BX Flareless Sleeve Swaging with the 6633K01 Harrison Roller Swaging Kit

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1794	Swager - Portable Tube, Hand Swaging, 1/4 - 1" Dia. Stainless Steel or Titanium Tubing Part #: 6633K-01 Supplier: 08199

B. Procedure

SUBTASK 20-10-09-940-004

- (1) Get the necessary tools as told in the operating instruction manual supplied with the tube swager, COM-1794.

SUBTASK 20-10-09-350-001

- (2) Apply the necessary torque, shown in (Figure 815), to the expander mandrel.

SUBTASK 20-10-09-220-013

- (3) After you swage, make sure the BACS13BX sleeve and tube agree with the specifications of (Figure 815).
 - (a) Do not trim the tube after you roller swage.
 - (b) If it is necessary, remove the burrs with an approved deburring tool.

SUBTASK 20-10-09-210-005

- (4) Make sure the seal areas of the sleeves are not scratched or damaged during fabrication.

SUBTASK 20-10-09-210-006

- (5) Make sure each seal area keeps the 63 RHR (no annular tool marks) finish specifications of its standard.

SUBTASK 20-10-09-220-014

- (6) Make sure the die marks on the external skirt and shoulder areas of the sleeves are not more than 0.002 inch in height.

SUBTASK 20-10-09-220-015

- (7) Make sure the die marks on the external skirt and shoulder areas of the sleeves do not touch the nut.

SUBTASK 20-10-09-210-007

- (8) Make sure the tube inner surfaces at the swage area do not have scratches or marks caused by defective rollers.

————— END OF TASK —————

TASK 20-10-09-300-804

9. BACS13AP Flareless Sleeve Preset

A. General

- (1) We recommend you pressure preset and do not preset by hand. If you must preset by hand, we recommend you preset some samples first. Then you can preset the section to repair. On samples, cut away the sleeve to make sure the ring cut on the tube makes a circle around the tube circumference and has a depth of 0.002 inch.

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B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1785	Rivet Puller - Lockbolt Part #: G85D-S Supplier: 11815 Opt Part #: G85D Supplier: 05693
SPL-1589	Kit - Preset Tube Fitting, "Sleeve Set", (Not for Titanium Tubing) (Set of 25 Ea. Dies, Mandrels, & Clamps) Part #: ST878D Supplier: 81205 Part #: ST879A Supplier: 81205
SPL-1590	Holder - Tube Fitting, Preset Part #: ST879AF Supplier: 81205

C. Procedure

SUBTASK 20-10-09-350-002

- (1) Do these steps to do the pressure preset with the Cherry lockbolt rivet puller, COM-1785:
 - (a) Attach the thrust sleeve and die holder to the Cherry lockbolt rivet puller, COM-1785.
 - (b) Install the mandrel and the preset die in the Cherry lockbolt rivet puller, COM-1785 (Figure 820 and Table 815).

Table 815/20-10-09-993-893 Preset Pressures for Cherry G-85 Lockbolt Gun with ST878D Presetting Tool Assembly

TUBE SIZE	WALL THICKNESS	TOOL NO.	RECOMMENDED AIR PRESSURE (PSI)	
			ALUMINUM	STEEL
			6061-T6	AISI 304-1/8 HARD
3/16	0.020-0.035	ST878D-3-020 ST878D-3-035	22.5	30.0
1/4	0.020-0.035	ST878D-4-020 ST878D-4-035	27.5	40.0
5/16	0.020-0.035	ST878D-5-020 ST878D-5-035	30.0	40.0
3/8	0.020-0.035	ST878D-6-020 ST878D-6-035	30.0	52.5
1/2	0.028-0.035	ST878D-8-028 ST878D-8-035	42.5	75.0
5/8	0.028-0.083	ST878D-10-028 ST878D-10-083	50.0	80.0
3/4	0.020-0.049	ST878D-12-020 ST878D-12-049	52.5	85.0

- (c) Connect the air pressure line and use the correct pressure (Figure 820 and Table 815).
- (d) Do several cycles of the Cherry lockbolt rivet puller, COM-1785 and make sure the pressure is set correctly.

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- (e) Assemble the split-clamp die, the clamp nut, and the sleeve. Put the assembly into the die holder.
- (f) Put the B-nut on the tube and make the tube end touch the bottom of the die holder.
- (g) Start the Cherry lockbolt rivet puller, COM-1785.
- (h) Hold the tube in its position while the die installs the sleeve on the tube.
- (i) Maintain the pressure while you preset the sleeve on the tube.
- (j) Unclamp the nut.
- (k) Remove the tube and die from the holder.
- (l) Open the die to show the preset sleeve.

SUBTASK 20-10-09-350-003

- (2) To preset the sleeve by hand, do these steps:
 - (a) Use the correct mandrel for the preset tube sleeve set fitting kit, SPL-1589 and tube fitting holder, SPL-1590 (Figure 821).
 - (b) Lubricate the threads, sleeve shoulder, and conical seal area of the fitting.
NOTE: Do not lubricate the tube.
 - (c) Assemble the sleeve on the tube.
 - (d) Insert the tube into the preset tube fitting holder, SPL-1590 and tube fitting holder, SPL-1590 union.
 - (e) Tighten the nut as shown in (Table 816 and Table 817).

Table 816/20-10-09-993-894 Displacement Turns and Torque Values for Hand Preset of Flareless Sleeves - Steel Tubing

TUBE OUTER DIAMETER ^{*[1]}		1/4	5/16	3/8	1/2	5/8	3/4	1	1-1/4
Wall Thickness (in.)	304	0.020	0.020	0.028	0.035	0.049	0.058	N/A	N/A
	21-6-9	0.016	0.020	0.020	0.026	0.033	0.039	N/A	N/A
Procedure A (Displacement, Turns) ^{*[2]}		1-1/6	1-1/6	1-1/6	1-1/6	1-1/6	1-1/6	N/A	N/A
Procedure B (Torque) ^{*[3]} Pound- Inches	304	145	200	290	545	780	900	N/A	N/A
	21-6-9	145	200	290	545	780	1200	N/A	N/A

*[1] Use an internal mandrel preset tool on tubes with thinner walls (refer to ST879A). When in doubt, make a test preset to make sure the ring cut minimum depth is 0.002 in. (0.051 mm).

*[2] Measure displacement from the point where the fitting, sleeve, and nut are firmly hand-tightened, and wrench is necessary to further tighten.

*[3] Apply torque, loosen, and apply indicated torque three times.

Table 817/20-10-09-993-895 Displacement Turns and Torque Values for Hand Preset of Flareless Sleeves - Aluminum Tubing

TUBE DIAMETER ^{*[1]}		1/4	4/16	3/8	1/2	5/8	3/4	1	1-1/4
Wall Thickness (in.)	6061-T6	0.035	0.035	0.035	0.035	0.035	0.035	N/A	N/A

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Table 817/20-10-09-993-895 Displacement Turns and Torque Values for Hand Preset of Flareless Sleeves - Aluminum Tubing (Continued)

Procedure A ^{*[2]} (Displacement, Turns)		1-1/6	1-1/6	1-1/6	1	1	1	N/A	N/A
Procedure B (Torque) ^{*[3]} Pound- Inches	6061-T6	110	140	170	280	360	450	N/A	N/A

*[1] Use an internal mandrel preset tool on tubes with inner walls (refer to ST879A). When in doubt, make a test preset to make sure the ring cut minimum depth is 0.002 in. (0.051 mm).

*[2] Measure displacement from the point where the fitting, sleeve, and nut are firmly hand-tightened, and a wrench is necessary to further tighten.

*[3] Apply torque, loosen, and apply indicated torque three times.

- (f) If the preset tube sleeve set fitting kit, SPL-1589 and tube fitting holder, SPL-1590 is not available, you can preset the sleeves with a carbon steel union and nut as shown in (Figure 823).

SUBTASK 20-10-09-220-016

- (3) After you preset, make sure the BACS13AP sleeve and tube joint have the properties that follow (Figure 822):

- (a) Corrosion resistant steel tubing (MIL-T-6845):

- 1) Make sure the sleeves have a maximum of 0.005 inch longitudinal end play.
- 2) Make sure the sleeves do not turn freely on the tube under finger pressure (without the use of force).

- (b) Annealed corrosion resistant tubing (MIL-T-8504 and MIL-T-8808) and aluminum alloy tubing (MIL-T-7081 or WW-T-700/6):

NOTE: Sleeves can have 0.015 inch maximum longitudinal end play and turn on the tube under finger pressure.

- (c) These conditions apply to all tubing materials:

- 1) Make sure the tube inner diameter does not decrease more than 0.005 inch (Figure 822).
- 2) Make sure the sealing surface of the sleeve bow is free of scratches, marks, or other defects.
- 3) The tube end is permitted to flare if the flare diameter does not prevent entrance of the MS21902 or MS21924 union into the MS flareless fitting end.

————— END OF TASK —————

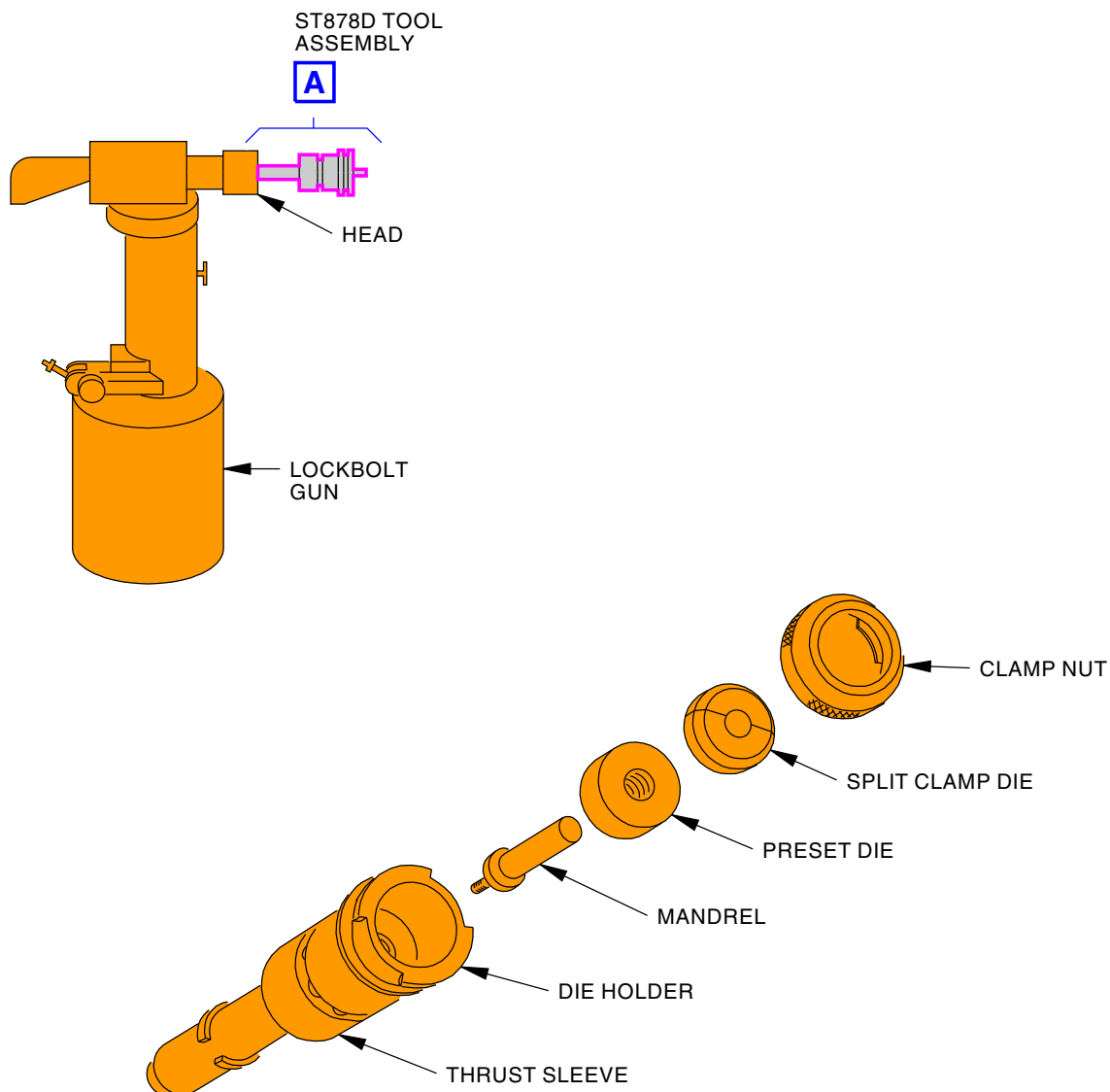
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ST878D TOOL ASSEMBLY



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**Preset Pressures (PSI) for the Cherry G-85 Lockbolt Gun with ST878D Presetting Tool Assembly
(BACS13AP Sleeves)
Figure 820/20-10-09-990-916**

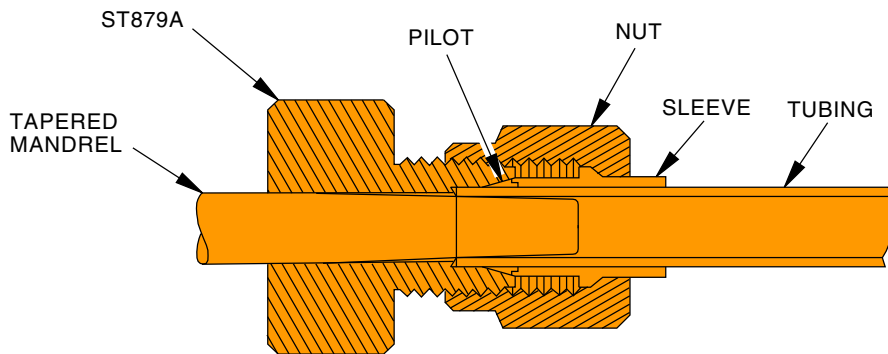
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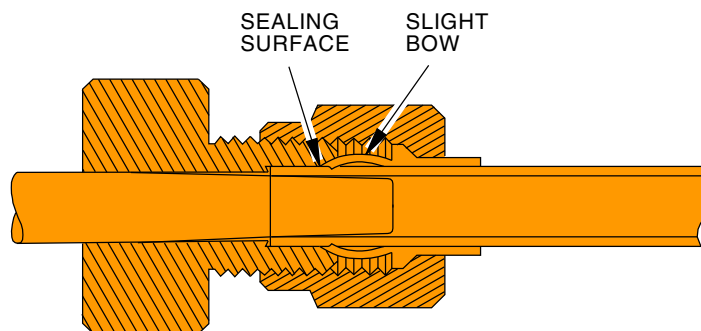
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BEFORE PRESET BY HAND



AFTER PRESET BY HAND

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Preset by Hand with Preset Tool ST879A
Figure 821/20-10-09-990-917

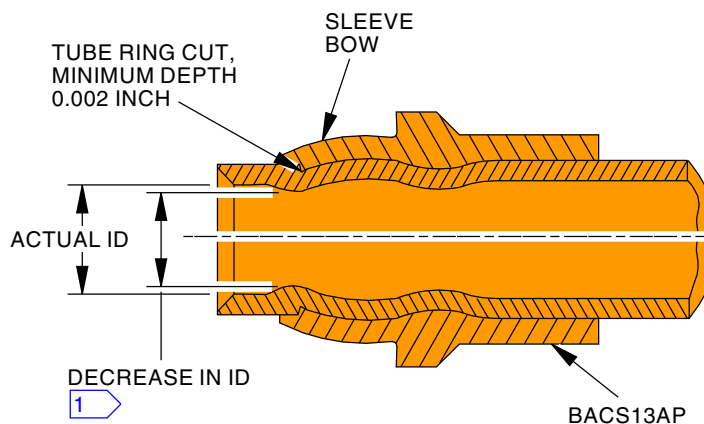
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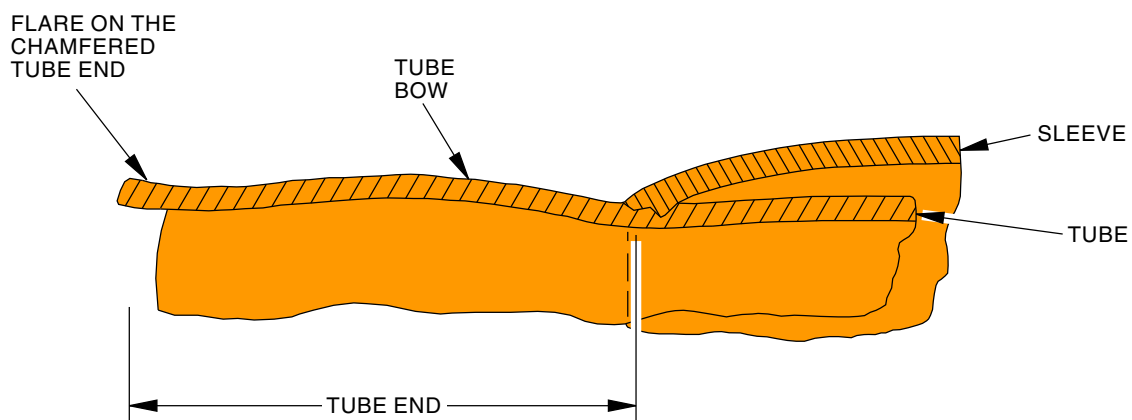
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ASSEMBLED AND PRESET SLEEVE



TUBE END DEFORMATION

1 MAKE SURE THE ID DOES NOT DECREASE MORE THAN 0.005 INCH AFTER PRESET OR 0.015 INCH AFTER YOU TIGHTEN MANY TIMES.

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**Properties of Preset BACS13AP Flareless Sleeve/Tube End
Figure 822/20-10-09-990-918**

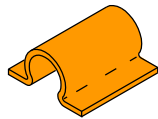
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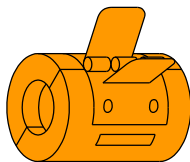
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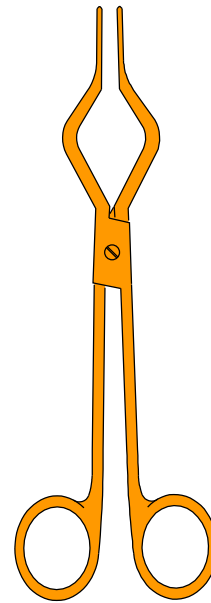
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**SNAP-ON
INSTALLATION STOP**



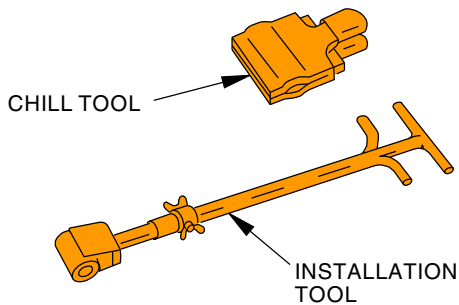
EXTENDED TIME TOOL



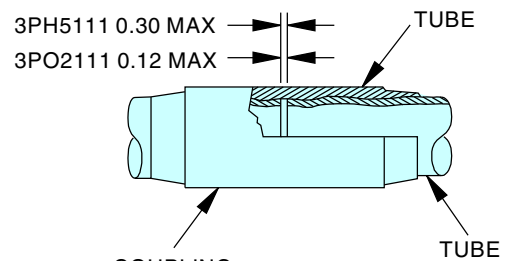
TONGS



**O-RINGS INSTALLATION
STOP**



NOTE:
CRYOFIT KITS INCLUDE ADDITIONAL ITEMS.



CRYOFIT COUPLING INSTALLATION

L19700 S0006402428_V2

**Cryofit Coupling 3P02111 and 3PH5111 Repair
Figure 823/20-10-09-990-919 (Sheet 1 of 2)**

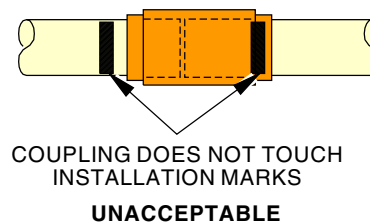
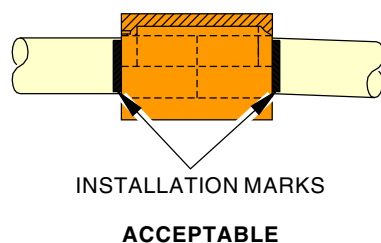
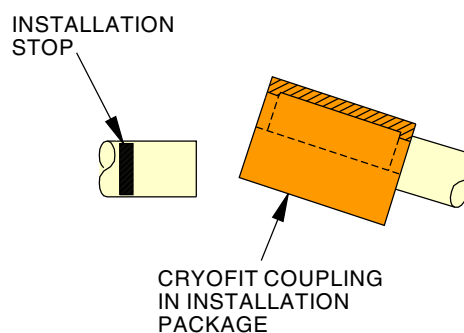
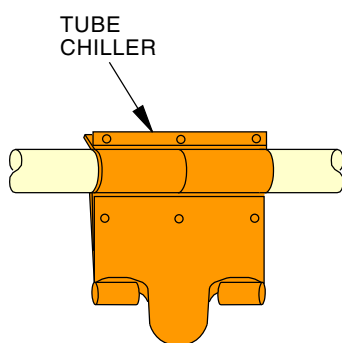
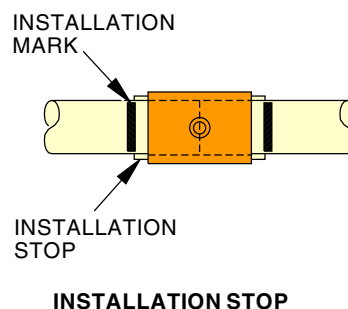
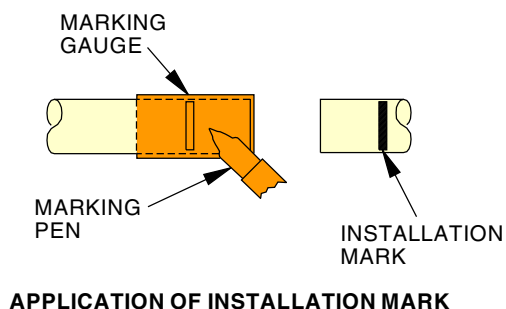
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POSITION OF INSTALLED FITTING ON TUBE

NOTE:

CRYOFIT KITS INCLUDE ADDITIONAL ITEMS.

L19709 S0006402429_V3

**Cryofit Coupling 3P02111 and 3PH5111 Repair
Figure 823/20-10-09-990-919 (Sheet 2 of 2)**

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TASK 20-10-09-400-802

10. BACC42W H-Coupling Installation

A. General



WARNING

DO NOT USE BACC42W H-COUPPLINGS ON ANY OXYGEN LINES OR ON FLUID LINES IN THE FIRE ZONES OF THE ENGINES OR APU'S. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR.

- (1) The BACC42W H-coupling has a union, coupling, slide, and nut. You can use the H-coupling on fuel and hydraulic high pressure (3000 psi) lines of Ti-3AL-2.5V, CRES 21-6-9, and CRES 304 1/8 hard tubing. This repair is also approved for line repair of CRES 304 annealed and 6061-T6 aluminum lines in 1500 psi or lower pressure applications. You can use this repair on tubing that is installed and in use.
- (2) You can repair defects that have a maximum width of 3/8 inch. You must make splices on larger defects. The minimum workable splice section with two H-couplings and a length of tube is 4.5 inches (Figure 811).

B. References

Reference	Title
20-30-80-910-801	General Cleaning of Metal (Series 80) (P/B 201)

C. Tools/Equipment

Reference	Description
STD-1357	Assembly - Tube Coupling

D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal	

E. Procedure



CAUTION

DO NOT TIGHTEN THE COUPLING ASSEMBLY BY HAND AFTER YOU REMOVE IT FROM THE SHIPPING CONTAINER OR BEFORE YOU INSTALL IT ON THE TUBE. THE COUPLING ASSEMBLY HAS NO MORE THAN ONE THREAD ENGAGED. YOU CAN COMPRESS THE UNION AND MAKE THE COUPLING ASSEMBLY DIFFICULT TO PUT IN POSITION.

SUBTASK 20-10-09-860-001

- (1) Remove pressure from the systems where you will do the repairs.

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SUBTASK 20-10-09-110-001



WARNING

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- (2) Use Series 80 solvent, B01000 (TASK 20-30-80-910-801) to clean the tube in the area where you will install the H-coupling tube coupling assembly, STD-1357.

NOTE: The number after the W in the part number gives the size of the coupling in sixteenths. For example, BACC42W56 fits 3/8-inch tube size. The BACC42W is superseded by BACC42W-T which is used on Ti-3AL-2.5V and all other hydraulic tubing. You can use BACC42W on all hydraulic tubes except Ti-3AL-2.5V.

SUBTASK 20-10-09-350-004

- (3) Cut the tube.

SUBTASK 20-10-09-110-002

- (4) Chamfer and remove the burrs from the inside diameter and outside diameter edges. Clean the edges with Series 80 solvent, B01000 (TASK 20-30-80-910-801).

SUBTASK 20-10-09-110-003



WARNING

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- (5) Clean the edges with Series 80 solvent, B01000 (General Cleaning of Metal (Series 80), TASK 20-30-80-910-801).

SUBTASK 20-10-09-940-005

- (6) Install tape on the nut side of the clearance with a minimum of 0.56 inch from the tube end and a maximum of 0.675 inch from the center of the clearance ().

SUBTASK 20-10-09-940-006

- (7) Use the same measurements to make a mark (index line) on the coupling side of the tube.

SUBTASK 20-10-09-940-007

- (8) Find and make a mark (marking dots) on the nut and coupling side of the tube (Figure 824).

NOTE: These marks will be used for the last inspection check (dimension "C").

SUBTASK 20-10-09-420-008

- (9) Install the tube coupling assembly, STD-1357 over the coupling side of the tube.

SUBTASK 20-10-09-210-008

- (10) Make sure the large radius and the large diameter end of the sleeve are toward the center of the union.

SUBTASK 20-10-09-420-021

- (11) Install the nut and sleeve over the tape on the nut side of the tube.

SUBTASK 20-10-09-210-009

- (12) Make sure the sleeve large bore is toward the clearance.

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SUBTASK 20-10-09-820-002

- (13) Align the tubes and move the union until it touches the tape on the nut side on the tube.

SUBTASK 20-10-09-210-010

- (14) Make sure the union meets or cover the index line on the coupling side of the tube.

SUBTASK 20-10-09-940-008

- (15) Install tape on the coupling side of the tube, with the tape edge even with the end of the union.

SUBTASK 20-10-09-420-022

- (16) Push the sleeve and coupling body on the ends of the union.

NOTE: Make sure the tape does not move and the coupling body does not turn.

SUBTASK 20-10-09-420-023

- (17) Engage the threads of the nut with the coupling body and tighten the nut handtight.

SUBTASK 20-10-09-420-024

- (18) Hold the coupling body with a wrench and tighten the coupling assembly nut to the stop.

SUBTASK 20-10-09-210-011

- (19) Examine the completed repair to make sure you can see the two marking dots (Figure 824).

- (a) If you cannot see the two dots, this shows that the sleeve and coupling are not fully seated against the center land of the union.

SUBTASK 20-10-09-210-012

- (20) Make sure dimension "C" did not increase.

SUBTASK 20-10-09-200-001

- (21) Do an inspection as follows:

- (a) Remove the nut.
- (b) Make sure the slide and coupling are no more than 0.015 inch from the union shoulder.
- (c) Make sure the union touches the tape.
- (d) If the clearance between the slide or coupling and the union is more than 0.015 inch, install the nut and tighten it until you get the necessary clearance (Figure 824).
- (e) Install the nut again and tighten the nut to the necessary torque value.
- (f) If the union does not touch the tape, you must remove the coupling and a sufficient tube length. Install a new repair section.

————— **END OF TASK** —————

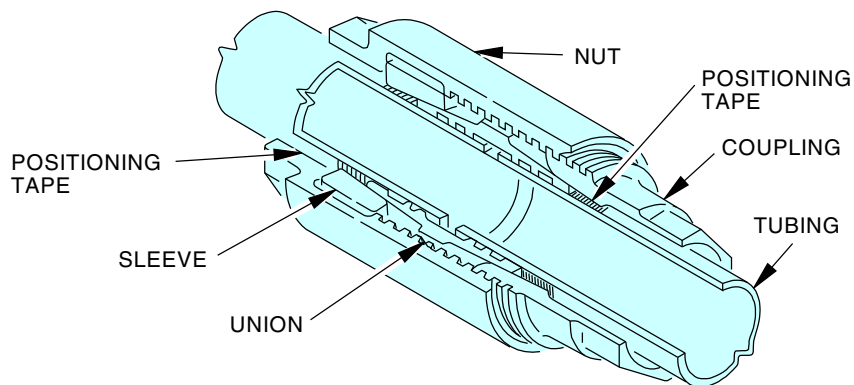
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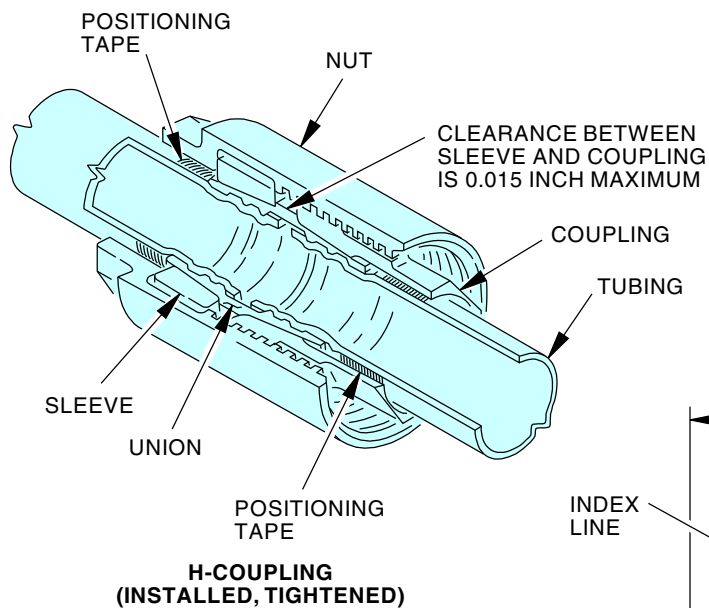
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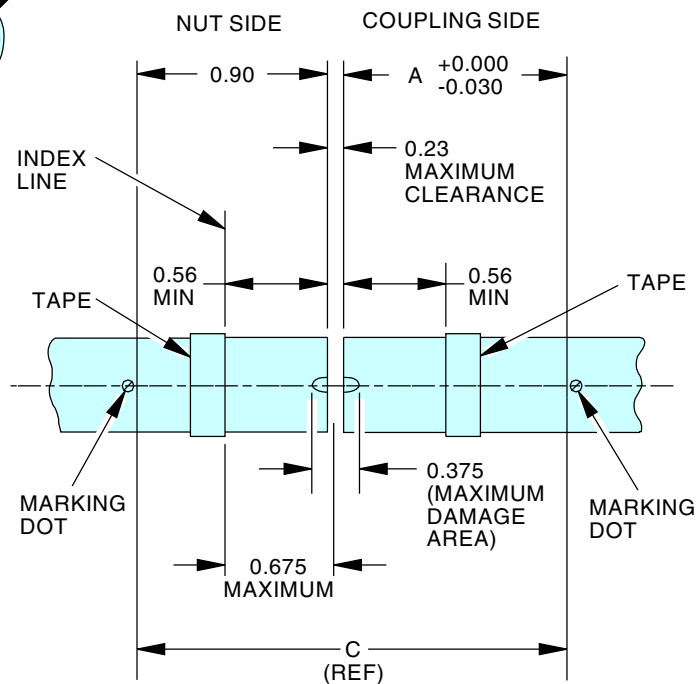
**H-COUPLING
(BEFORE INSTALLATION)**



**H-COUPLING
(INSTALLED, TIGHTENED)**

TUBE SIZE	DIMENSION A
04 THRU 10	1.440
12 THRU 16	1.740

NOTE:
USE THESE DIMENSIONS TO FIND DIMENSION C.
ALL DIMENSIONS ARE IN INCHES.



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**H-Coupling Installation
Figure 824/20-10-09-990-922**

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TASK 20-10-09-400-803

11. 3P02111/3PHS111 Cryofit Coupling Installation

(Figure 823)

A. General

 WARNING	DO NOT USE CRYOFIT COUPLINGS ON ANY OXYGEN LINES OR ON FLUID LINES INSIDE THE FIRE ZONES OF ENGINES OR APU'S. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR.
 WARNING	USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO. PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.
 WARNING	SLOWLY AND CAREFULLY SUBMERGE WARM ITEMS IN LIQUID NITROGEN TO PREVENT RAPID BOILING OFF AND SPLASHING. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

- (1) The Cryofit coupling is a fitting which you can use to repair Ti-3AL-2.5V tubing as shown in (Figure 806). To install the fitting in a straight section, shrink fit it in its position.

B. References

Reference	Title
20-30-80-910-801	General Cleaning of Metal (Series 80) (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1358	Kit - Cryofit Repair Part #: TS3P02111 Supplier: 88277
STD-1354	Tongs

D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal	
G00262	Nitrogen - Liquid	A-A-59503 Type II, MIL-PRF-27401 Type II
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

E. Procedure

SUBTASK 20-10-09-860-002

- (1) Remove the pressure from the systems where you will do repairs.

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SUBTASK 20-10-09-110-004



WARNING

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- (2) Use Series 80 solvent, B01000 (General Cleaning of Metal (Series 80), TASK 20-30-80-910-801) to clean the tube in the area where you will install the Cryofit coupling cryofit repair kit, COM-1358.

SUBTASK 20-10-09-420-025

- (3) Use Scotch Flatback Masking Tape 250, G00270 to make a mark on the tube to make sure you put the Cryofit coupling over the center of the tube repair.

SUBTASK 20-10-09-320-001

- (4) Cut the tube.

SUBTASK 20-10-09-350-005

- (5) Chamfer and remove burrs from the inside diameter and outside diameter edges.

SUBTASK 20-10-09-110-005

- (6) Clean the edges with Series 80 solvent, B01000 (General Cleaning of Metal (Series 80), TASK 20-30-80-910-801)(TASK 20-30-80-910-801).

SUBTASK 20-10-09-110-006

- (7) Apply a thin layer (one to two drops) of Loctite 290 around the tube circumference in the area under the serrations.

NOTE: Be careful not to let the Loctite into the tube.

SUBTASK 20-10-09-110-007



WARNING

USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO. PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

- (8) Put nitrogen, G00262 into a small, insulated container.

SUBTASK 20-10-09-110-008



WARNING

SLOWLY AND CAREFULLY SUBMERGE WARM ITEMS IN LIQUID NITROGEN TO PREVENT RAPID BOILING OFF AND SPLASHING. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

- (9) Remove the Cryofit coupling from the main storage container and put it into the small container of liquid nitrogen.
 - (a) Make sure the fitting is fully covered by nitrogen, G00262.

SUBTASK 20-10-09-940-009

- (10) Move the Cryofit coupling in the nitrogen, G00262 (-320 ° F) to the repair location.

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SUBTASK 20-10-09-420-009

- (11) Slip the coupling (from the installation kit) over the ends to ensure that the tubes are round and free of burrs. The test coupling should slide freely.

SUBTASK 20-10-09-480-001

- (12) Position the test coupling so that both tubes are visible in the coupling window. For 3PO2111 couplings, ensure that a gap of less than 0.120 inch (3.048) exists between the tube ends. For 3PHS111 couplings, ensure that the gap is less than 0.300 inch (7.620).

SUBTASK 20-10-09-080-001

- (13) Remove the test coupling and place the marking gauge over one of the tube ends. Using the marking pen, color in the rectangular slot in the gauge to provide an installation mark on the tube. following the same procedure to mark the remaining tube end.

SUBTASK 20-10-09-480-002

- (14) Place an installation stop ("O" ring) or snap-on coupling in the middle of the mark on one of the tube ends.

SUBTASK 20-10-09-480-003

- (15) Check the location by positioning the test coupling so that it is butted against the stop. Both tube ends should be visible in the window and the test coupling should cover approximately half the installation mark on each tube.

SUBTASK 20-10-09-820-003

- (16) Adjust the tubes and installation stop as necessary. Remove the test coupling.

SUBTASK 20-10-09-420-012

- (17) Make sure that the tube ends within half the coupling length of the end are free of scratches.

SUBTASK 20-10-09-840-001

- (18) If a fitting must be installed over a tube end containing a scratch, apply a thin layer (one to two drops) of Loctite 290 around the tube circumference in the area under the serration. Be careful not to let the Loctite into the tube. No Loctite application is required for tube ends without scratches.

SUBTASK 20-10-09-840-002

- (19) For a 3PO2111, remove a Cryofit coupling from the liquid nitrogen and immediately place it into a pre-chilled extended time tool. Close the tool and immediately return the coupling/tool to liquid nitrogen. This step is omitted for 3PHS111 couplings since they are preassembled in the tool and furnished in Lexan Plastic Packaging from the manufacturer..

SUBTASK 20-10-09-840-003

- (20) Place the cooled tube chiller over the tubes to be joined. Remove the chiller after 20 to 30 seconds.

NOTE: This step may be omitted. However, placing Cryofit coupling in contact with a tube which has not been pre-chilled with Liquid nitrogen may initiate premature warming and shrinkage of the coupling.

SUBTASK 20-10-09-420-013

- (21) Install the coupling and following the steps below in rapid sequence:
 - (a) Remove the chiller.
 - (b) Using the cooled tongs, STD-1354, remove the Cryofit installation package from the Liquid nitrogen and grasp the package between thumb and forefinger.
 - (c) Deflect the tube without the installation stop to allow the coupling to be slipped over the tube end.

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- (d) Slip the coupling on the tube, realign the tubes and slide the coupling against the installation stop.
- (e) Ensure that the Cryofit coupling is against the installation stop and that the fitting is in correct position relative to the installation marks.
- (f) Allow the coupling to warm and shrink on to the tube. Remove the Cryofit installation package and the installation stop.

SUBTASK 20-10-09-200-002

- (22) Verify that both ends of the coupling lie within the installation marks on both tubes.

NOTE: If one or both ends of the fitting do not cover a portion of the installation mark, the installation is incorrect and must be replaced.

————— **END OF TASK** —————

TASK 20-10-09-400-804

12. Externally Swaged (Permaswage) Fittings Installation

A. General

- (1) To do the externally swaged fitting (Permaswage) repair procedure, use the DLT series swaging tool and the BACU24BS or D10282 in-line tube unions (sizes 04, 06, 08, 10, 12, 16 and 20). You can use CRES externally swaged fittings (Permaswage) fittings, as shown in (Figure 806, Table 818), with 304-1/8 hard CRES tube to repair Ti-3AL-2.5V and 21-6-9 CRES. Repair 6061T6 aluminum tubing with aluminum fittings with D suffix in the basic part number.

NOTE: The permaswage repair is not suitable to the potable waterlines because microbes may grow in the cavity of the seal.

Table 818/20-10-09-993-896 Fitting/Tube Material Combinations for Repair with Permaswage Unions

DMC PART NO. ^{*[1]}	FITTING MATERIAL	FOR USE WITH TUBE MATERIAL	APPROVED TUBE SIZES OD/WALL						
			04	06	08	10	12	16	20
D10282-() ^{*[2]}	21-6-9 CRES	21-6-9 CRES	0.016	0.020	0.026	0.033	0.039	0.052	--
D10282-() ^{*[2]}	21-6-9 CRES	3AL-2.5V Ti	0.016	0.019	0.026	0.032	0.039	0.051	0.070
D10282-() ^{*[2]}	21-6-9 CRES	304-1/8 HARD CRES (MIL-T-6845)	0.020	0.028	0.035	0.049	0.058	0.065	--
D10282D() ^{*[2]}	6061T6 AL (MIL-T-7081)	6061T6 AL (MIL-T-7081)	0.035	0.035	0.035	0.035	0.035	0.035	0.049
BACU24BS (SIZE)(SIZE)J ^{*[2]}	21-6-9	21-6-9 CRES	0.016	0.020	0.026	0.033	0.039	0.052	--
BACU24BS (SIZE)(SIZE)J ^{*[2]}	21-6-9	3AL-2.5V Ti	0.016	0.019	0.026	0.032	0.039	0.051	0.070

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**Table 818/20-10-09-993-896 Fitting/Tube Material Combinations for Repair with Permaswage Unions
(Continued)**

BACU24BS (SIZE)(SIZE)J*[2]	21-6-9	304-1/8 HARD CRES (MIL-T-6845)	0.020	0.028	0.035	0.049	0.058	0.065	--
BACU24BS (SIZE)(SIZE)D*[2]	6061T AL	6061T6 AL (MIL-T-7081)	0.035	0.035	0.035	0.035	0.035	0.035	0.049

*[1] Material code "J" with the Boeing part number or no material code (-) with the DMC part number indicates 21-6-9 CRES fitting with two internal grooves on each end, one each filled with silicone. Material code "D" on either the Boeing or DMC part number indicates 6061T Aluminum fitting with two internal grooves on each end, all filled with silicone. Aluminum unions without all grooves filled with the silicone sealant are not approved for Boeing airplanes.

*[2] A Boeing standard for an externally swaged union (BACU24BS (SIZE)(SIZE) Material) based on the DMC Permaswage D10282 Union has been developed by Boeing for use on the 777 airplane. The BACU24BS (SIZE)(SIZE) J union (both sizes the same) and the D10282-(SIZE) union are interchangeable. In addition, the BACU24BS (SIZE)(SIZE) D union (both sizes the same) and D10282D (SIZE) D union are interchangeable. The Corrosion Resistant Steel (CRES) D10282-(SIZE) and Aluminum D10282D(SIZE) Permaswage unions are improved replacements for the standard CRES D10036D (SIZE) and Aluminum D10036D (SIZE) unions, respectively. The D10036 unions are functionally interchangeable with the D10282 unions. BACU24BS (SIZE)(SIZE) J - (both sizes the same), BACU24BS (SIZE)(SIZE) D - (both sizes the same), D10282-(SIZE) and D10282D (SIZE) union are not shown in DMC catalogs, but you can make an order directly to Designed Metal Connections, 14800 South Figueroa St., Los Angeles, CA 90248.

- (2) When you do a repair, remove the part of the tube with the defect. Put in a tube splice and install the splice with two fittings. Fittings and tubing material sizes are shown in (Table 818).
- (3) The splice must be shorter than the removed tube section. At a maximum length, make the splice shorter than the tube section by four times the growth value shown in (Figure 826) (four fittings). This permits an increase in length as a result of swaging. As a minimum length, make the splice longer than 0.300 in. (7.620 mm) less than the cut-out. This permits tube gaps (not more than 0.150 in. (3.810 mm)) as shown in (Figure 826).

NOTE: Include the length growth caused by swaging when you work with short tube sections with small flexibility. Short tube sections or tube repairs between rigidly installed fittings can buckle.

- (4) DMC Permaswage Lightweight series (DLT Series) - Tool numbers are listed in (Table 819). You can get tool kits in different size combinations. Contact DMC for tool kit part numbers. Make sure that the DLT Series tooling has been inspected to the following DMC Tooling Control Documents:

NOTE: One pump is required to actuate the power units, as shown in (Table 819) (Designed Metal Connections, P.O. Box 61188, 14800 S. Figueroa St., Los Angeles, CA 90061).

Table 819/20-10-09-993-897 Swage and Inspection Tool Part Numbers

TUBE SIZE	SWAGE TOOL ASSEMBLY	SWAGE HEAD ASSEMBLY	POWER UNIT*[1]	INSPECTION GAGE
04	DLT05PSKT3000	DLT05PSHA3004	DLT05MAPW0000	D12-9892-04
06	DLT10PSKT3000	DLT10PSHA3006	DLT10MAPW0000	D-12-9892-06
08	DLT20PSKT3000	DLT20PSHA3008	DLT20MAPW0000	D12-9892-08
10	DLT20PSKT3000	DLT20PSHA3010	DLT20MAPW0000	D1209892-10
12	DLT30PSKT3000	DLT30PSHA3012	DLT30MAPW0000	D1209892-12

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Table 819/20-10-09-993-897 Swage and Inspection Tool Part Numbers (Continued)

16	DLT40PSKT3302	DLT40PSHA4016	DLT40MAPW0000	DNR9892-016
20	DLT40PSKT3003	DLT40PSHA3020	DLT40MAPW0000	D12-9892-20

*[1] One of the following pumps is necessary to actuate the power units: DLT02MAPP1000 pneumatic pump 10,000 psi; DLT05MAPM1000 manual pump 10,000 psi.

- (a) MCP-016 - Inspection Criteria of DMC, DLT Series, Swage Head Assembly - Standard Permaswage, 3000 psi (20,684 kPa) Application.
- (b) SOPG - 01- 05 Instructional Manual for 3000 psi (20,684 kPa) Systems.
- (c) DMC - 1320 DLT Tools Prevention Maintenance.

B. References

Reference	Title
20-10-09-760-801	Electrical Resistance Specifications in the Fuel Tank Check (P/B 401)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-541	Kit - Tube Repair, 3000 PSI Part #: DLTFRPSKT3000 Supplier: 14798 Part #: DLTFRPSKT3300 Supplier: 14798

D. Consumable Materials

Reference	Description	Specification
B00068	Alcohol - Denatured, Ethyl (Ethanol)	AMS 3002, MIL-E-51454 Type II
B00138	Abrasive - Silicon Carbide Coated Cloth	
C00064	Coating - Aluminum Chemical Conversion	BAC5719 Type II Class A (MIL-DTL-5541 Class 1A)
C00259	Coating - Chemical And Solvent Resistant Finish, Corrosion Inhibiting Primer	BMS10-11 Type I
G02061	Marker - Permanent, Felt Tip Pen	

E. Prepare Tube for Installation

SUBTASK 20-10-09-940-010

 WARNING	DO NOT USE PERMASWAGE FITTINGS ON ANY OXYGEN LINES OR ON FLUID LINES INSIDE THE FIRE ZONES OF ENGINES OR APU'S. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR.
 WARNING	DO NOT USE PERMASWAGE FITTINGS TO REPAIR THESE COMPONENTS. IF YOU USE PERMASWAGE FITTINGS FOR THESE COMPONENTS, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Boeing does not approve Permaswage fittings for these applications:
 - (a) For the repair of tubing in the fuel system (such as fuel pressure sensing lines)

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- (b) On pneumatic ducts
- (c) Potable water lines or waste water drain lines
- (d) The repair of electrical conduits

SUBTASK 20-10-09-940-020

- (2) Use the tools, tube repair kit, SPL-541, shown in (Table 819).

SUBTASK 20-10-09-940-011

- (3) Cut out the damaged section of the tube:
 - (a) Make sure the section you cut out of the tube is a straight section with a minimum straight length as shown in (Figure 825).
NOTE: Make sure the fitting and swage tool will fit.
 - (b) Use one Permaswage fitting for the repair if the damaged section is no more than 0.150 in. (3.810 mm) long.
NOTE: In this case, the cut can be through the center of the damaged section.
 - (c) If the damage is too near to a bend (less than 0.500 in. (12.700 mm)) or longer than 0.150 in. (3.810 mm), use a tube splice and two fittings to make the repair (Figure 825).

SUBTASK 20-10-09-940-012

- (4) For tube cutouts with a bend, use the cutout tube section as a template to mark and cut the new tube segment.
NOTE: The maximum gap between the tube ends is approximately 0.150 in. (3.810 mm) for the union installation.

SUBTASK 20-10-09-110-009

- (5) Clean the tube in the swage area:
 - (a) Use an applicable solvent, for example, alcohol, B00068 to clean the not painted tube sections that you will repair.
 - (b) Make sure the sections are free of dirt, grease, and other unwanted material for a distance equal to the values shown in (Figure 825).
 - (c) Remove paint and anodize from the tubes in an area equal to the values shown in (Figure 825). Use the methods shown in (Table 820).
 - (d) Make sure the cleaned surfaces are smooth, uniform, bright, and free of unwanted materials.
 - (e) Use a brush to apply coating, C00064 to the open surfaces of aluminum tubes.

SUBTASK 20-10-09-940-013

- (6) Do these steps to remove the burrs from the tube ends:
 - (a) To remove burrs from the inner bore of the tube ends, use DMC plug-type deburring tools or equivalent. Refer to (Figure 807) for the correct deburring procedure.
NOTE: You must remove burrs from the tube inner diameter each time you cut the tube. Make sure the tube shavings do not get into the system.
Do not release the spring pressure of the deburring tool while you pull the tool from the tube.
 - (b) It is not usually necessary to remove burrs from the tube outer diameter. If it is necessary, use abrasive, B00138 to remove particles.

SUBTASK 20-10-09-940-014

- (7) Use one of these steps to apply witness marks:

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- (a) Use a marker, G02061 or equivalent to apply witness marks as shown in (Figure 827).
NOTE: Use DMC tools D12580-1, -2, -3 or equivalent.
- (b) Make marks directly on the tube to show the minimum insertion depths as shown in (Figure 827).
- (c) Swage fittings to the marks.

SUBTASK 20-10-09-370-001

- (8) Apply paint to bare areas. For example, tool marks and areas where you removed paint (fittings and painted tubes).

SUBTASK 20-10-09-370-002

- (9) Apply coating, C00064 to open areas of aluminum and primer, C00259 to all other tubes and fittings.

F. Procedure

SUBTASK 20-10-09-860-003

- (1) Remove pressure from the systems where you will do the repair.

SUBTASK 20-10-09-940-015

- (2) Use a union and a tube as shown in (Table 818).

NOTE: Keep the Permaswage fittings in their container until you are ready to install them.

SUBTASK 20-10-09-350-006

- (3) Make sure the tube is sufficiently long to do the repair (Figure 825).

SUBTASK 20-10-09-110-010

- (4) Clean the tube as shown in (Table 820), then cut the tube.

NOTE: Seal the tube ends with a cap if you do not join the tubing immediately.

Table 820/20-10-09-993-898 Cleaning and Paint Removal Procedures for Aluminum Tubes

MATERIAL SURFACE	PROCEDURE TO CLEAN TUBE
Bare or Alodine	Solvent clean
Anodize	Hand apply abrasive material, 180-grit or finer: - Fed Spec P-P-121 - Fed Speck P-C-451 - Abrasive Scotch Brite, Type A
Primer/Paint	1. Hand apply abrasive material, 240-grit or finer 2. Lacquer thinner (refer to TT-T-266)(flammable) MEK (refer to TT-T-261)(flammable) for primed surfaces (MIL-P-6889) and lacquer base paint/enamel

SUBTASK 20-10-09-210-013

- (5) Examine the unions for silicone seals (Table 818).

SUBTASK 20-10-09-420-010

- (6) Move the union over the tube ends. Center the union on the witness marks or put it in position at the correct insertion depth.

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SUBTASK 20-10-09-350-007



MAKE SURE YOU MAKE NO PUMP ADJUSTMENT THAT CAN CAUSE THE SWAGE TOOL HYDRAULIC PRESSURE TO BE MORE THAN THE MANUFACTURE RECOMMENDED. DLT SERIES TOOLS ARE 10,000 $\pm$ 250 PSI (68,948 $\pm$ 1724 KPA) MAXIMUM. IF PRESSURE IS GREATER THAN ABOVE MAXIMUM/MINIMUM VALUES INJURY OR DAMAGE CAN OCCUR.

- (7) Swage the union to the tube as shown in the manufacturer's recommended procedures.

SUBTASK 20-10-09-350-008

- (8) Swage each end three times.

NOTE: After the initial swage, move the swage head between 30 and 45 degrees from the previous swage position before you swage again.

SUBTASK 20-10-09-110-011

- (9) Lubricate the head and lower die block regularly.

SUBTASK 20-10-09-210-014

- (10) Examine the end plates for loose retaining screws.

SUBTASK 20-10-09-220-017

- (11) Examine the finished swage as shown in the manufacturer's recommended procedure or measure with Vernier caliper for dimensions as shown in (Figure 828).

SUBTASK 20-10-09-760-006

- (12) In the fuel tanks and vapor areas, do a check of the electrical resistance specifications across each tube/fitting interface (TASK 20-10-09-760-801).

SUBTASK 20-10-09-760-007

- (13) Make resistance measurements for all Permaswage repair installations in wing tanks and fuel vapor areas (TASK 20-10-09-760-801).

SUBTASK 20-10-09-790-002

- (14) For Permaswage fitting repairs in general areas, do a leak test as follows:
- (a) Pressurize the system for 5 minutes minimum.
 - (b) Make sure there is no sign of hydraulic leaks. Use your finger or a white cloth to do a check for leaks.

SUBTASK 20-10-09-210-015

- (15) Examine the tube-to-fitting interface for hydraulic leaks you can see.

NOTE: When dimensional or leakage specifications are not met, you can swage again. Then do a leak test. You must replace fittings you cannot seal.

SUBTASK 20-10-09-370-003

- (16) Apply primer, C00259 to the Alodine areas of the finished tube joint where the bare metal is open.

SUBTASK 20-10-09-820-009

- (17) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

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SUBTASK 20-10-09-820-010

- (18) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

- (a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

———— **END OF TASK** ————

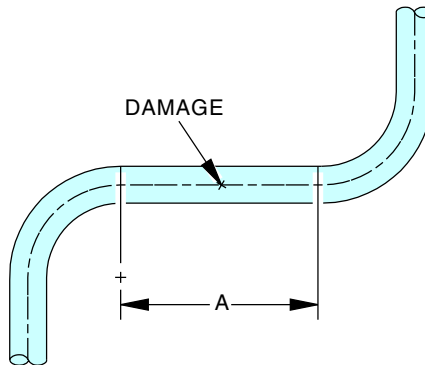
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SIZE	TUBE SIZE						
	04	06	08	10	12	16	20
Fitting length	1.540/ 1.530	1.690/ 1.680	2.700/ 2.686	2.780/ 2.766	2.920/ 3.906	3.209/ 3.195	3.664/ 3.650
A tube length (min)	2.15	2.30	3.30	3.40	3.55	3.80	4.30

NOTE:
ALL DIMENSIONS ARE IN INCHES (mm).

L19715 S0006402433_V2

Minimum Straight Length for Permaswage Fitting Installation
Figure 825/20-10-09-990-923

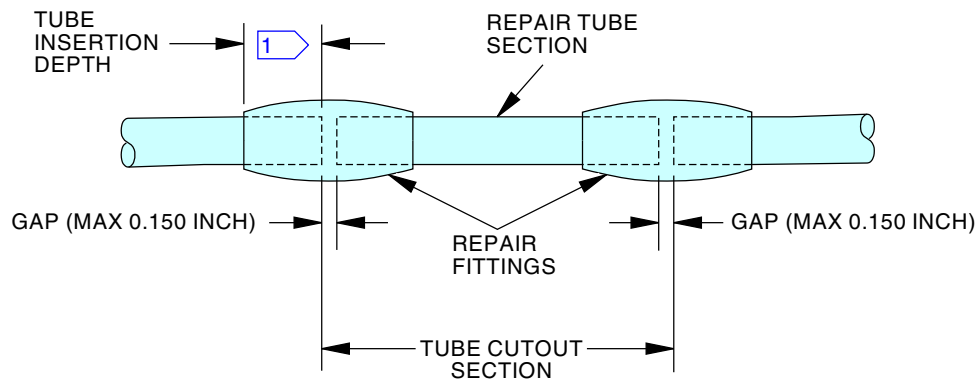
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MATERIAL	TUBE SIZE						
	04	06	08	10	12	16	20
Cres/Ti	0.02	0.02	0.03	0.04	0.057	0.049	0.05
Al	None	0.04	0.06	0.06	0.061	0.048	0.06

SWAGE GROWTH VALUES (INCH)

1 THE A DIMENSION IS SHOWN IN FIG. 829.

L19716 S0006402434_V2

Tube Splice Repair
Figure 826/20-10-09-990-924

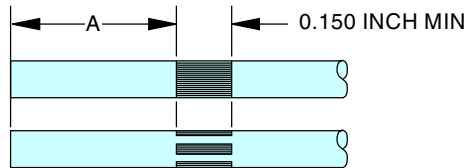
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DIMENSION (FIG. 827)	TUBE SIZE AND INSERTION DEPTH - INCHES					
	04	06	08	10	12	16
A	0.69	0.77	1.27	1.31	1.38	1.52

MARK FOR THE MINIMUM TUBE INSERTION DEPTHS

L19718 S0006402436_V2

Witness Mark Location and Usual Marking Procedures
Figure 827/20-10-09-990-925

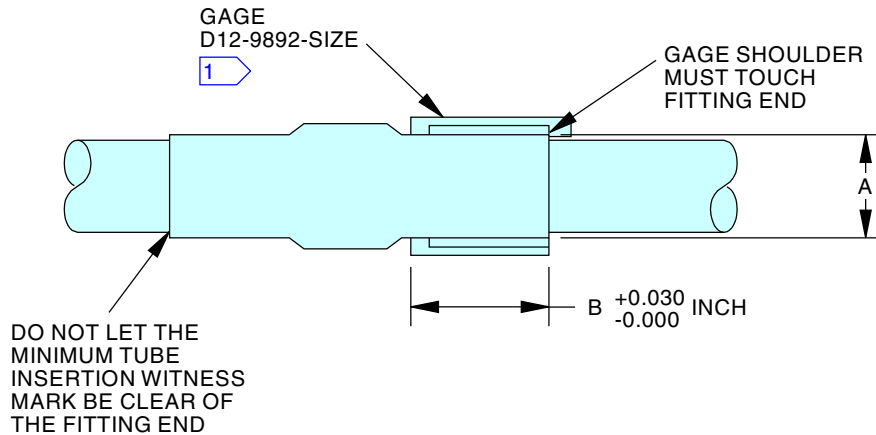
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TUBE DIAMETER (INCHES)	SWAGED DIAMETER MAX A DIMENSIONS (INCHES)	SWAGED LENGTH MIN B DIMENSIONS (INCHES)
1/4 (04)	0.315	0.46
3/8 (06)	0.447	0.53
1/2 (08)	0.606	1.02
5/8 (10)	0.735	1.02
3/4 (12)	0.863	1.02
1 (16)	1.181	1.406
1-1/4 (20)	1.390	1.406

AFTER SWAGE DIMENSIONS (INCH)

1 USE DNR9892-016 FOR SIZE 16.

L19721 S0006402437_V3

Final Swage Dimensions
Figure 828/20-10-09-990-926

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TASK 20-10-09-400-806

13. Axial Swage Fitting Union Installation (8,000 psi Rated - Rynglok)

A. General



WARNING

DO NOT USE AXIAL SWAGE FITTINGS ON OXYGEN LINES. IF YOU USE AXIAL SWAGE FITTINGS ON OXYGEN LINES, DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL CAN OCCUR.



WARNING

DO NOT USE RYNGLOK FITTINGS TO REPAIR THESE COMPONENTS. IF YOU USE RYNGLOK FITTINGS FOR THESE COMPONENTS, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Boeing does not approve Rynglok tube-to-tube fittings for these applications:
 - (a) For the repair of tubing in the fuel system (such as fuel pressure sensing lines) or fuel tanks.
 - (b) On pneumatic ducts
 - (c) Potable water lines or waste water drain lines
 - (d) The repair of electrical conduits
- (2) The Rynglok in-line tube unions (Figure 829), sizes 04, 06, 08, 10, 12, and 16, are used with 304 1/8 hard CRES tube to repair Ti-3AL-2.5 and 21-6-9 CRES. The same unions plus a size 20 are used with 6061-T6 aluminum tube to repair 6061-T6 aluminum tube, provided the bare areas of the tubing are painted after swaging to limit the possibility for galvanic corrosion to occur.
- (3) When you do a repair, remove the part of the tube with the damage. If the area of the tube damage is less than the value listed in (Table 807), use one Axial Swage union (8,000 psi rated - Rynglok) for repair.
- (4) If the tube damage is longer than the value listed in (Table 807), put in a tube splice and install the splice with two fittings. The splice must be equal to or slightly shorter than the removed tube section. The minimum length of tubing to be removed is shown in (Table 822). Fittings and tubing material sizes are shown in (Table 821).

Table 821/20-10-09-993-899 Approved Fitting/Tube Material Combinations for Repair with Rynglok Unions (8,000 psi Rated)

AEROQUIP PART NUMBER	FOR USE WITH TUBE MATERIALS	APPROVED TUBE SIZES OD/WALL						
		04	06	08	10	12	16	20
Axial Swage (8,000 psi rated 8010T - Rynglok) (Titanium Material)	21-6-9 CRES	0.016	0.020	0.026	0.033	0.039	0.052	N/A
	304 1/8 Hard CRES (MIL-T- 6845)	0.020	0.028	0.035	0.049	0.058	0.065	N/A
		0.035	0.035	0.035	0.035	0.035	0.035	0.035
		0.016	0.019	0.026	0.032	0.039	0.051	N/A

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Table 822/20-10-09-993-900 Splice Repair with More Than One Axial Swage (5,000 psi Rated and 8,000 psi Rated - Rynglok) Tube-to-Tube Union - Minimum Removed Tube Section

TUBE DASH NUMBER	TUBE OUTER DIAMETER (INCHES)	AXIAL SWAGE FITTING UNION, 5,000 PSI RATED OR 8,000 PSI RATED - RYNGLOK, MINIMUM REMOVED TUBE SECTION (INCHES)
04	0.250	2.38
06	0.375	2.64
08	0.500	2.92
10	0.625	3.18
12	0.750	3.56
16	1.000	4.15
20	1.250	4.81

B. References

Reference	Title
29-11-00-860-807	Main Hydraulic System and the Reservoir Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt.", which stands for Optional.

Reference	Description
COM-1803	Swager - Rynglok Hydraulic Fitting Part #: RCSK8-02-004 Supplier: 00624 Part #: RTSK8-02-013 Supplier: 00624
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

D. Consumable Materials

Reference	Description	Specification
B00068	Alcohol - Denatured, Ethyl (Ethanol)	AMS 3002, MIL-E-51454 Type II
C00064	Coating - Aluminum Chemical Conversion	BAC5719 Type II Class A (MIL-DTL-5541 Class 1A)
C00259	Coating - Chemical And Solvent Resistant Finish, Corrosion Inhibiting Primer	BMS10-11 Type I

E. Procedure

SUBTASK 20-10-09-860-006

- (1) Remove pressure from the system where you will do the repair (Main Hydraulic System and the Reservoir Depressurization, TASK 29-11-00-860-807).
 - (a) Allow the hydraulic fluid to drain into a suitable container (example, 1 U.S.-gal (3.81 l) oil resistant container, STD-203).

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SUBTASK 20-10-09-360-001

- (2) Use the tools contained in swager hydraulic fitting, COM-1803.

NOTE: The RCSK tool kits have tools to cut and deburr. The RTSK tool kits do not have tools to cut and deburr. If you use an RTSK tool kit, use tools to cut and deburr that are not in the tool kit.

SUBTASK 20-10-09-360-002

- (3) Cut out the damaged section of the tube using a chipless tube cutter (Figure 807) and the following;
- (a) Make sure the section you cut out of the tube is a straight section with a minimum straight length as shown in (Figure 812).
- NOTE: This will make sure the fitting and the swage tool will fit.
- (b) Use one Axial Swage union (8,000 psi rated - Rynglok) for the repair if the damaged section is not longer than the dimensions listed in Table 807.
- 1) If the damage is within the dimensions, the cut can be through the center of the damaged section.

SUBTASK 20-10-09-150-001

- (4) Remove the paint and the anodize from the tubes to the dimensions shown in (Figure 812).

SUBTASK 20-10-09-110-013

- (5) Clean the non-painted tube sections that you will repair with alcohol, B00068.

SUBTASK 20-10-09-370-004

- (6) Use a brush to apply alodine coating, C00064 to the cut ends of the tube.

SUBTASK 20-10-09-360-003

- (7) Seal the tube ends with a cap if you do not join the tubing immediately.

SUBTASK 20-10-09-360-004

- (8) Apply positioning and inspection marks on the tube to be repaired using the appropriate gage from the swager hydraulic fitting, COM-1803 tool kit and a Sanford Sharpie (or equivalent) felt tip pen with a fine or extra fine point (Figure 830, Figure 832).
- NOTE: The RCSK tool kits have tools to cut and deburr. The RTSK tool kits do not have tools to cut and deburr. If you use an RTSK tool kit, use tools to cut and deburr that are not in the tool kit.
- (a) Bottom the gage on the cut edge of the tube before making the marks.

SUBTASK 20-10-09-360-005

- (9) Move the Axial Swage union (8,000 psi rated - Rynglok) over the tube ends.

SUBTASK 20-10-09-360-006

- (10) Put the edge of the fitting ring over the center of the positioning mark (nominal tube insertion) as shown in (Figure 831).
- NOTE: The edge of the fitting ring may be anywhere along the length of the positioning mark but the nominal position is recommended.

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SUBTASK 20-10-09-360-007



MAKE SURE YOU MAKE NO PUMP ADJUSTMENT THAT CAN CAUSE THE SWAGE TOOL HYDRAULIC PRESSURE TO BE OUTSIDE THE MANUFACTURER'S RECOMMENDATIONS. THE AEROQUIP RECOMMENDATION FOR THE TOOL IS 8000 PSI TO 8500 PSI MAXIMUM. IF PRESSURE IS GREATER THAN THIS VALUE, INJURY AND DAMAGE CAN OCCUR.

- (11) Swage the union to the tube as shown in the Aeroquip Rynglok Installation Guide supplied with the swager hydraulic fitting, COM-1803.

NOTE: The fitting must always be fully installed in the tool to maximize tool life.

- (a) Make sure that the swage tool hydraulic pressure is between 8000 psi (55,158 kPa) and 8500 psi (58,605 kPa).

SUBTASK 20-10-09-360-008

- (12) Examine the finished installation for correct ring advancement using the appropriate size inspection gage from the swager hydraulic fitting, COM-1803.
- (a) The inspection gage should fit over the ring area as shown in (Figure 832) so that the ring is flush with the center portion of the union.

SUBTASK 20-10-09-780-001

- (13) Pressurize the hydraulic system to operating pressure for the system which was repaired.

SUBTASK 20-10-09-790-003

- (14) Examine the tube-to-union interface for hydraulic leakage.
- (a) If leakage is found, the union must be cut out and a tube repair by section replacement must be done.

SUBTASK 20-10-09-370-005

- (15) Apply alodine coating, C00064 to bare areas of the aluminum tubing where paint was removed, followed by a coat of primer, C00259.

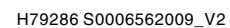
————— **END OF TASK** —————

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Axial Swage Tube to Tube Union (5,000 psi Rated and 8,000 psi Rated)
Figure 829/20-10-09-990-928

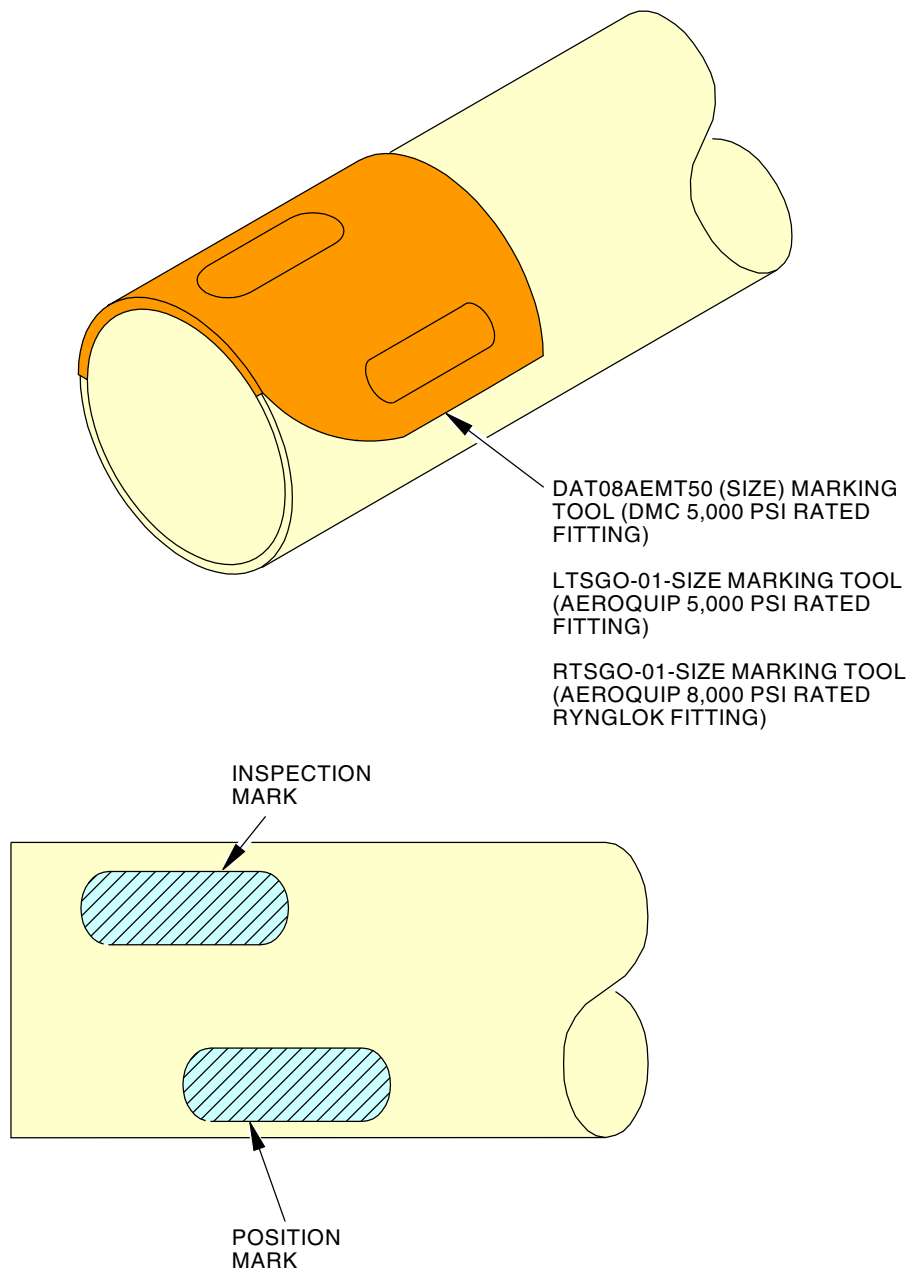
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H79298 S0006562013_V3

Mark Location During Rynglok Fitting Installation
Figure 830/20-10-09-990-929

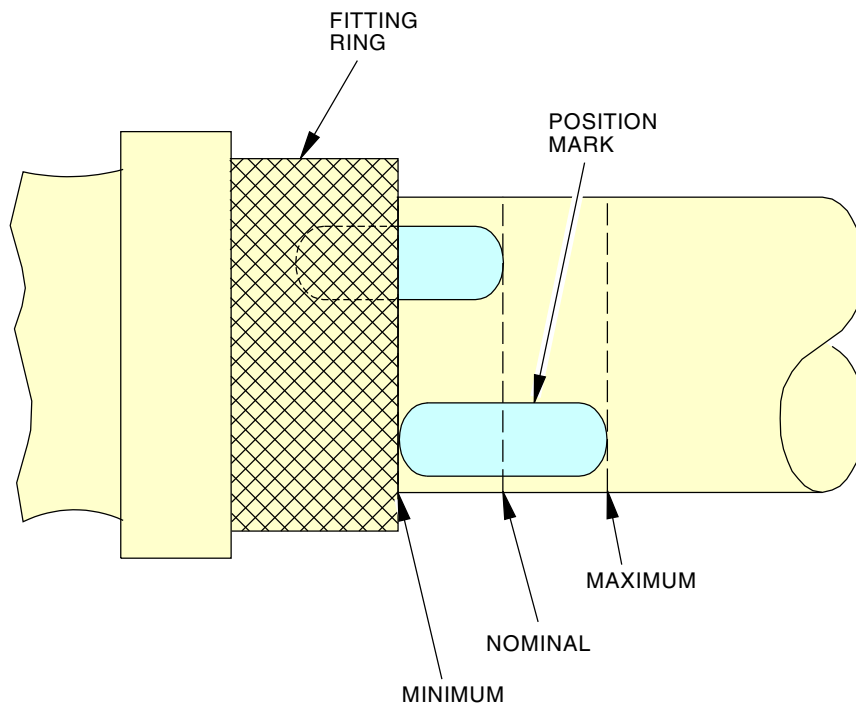
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H79310 S0006562014_V3

Fitting Position for Tube Insertion
Figure 831/20-10-09-990-930

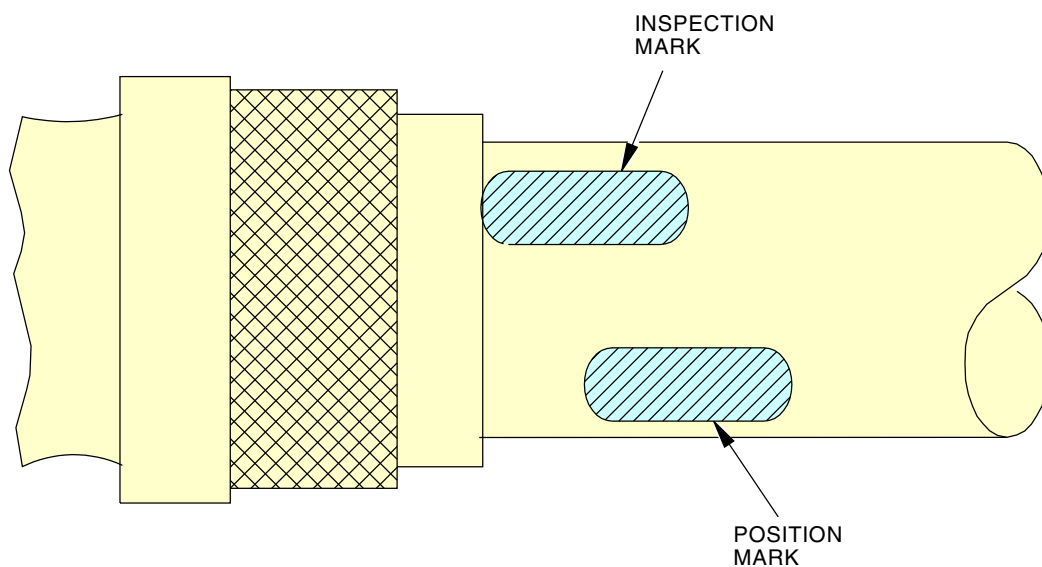
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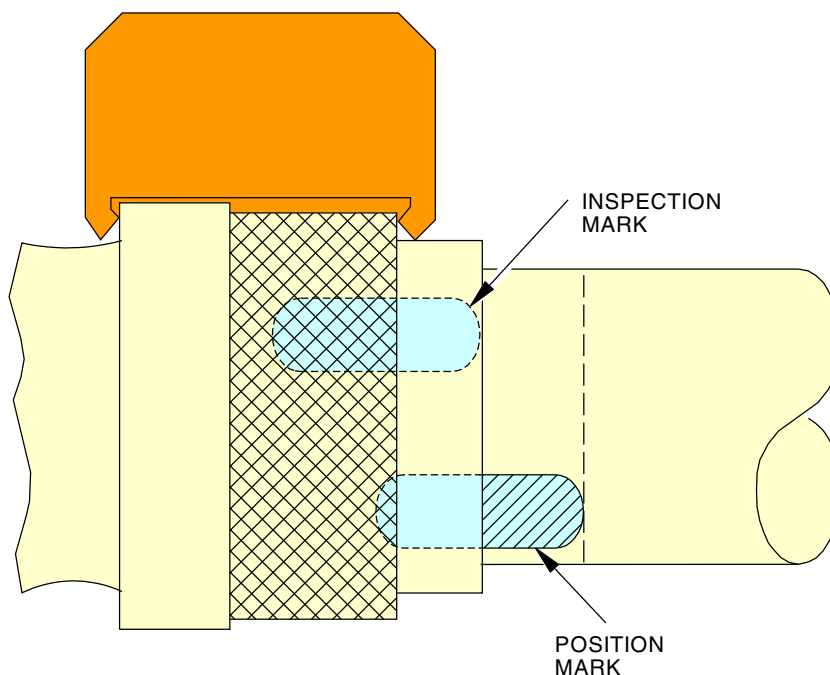
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MINIMUM INSPECTION MARK AFTER SWAGING



MAXIMUM INSPECTION MARK AFTER SWAGING

H79312 S0006562015_V3

**Use of Inspection Gage After Swage of Axial Swage Fittings (5,000 psi Rated or 8,000 psi Rated - Rynglok)
Figure 832/20-10-09-990-931**

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TASK 20-10-09-400-807

14. Axial Swage Fitting Installation (5,000 psi rated - Union) or Male/Female Adapter Fitting

A. General

- (1) Make sure that you do not use Axial Swage shape fittings (tees, elbows) to repair tubes.



WARNING

DO NOT USE AXIAL SWAGE FITTINGS TO REPAIR THESE COMPONENTS. IF YOU USE AXIAL SWAGE FITTINGS FOR THESE COMPONENTS, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Boeing does not approve Axial Swage Union Fittings (5,000 psi rated) for the applications that follow.
- (a) The repair of tubing in the fuel system (such as fuel pressure sensing lines) or fuel tanks.
 - (b) On pneumatic ducts.
 - (c) On potable water lines or waste water drain lines.
 - (d) The repair of electrical conduits.
- (3) Do not use the Axial Swage tube-to-tube union fittings on fluid lines in fuel tanks, in engine areas, or on lines used in oxygen systems. The Axial Swage tube-to-tube fitting is not qualified for these applications.
- (4) The 5,000 psi rated Axial Swage union or adapter fittings can be used to repair 3,000 psi 3Al-2.5V titanium and 21-6-9 CRES hydraulic tubing.
- (5) The 5,000 psi rated Axial Swage union or adapter fittings and tooling are color-coded blue to distinguish them from the 8,000 psi rated Axial Swage fittings and tooling.
- (6) The 5,000 psi rated Axial Swage tube-to-tube AS5969T union fitting, sizes 04, 06, 08, 10, 12, 16, and 20, is approved for use with high pressure and low pressure 3AL-2.5V titanium tubing and high pressure 21-6-9 CRES tubing to repair the respective pressure rated 3AL-2.5V titanium and 21-6-9 CRES tubing.
- (7) When you do a repair, remove the part of the tube with the damage. If the area of the tube damage is less than Table 807, use one Axial Swage union fitting for repair.
- (8) If the tube damage is longer than the value listed in Table 807, put in a tube splice and install the splice with two fittings.
- (a) The splice must be equal to or slightly shorter than the removed tube section.
 - (b) The minimum length of tubing to be removed is shown in Table 807.
- (9) Fittings and tubing material sizes are shown in Table 823.

Table 823/20-10-09-993-901

DMC PART NUMBER	FOR USE WITH TUBE MATERIALS	APPROVED TUBE SIZES OD/WALL (IN.)					
		04	06	08	10	12	16
Titanium Material:	21-6-9 CRES	0.016	0.019	0.026	0.032	0.039	

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Table 823/20-10-09-993-901 (Continued)

DMC PART NUMBER	FOR USE WITH TUBE MATERIALS	APPROVED TUBE SIZES OD/WALL (IN.)					
		0.016	0.020	0.026	0.033	0.039	
DAS5969T, Tube- to-Tube Union DAS5792T, Female Adapter DAS5793T, Male Adapter	3AL-2.5V Titanium						

B. References

Reference	Title
29-11-00-860-801	Main Hydraulic System Pressurization (P/B 201)
29-11-00-860-807	Main Hydraulic System and the Reservoir Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-8946	Kit - Axial Swage Tube Repair With Pump, 5000 PSI Part #: DAT08AEFKT5001 Supplier: 14798 Part #: RCLK5C01S020 Supplier: 00624
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal	
C00064	Coating - Aluminum Chemical Conversion	BAC5719 Type II Class A (MIL-DTL-5541 Class 1A)

E. Procedure

SUBTASK 20-10-09-040-002

- (1) Remove pressure from the system where you will do the repairs, do this task: Main Hydraulic System and the Reservoir Depressurization, TASK 29-11-00-860-807.
 - (a) Drain the hydraulic fluid into a suitable container.
 - 1) An example of a suitable container is a 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-09-800-018

- (2) Use the tools contained in tube repair kit, COM-8946.

SUBTASK 20-10-09-020-009

- (3) Cut out the damaged section of the tube using a chipless tube cutter (Figure 807).

NOTE: The RCSK tool kits have tools to cut and deburr. The RTSK tool kits do not have tools to cut and deburr. If you use an RTSK tool kit, use tools to cut and deburr that are not in the tool kit.

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- (a) Make sure that the section you cut out of the tube is a straight section with a minimum straight length as shown in Figure 812.

NOTE: This will make sure the fitting and swage tool will fit.

- (b) If the damage is shorter than the dimensions listed in Table 807, use one Axial Swage union (5,000 psi rated) for the repair.
- (c) If the damage is within the dimensions listed in Table 807, the cut can be through the center of the damaged section.

SUBTASK 20-10-09-370-007

- (4) Remove the paint and the anodize from the tubes to the dimensions shown in Figure 812.

SUBTASK 20-10-09-160-003

- (5) Clean the non-painted tube sections that you will repair with Series 80 solvent, B01000.

SUBTASK 20-10-09-370-008

- (6) Use a brush to apply coating, C00064.

SUBTASK 20-10-09-800-019

- (7) Seal the tube ends with a cap if you do not join the tube immediately.

SUBTASK 20-10-09-480-004

- (8) Apply positioning and inspection marks on the tube to be repaired using the appropriate gage from the tube repair kit, COM-8946 and a Sanford Sharpie (or equivalent) felt tip pen with a fine or extra-fine point.
 - (a) See Figure 830, Figure 831, and Figure 832.
 - (b) Bottom the gage on the cut edge of the tube before making the marks.

SUBTASK 20-10-09-400-001

- (9) Move the Axial Swage union (5,000 psi rated) over the tube ends.

SUBTASK 20-10-09-800-020

- (10) Put the edge of the fitting ring over the center of the positioning mark (nominal tube insertion) as shown in Figure 831.
 - (a) Make sure that the edge of the fitting ring is anywhere along the length of the positioning mark.

NOTE: Nominal position is recommended.

SUBTASK 20-10-09-580-001

 WARNING	DO NOT ADJUST THE PUMP TO A PRESSURE THAT CAN CAUSE THE SWAGE TOOL TO BE ABOVE THE LEVEL SPECIFIED. IF YOU ADJUST PRESSURE TO MORE THAN SPECIFIED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (11) Make sure that you do not make a pump adjustment that can cause the swage tool hydraulic pressure to be outside the manufacturer's recommendations.
 - (a) The manufacturer's recommendations for the tool is 8000 psi (55,158 kPa) to 8500 psi (58,605 kPa) maximum.

SUBTASK 20-10-09-400-002

- (12) Swage the union to the tube as shown in the installation guide supplied with the swaging equipment.

NOTE: The fitting must always be fully installed in the tool to maximize tool life.

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SUBTASK 20-10-09-200-003

- (13) Examine the finished installation for correct ring advancement.
- (a) Use the appropriate size inspection gage from the tube repair kit, COM-8946.
- 1) The inspection gage should fit over the ring area as shown in Figure 832.
- NOTE: This is so the ring is flush with the center portion of the union.

SUBTASK 20-10-09-440-001

- (14) Pressurize the hydraulic system to operating pressure for the system that was prepared, do this task: Main Hydraulic System Pressurization, TASK 29-11-00-860-801.

————— **END OF TASK** —————

TASK 20-10-09-350-801

15. Hydraulic Tubing Repair with Flexible Hoses

A. General

- (1) The Boeing Company recommends that the operator do these procedures:
- (a) Make a record of the flexible hoses that you install as temporary repairs for rigid lines.
- (b) Make a schedule for the regular inspection of flexible hose installations.
- (c) Make sure the installation stays an airworthy repair until the system is put back to its initial configuration.
- (d) Make a procedure to make sure the flexible hoses that are installed as temporary repairs are replaced as soon as possible.
- NOTE: You must replace the hoses no later than the scheduled time check approved by the applicable regulatory agency (assigned principal maintenance inspector for FAA operators).
- (2) You can use many different repair techniques. The Boeing Company cannot know about or control these repair techniques. It is your responsibility to decide if this procedure is applicable to your repair techniques.
- (3) This procedure is not acceptable for engine hydraulic tube repair or for the replacement of rigid or flexible coiled tubing. Engine hydraulic tubes are those tubes below or forward of the firewall, and within the engine cowl. Consult Boeing when considering a repair to any engine hydraulic tube or coiled tube.

B. References

Reference	Title
20-10-10-400-801	Flexible Hose Installation (P/B 401)
29-11-00-860-807	Main Hydraulic System and the Reservoir Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
SPL-5276	Repair Kit, Hydraulic Tubing (Temp. Repairs, operating pressures up to and including 3000 psi) (Approved for Titanium) Part #: 65-92528-1 Supplier: 81205 Part #: 65-92528-11 Supplier: 81205 Part #: 65-92528-4 Supplier: 81205 Part #: 65-92528-5 Supplier: 81205

D. Install the Flexible Hose



DO NOT ALLOW PUMPS, VALVES, ACTUATORS OR OTHER COMPONENTS TO HANG FROM KEVLAR HOSES. KEVLAR HYDRAULIC HOSES KINK EASILY AND MAY DEVELOP LEAKAGE.

NOTE: Kevlar hydraulic hoses kink more easily than CRES (steel) wire braided hoses.

NOTE: Kevlar fibers are usually not damaged by kinking. After the hose is pressurized, all signs of kinking may disappear. However, the inner Teflon tube may be damaged and eventually leak. Kinking is especially critical for larger hoses such as the ADP pressure hoses (1 1/4 inches).

SUBTASK 20-10-09-220-018

(1) Use a flexible hose that has the specifications that follow:

- (a) Make sure the flexible hose is specified for at least the same operating pressure and fluid type as the system in which you will install the flexible hose.

NOTE: The 777 airplane uses the new kevlar reinforced hydraulic hose. This hose may be used provided the guidelines of (Table 824) are met.

- (b) Make sure the new flexible hose has a minimum of the same inner diameter as the damaged tube.
- (c) Make sure the new flexible hose is sufficiently long to replace the damaged tube or the damaged section of the tube.
- (d) Make sure the new flexible hose has sufficient slack, flex, twisting, bending, clearance, and support specifications as shown below and in (Figure 833).
- 1) Slack - Do not install the hose assemblies in a way that will cause a mechanical load on the hose. Hoses will change length from +2 to -4 percent when pressurized. Supply sufficient slack or bend to make the allowance for a change in length and length tolerances.
 - 2) Flex - When hose assemblies will have much vibration or flexing, make sure there is sufficient slack between the rigid fittings. Install the hose so flexing does not occur at the end fittings. The hose must stay straight for at least two hose diameters from the end fittings. Do not use clamp locations that will restrict or prevent the hose from flexing.
 - 3) Twisting - Make sure you install the hoses without twists to prevent loose nuts and possible rupture of the hose. You can use swivel connections at one or two ends to release the twist stresses.
 - 4) Bending - To prevent sharp bends in the hose assembly, use elbow fittings, hose with elbow type end fittings, or the applicable bend radii, as shown in (Table 824).

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Table 824/20-10-09-993-850 Minimum Hose Bend Radius

HOSE	HOSE INNER DIAMETER (INCH)	MINIMUM HOSE BEND RADIUS MEASURED AT INNER BEND (INCH)
AS115-04	1/4	1.50
AS115-06	3/8	2.50
AS115-08	1/2	2.88
AS115-10	5/8	3.25
AS115-12	3/4	4.00

- 5) Clearance - Make sure the hose assembly is clear of all other lines, equipment, and adjacent structure under all operating conditions. The hoses must have the minimum clearance specifications shown in (Table 825).

Table 825/20-10-09-993-851 Minimum Hose Bend Clearance

HOSE CLEARANCE TO	MINIMUM CLEARANCE (INCH)
Control Cables and Linkages	1.0 ^{*[1]}
Cable at Pulleys	0.5
Cable at Mid-span	2.0
Electrical Wiring	0.5
Hydraulic Tubes or Hoses	0.2

*[1] Measured at a relative position where the hose is closest to the cable or linkage.

- 6) Support - Make sure the hose assembly has supports that do not cause deflection of rigid lines because of the relative motion that can occur. Use sufficient clamps to follow the contour of the structure to prevent hose abrasive wear, kinking, and entanglement during flexing. At a minimum, put clamps at locations where the tube clamps were. Make sure the hose is not rigidly supported by tight, rigid clamps around its outer diameter. If a hose between rigid connections must move longitudinally, clamps must be of a type that will not cause wear on the hose casing. Make sure the connections have supports at the tube, not at the hose.

SUBTASK 20-10-09-860-004

- (2) Do this task: Main Hydraulic System and the Reservoir Depressurization, TASK 29-11-00-860-807.

for the hydraulic system where you will do the repair.

SUBTASK 20-10-09-960-001

- (3) If you can replace all of the damaged tube with a flexible hose, do these steps:
- (a) Remove the damaged tube.
 - (b) If necessary, prepare the ends of the tubes to which you will install the flexible hose. Use the applicable fittings as shown in the Tubing Repair paragraph.

SUBTASK 20-10-09-960-002

- (4) If the damaged tube is too long to replace by a flexible hose, do the steps that follow:
- (a) Cut out the damaged tube section to accept the flexible hose with the hydraulic tubing repair kit, SPL-5276.
 - (b) Prepare the ends of the cut tube with the applicable fittings as told in the Tubing Repair paragraph.

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SUBTASK 20-10-09-420-011

(5) Do this task: Flexible Hose Installation, TASK 20-10-10-400-801.

SUBTASK 20-10-09-860-005

(6) Supply the usual operating pressure to the repaired tube.

SUBTASK 20-10-09-210-016

(7) Examine the hose and connections for leaks.

SUBTASK 20-10-09-220-019

(8) Make sure the repair agrees with all specifications for slack, flex, twisting, bending, clearance, and support.

———— **END OF TASK** ————

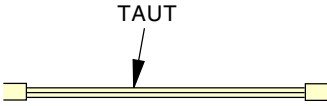
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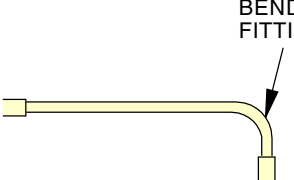
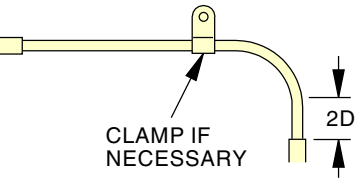
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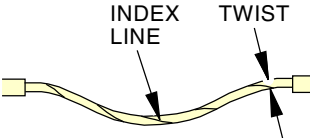
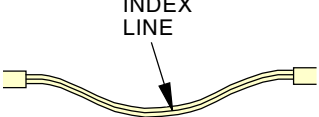
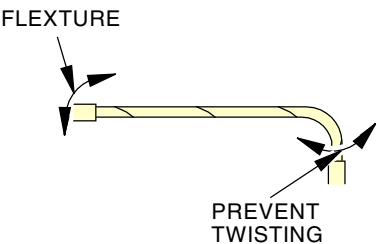
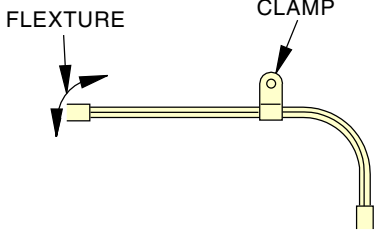
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NOT ACCEPTABLE	ACCEPTABLE

SLACK

	
NOT ACCEPTABLE	ACCEPTABLE

FLEX

	
	
NOT ACCEPTABLE	ACCEPTABLE

TWISTING

L19726 S0006402438_V2

**Hydraulic Tubing Repair with Flexible Hose
Figure 833/20-10-09-990-927 (Sheet 1 of 2)**

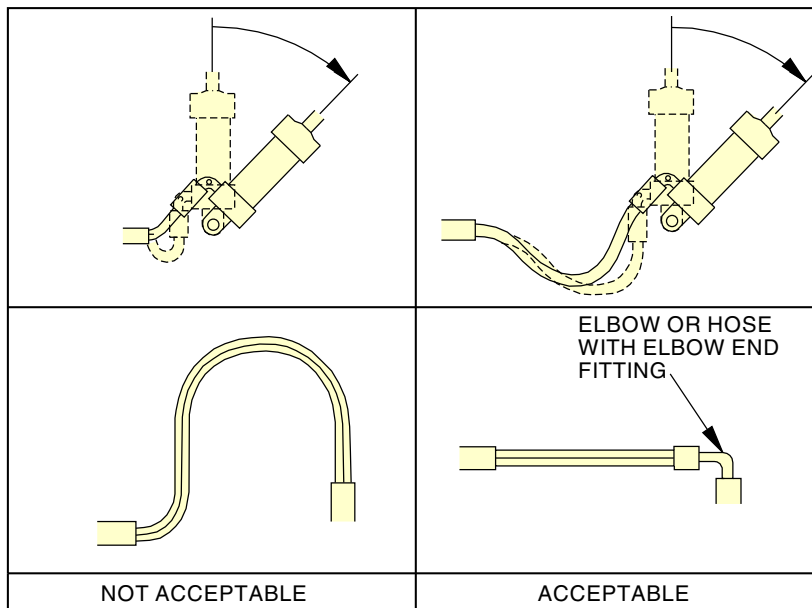
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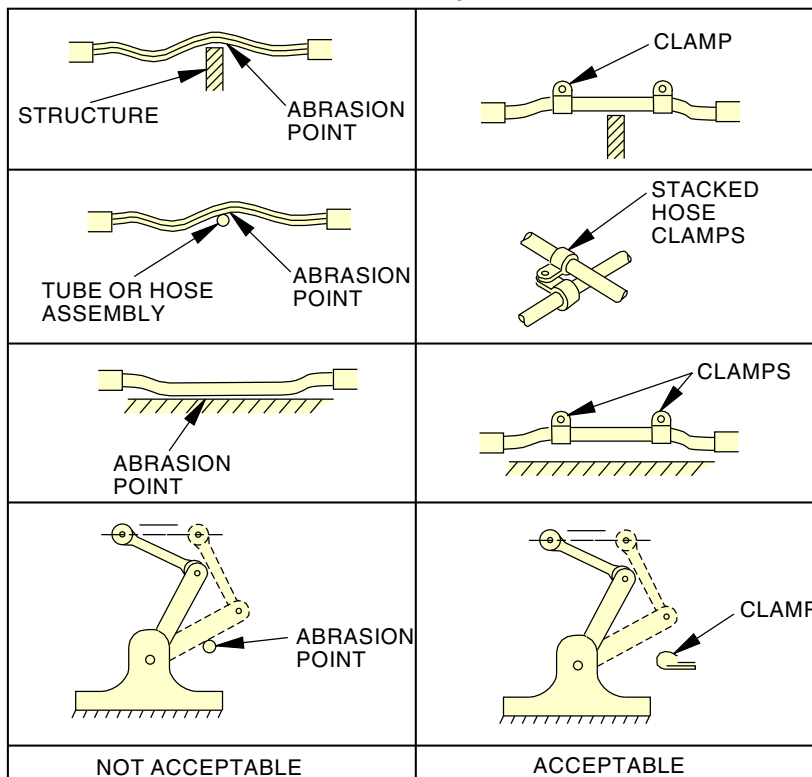
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BENDING



CLEARANCE

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**Hydraulic Tubing Repair with Flexible Hose
Figure 833/20-10-09-990-927 (Sheet 2 of 2)**

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TASK 20-10-09-300-806

16. Repair Size 16 (1 inch) and Size 20 (1-1/4 inch) 6061-T4 Aluminum Tubing in the Hydraulic System of the Airplane

A. General



WARNING

DO NOT USE THIS PROCEDURE ON OXYGEN TUBING. GREASE, DIRT, OR OTHER FLAMMABLE MATERIALS IN THE OXYGEN TUBING CAN CAUSE A FIRE OR EXPLOSION.

- (1) The hydraulic system in the airplane contains both 6061-T4 and T6 aluminum tubes.
- (2) This is a repair method that applies only to 6061-T4 hydraulic aluminum tubes in Sizes 16 (1 inch) and 20 (1-1/4 inch) and uses 6061-T6 aluminum tube material for making a splice. 6061-T6 material may be used as an alternate material for repair of 6061-T4 aluminum tubes, but 6061-T4 aluminum tube material may NOT be used to repair 6061-T6 aluminum tubes.
- (3) Approved repairs to 6061-T6 aluminum hydraulic tube material are covered elsewhere in this AMM.
- (4) Repair is accomplished using only the BACS13BX sleeve, the elastomer swaging process, and other applicable methods specified in this procedure for flareless tube repairs.
- (5) The wear depth limit for 6061-T4 tubes is 1/3 the wall thickness of the tube.

B. References

Reference	Title
20-10-09-400-801	Flareless Tubing Assembly Installation (P/B 401)
20-11-00-910-801	Standard Torque Values (P/B 201)

C. Repair 6061-T4 Aluminum Tubing

SUBTASK 20-10-09-300-007

- (1) Do the repair:
 - (a) Decide if 6061-T6 aluminum tube splice is necessary or if the damage is small enough to repair by installing a flareless MS21902 union between two BACS13BX sleeves.
 - (b) Refer to Figure 808 and Table 807 to find the necessary tube cutout length when you use a single flareless MS21902 union to replace a damaged tube area.
 - (c) To use assembled tube ends or a center section to do a repair, find the cutout length and install as follows:
 - 1) Make an estimate of the total length (L1) of the 6061-T6 aluminum tube repair section necessary to replace the damaged tube: (Figure 809, Figure 811)
 - 2) Cut and trim the repair tube as follows: (Figure 807)
 - a) Use the correct size ratchet chipless cutter.
 - b) Turn the cutter drive screw counter clockwise to retract the cutter wheel.
 - c) Put the cutter over the tube.
 - d) Turn the screw clockwise until the cutter touches the tube at the necessary cut location.
 - e) Turn the cutter screw 1/8 to 1/4 turn and rotate the cutter until the cutter is easy to rotate. The tube should now be cut.
 - f) Remove the tool.

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- g) To deburr the tube, use the correct stem subassembly and deburring tool. To assemble the tool refer to Figure 807.
- h) Push down on the plunger and install the tool into the end of the tube.
- i) Release the plunger and let the plug fill the inside of the tube.
- j) Rotate the deburring tool until the inside burr is removed.
- k) Remove the tool with the plug expanded. The expanded plug should remove particles from the inside of the tube.

NOTE: Make sure you do not drop metal particles in the area of the repair.

- 3) Swage the necessary flareless BACS13BX sleeves to the repair tube using the applicable section: Swage BACS13BX Flareless Sleeves with the Harrison Elastomer Swagers 5175, 5570, 5720.
- 4) Assemble and tighten the flareless fittings which are of the repair section (TASK 20-10-09-400-801).
- 5) Measure all of the tube assembly length with BACS13BX sleeves (L1) (Figure 809, Figure 811).
- 6) To find the necessary cutout length (L2) as shown in Figure 809, Figure 811, use the procedure given in Table 812) for BACS13BX sleeves and Harrison Portable Swagers with MS21902 unions.
- 7) Remove the pressure from the systems where you will do the repairs.
- 8) Cut out the damaged tube (L2) and trim the tube ends as shown in Figure 807.
- 9) When you make the installation, refer to the section: "Swage the BACS13BX flareless sleeves with the Harrison Elastomer Swagers 5175, 5570, 5720.
- 10) Install the repair section. To tighten the nuts, do this task: Standard Torque Values, TASK 20-11-00-910-801.

————— **END OF TASK** —————

TASK 20-10-09-930-801

17. Part Marking of Flareless Tubing Assemblies

A. General

- (1) Do this task to identify field manufactured replacements for hydraulic tubes or originally installed hydraulic tubes that have lost identification.
 - (a) For originally installed hydraulic tubes that have lost identification, reapply the original tube part number using one of the methods given below.
 - (b) For a field manufactured replacement tube, select a NEW tube part number that will include information to allow easy identification/location for future use (in case the tube must be repaired or replaced), for example, 65C26841-1002REPL. Apply the NEW tube part number using one of the methods below.
 - (c) Do one of these steps to identify hydraulic tubes.

B. Consumable Materials

Reference	Description	Specification
B50095	Solvent	BAC5750
C00033	Coating - Protective Enamel, Flexibility Use	BMS10-60 Type II
C50066	Coating - Protective Enamel, Clear	BMS10-60 Type I Class A

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(Continued)

Reference	Description	Specification
G00251	Abrasive - Mat, Non-Woven, Non-Metallic	A-A-58054
G02061	Marker - Permanent, Felt Tip Pen	
G50393	Tape - Adhesive, Label	BAC5307 Type III Polyester (Mylar)
G50395	Ink - Laundry Marking	TT-I-542
G50396	Ink - Marking, Silk Screen	Standard Overhaul Practices Manual (SOPM) 20-50-10
G50410	Stamp Pad (Commercially Available)	

C. Procedure

SUBTASK 20-10-09-930-001

(1) Rubber Stamp Method

- Clean the tube surface with solvent, B50095. Remove oxide from the tubing surface with abrasive mat, G00251.
- Select an ink, G50396 (see SOPM 20-50-10) that is suitable for the tube material and visible on the tube surface.
- Hand Stamp the new tube part number on the tube. Apply liquidink, G50396 to a stamp pad, G50410 and apply the part number to the tube surface with the stamp.
NOTE: For tubes longer than 24 inches, mark new part number within 6 inches of each end or the newest straight area that is not in a clamp area.
- Apply a clearcoating, C00033.

SUBTASK 20-10-09-930-002

(2) Hand letter Method

- Clean the tube surface with solvent, B50095. Remove oxide from the tubing surface with abrasive mat, G00251.
- Hand mark the part number on the tube with permanent marking usingink, G50395 or marker, G02061.
NOTE: For tubes longer than 24 inches, mark new part number within 6 inches of each end or the newest straight area that is not in a clamp area.

SUBTASK 20-10-09-930-003

(3) Tape or Adhesive Label Method

- Cut the adhesive tape, G50393 length to encircle the tube at least two times on a 0.250 inch to 0.500 inch diameter tube. On 0.625 inch diameter tubes and larger, encircle the tube with the adhesive tape, G50393 one and one-half to two times as necessary.
- Attach the adhesive tape, G50393 with the part number.
NOTE: For tubes longer than 24 inches, mark new part number within 6 inches of each end or the newest straight area that is not in a clamp area.
NOTE: The original identification tapes, part number BACT11Y-() () can be used for marking replacement tubes, although BACT11Y tapes require special handling equipment.
- Apply a clear coating, C50066.

————— END OF TASK —————

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TASK 20-10-09-400-808

18. Fire Resistant Silicone Tape to Nose Landing Gear Alternate Extension Hydraulic Tube - Installation

(Figure 834)

A. General

- (1) This task has procedures to install self-fusing fire resistant silicone tape around the section of the nose landing gear alternate extension hydraulic tube that is adjacent to the P30 panel in the main equipment center between STA 360 and STA 380.

B. References

Reference	Title
24-22-00 P/B 201	AC GENERATION AND BUS CONTROL - MAINTENANCE PRACTICES

C. Consumable Materials

Reference	Description	Specification
B01008	Solvent - Final Cleaning Of Metal Prior To Non-Structural Bonding - Series 88	
G50068	Tape - Self-Fusing, Silicone Rubber, Electrical - Scotch 70	
G50262	Wiper - Cleaning	BMS15-5

D. Prepare to Install the Tape

SUBTASK 20-10-09-040-003

- (1) Remove power from the aircraft AC GENERATION AND BUS CONTROL - MAINTENANCE PRACTICES, PAGEBLOCK 24-22-00/201.

SUBTASK 20-10-09-010-003

- (2) Remove the floor panel assembly.

SUBTASK 20-10-09-020-010

- (3) Remove old fire resistant silicone tape.

SUBTASK 20-10-09-160-004

- (4) Solvent clean the tube where the tape will be installed.
 - (a) Use a wiper, G50262 wet with Series 88 solvent, B01008.
 - (b) Immediately wipe the surface with a clean, dry wiper, G50262.
 - 1) Make sure that the solvent does not dry on the surface.
 - (c) Repeat solvent cleaning, as necessary.

E. Install the Tape

SUBTASK 20-10-09-420-036

- (1) Install the Scotch 70 tape, G50068.
 - (a) Wrap one piece of tape from one of the tube to the other and back to the original end of the tube.
 - 1) Make sure that each turn overlaps the previous turn by 67% or more.
 - 2) Stretch the tape 10%-100% for each turn except at the end.
 - 3) Do not stretch the tape on the last turn.

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- 4) Push down on the tape ends.

NOTE: This is to make sure that they do not lift up before the tape fuses.

F. Put the Airplane Back to Its Usual Condition

SUBTASK 20-10-09-410-001

- (1) Install the floor panel assembly.

SUBTASK 20-10-09-440-002

- (2) Supply electrical power to the airplane, if necessary (AC GENERATION AND BUS CONTROL - MAINTENANCE PRACTICES, PAGEBLOCK 24-22-00/201.

———— **END OF TASK** ————

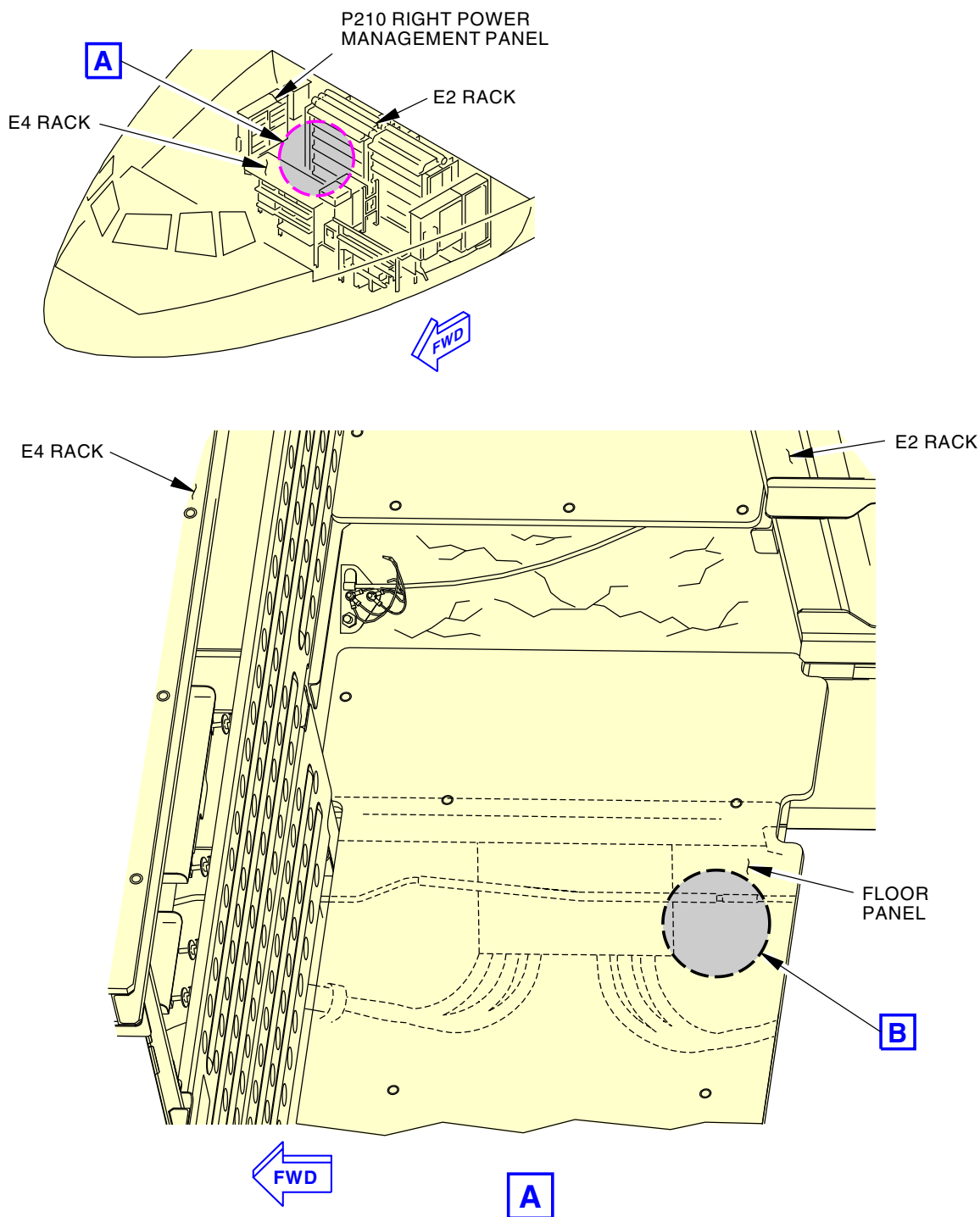
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2171762 S0000478136_V2

Tape Installation
Figure 834/20-10-09-990-910 (Sheet 1 of 2)

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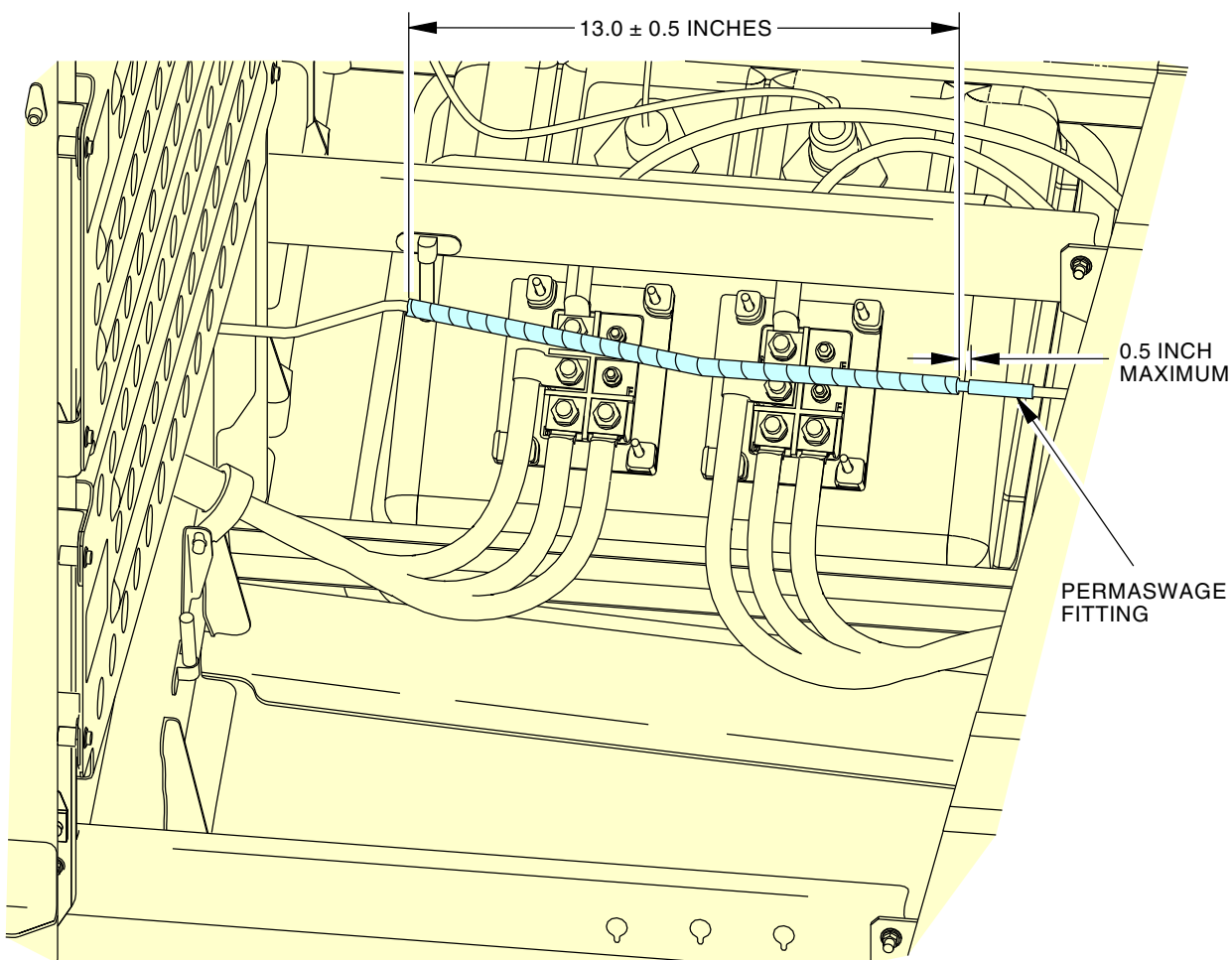
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B

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Tape Installation
Figure 834/20-10-09-990-910 (Sheet 2 of 2)

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FLEXIBLE HOSE - MAINTENANCE PRACTICES

1. General

A. This task gives maintenance practices for hydraulic hoses.

TASK 20-10-10-211-801

2. Kevlar Hydraulic Hose - Examination

A. General

- (1) This task examines the condition of the Kevlar hoses.
- (2) Hose leakage and failure can be caused by:
 - (a) External damage that can cause a fatigue crack in the inner teflon tube.
 - (b) Vibration as a result of incorrect support.
 - (c) Preload induced in the hose during installation that will result in a fatigue related failure of the hose.
- (3) Kevlar hydraulic hoses kink more easily than CRES (steel) wire braided hoses.
 - (a) Kinking is common during installation of the hose or maintenance in the area it is located.

NOTE: Kevlar fibers are usually not damaged by kinking. After the hose is pressurized, all signs of kinking may disappear. However, the inner Teflon tube may be damaged and eventually leak. Kinking is especially critical for larger hoses such as the ADP pressure hoses (1-1/4 inches).

B. References

Reference	Title
20-10-10 P/B 401	FLEXIBLE HOSE - REMOVAL/INSTALLATION

C. Kevlar Hose Examination

SUBTASK 20-10-10-211-002

- (1) Kevlar hoses should be examined for the conditions that follow.
 - (a) Leaks [See Figure 201, sheet 1]]

NOTE: Use of excessive lube during installation can seep out of threaded joints and appear to be leakage, but it is not leakage.
 - (b) Wear
 - (c) Twisting
 - (d) Signs of kinking [See Figure 201, sheet 2]
 - (e) Signs of non-planar bending.
- (2) Hoses that are damaged should be replaced using procedure: FLEXIBLE HOSE - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-10/401 and the condition that caused the damage corrected.
- (3) Kevlar hoses have an outer braid protective layer to limit damage due to the conditions that follow:
 - (a) Chafing
 - (b) Ultraviolet light
 - (c) Impact.

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- (4) The outer braid does not provide any structural integrity for the hose. Therefore, if damage has not penetrated through the outer braid, then the outer braid still provides 100% ultraviolet light protection, and the hose does not need to be replaced.

———— **END OF TASK** ————

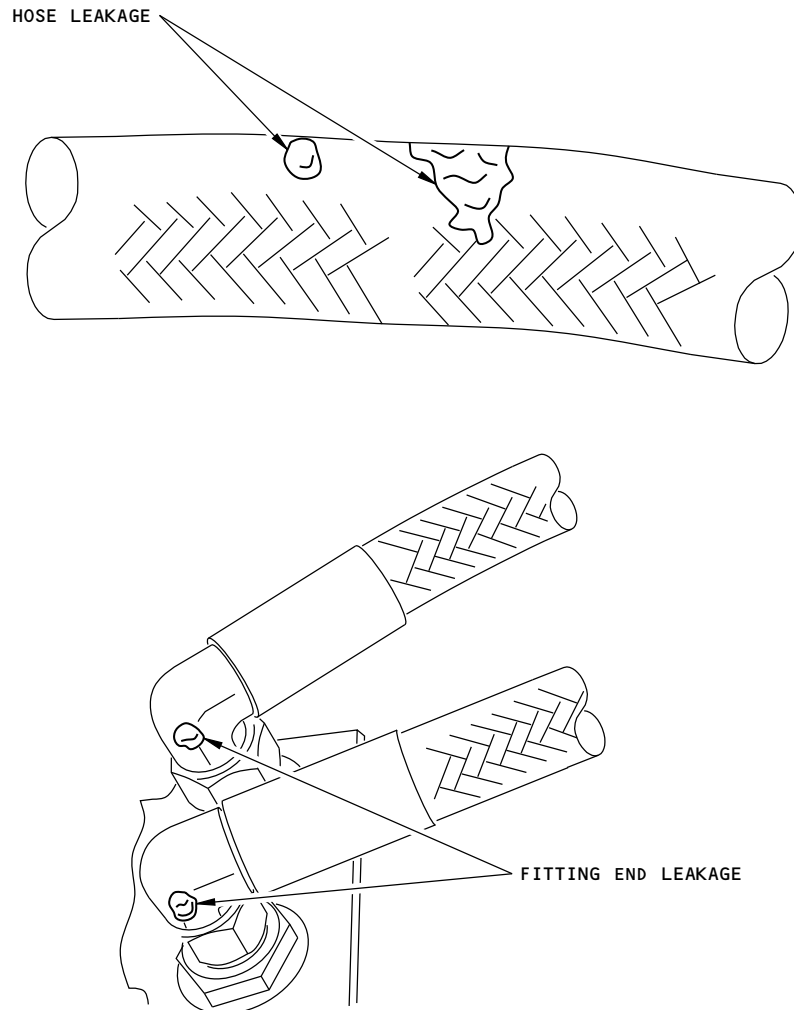
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EXAMPLES OF HYDRAULIC LEAKAGE FROM KEVLAR HOSES

2324582 S0000527210_V1

Kevlar Hose Damage and Leakage Maintenance Practices
Figure 201/20-10-10-990-810 (Sheet 1 of 2)

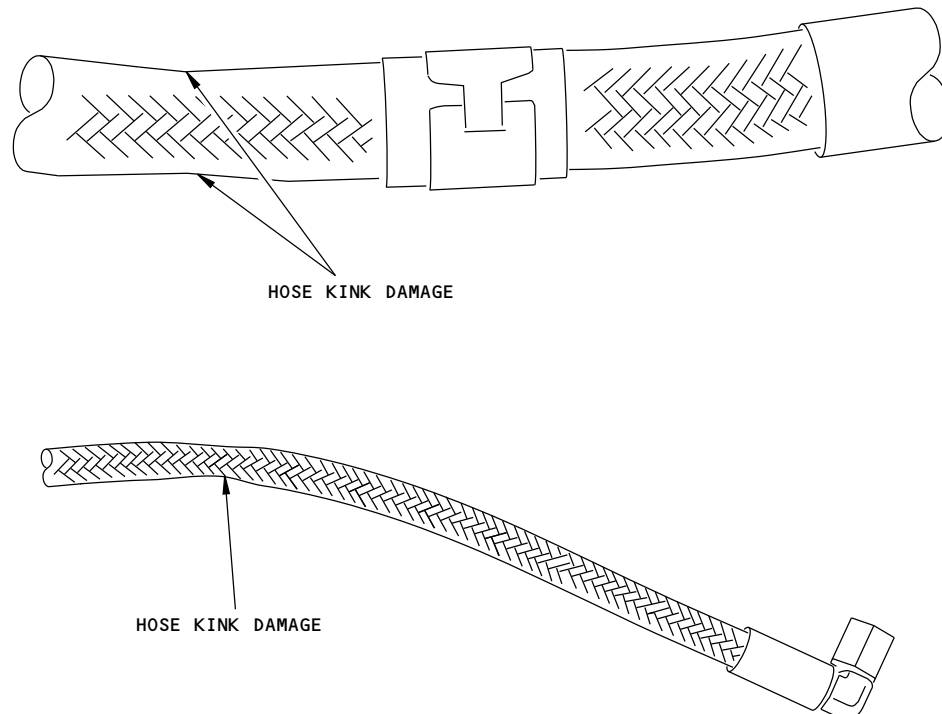
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EXAMPLES OF KINK DAMAGE TO KEVLAR HOSES

2324594 S0000527211_V1

Kevlar Hose Damage and Leakage Maintenance Practices
Figure 201/20-10-10-990-810 (Sheet 2 of 2)

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TASK 20-10-10-211-802

3. CRES Hydraulic Hose - Examination

A. General

- (1) CRES hydraulic hoses can also be referred to as "Teflon Hoses".
- (2) Teflon hoses are not subject to aging. The design objective for teflon hoses is that they are not life limited.
- (3) Teflon is inert to contaminants found in aircraft applications. However, corrosive contaminants on a hose, particularly chlorine compounds, have resulted in corrosion pitting of the CRES wire braiding. Corrosion pitting of CRES hydraulic tubing has also been found in wheel wells and other areas. Periodic cleaning with a Boeing recommended cleaning solution (AIRPLANE CLEANING AND POLISHING - SERVICING, PAGEBLOCK 12-25-01/301) along with coating of the hoses with corrosion preventative compound or equivalent could be beneficial.
- (4) Hose leakage and failure can be caused by:
 - (a) External damage that can cause a fatigue crack in the inner teflon tube.
 - (b) Vibration as a result of incorrect support.
 - (c) Preload induced in the hose during installation that will result in a fatigue related failure of the hose.

B. References

Reference	Title
12-25-01 P/B 301	AIRPLANE CLEANING AND POLISHING - SERVICING
20-10-10 P/B 401	FLEXIBLE HOSE - REMOVAL/INSTALLATION

C. CRES Hydraulic Hose Examination

SUBTASK 20-10-10-211-003

- (1) CRES hoses should be examined for the conditions that follow.
 - (a) Kinks.
 - (b) Twisting.
 - (c) Chafing.
 - (d) Corrosion.
 - (e) Broken wires.
 - (f) Leakage.
 - (g) Missing/incorrect support.
 - (h) Bird-caging
- (2) Hoses that are found to be damaged should be replaced and the condition that caused the damage should be corrected.
 - (a) To replace the hose use the procedure: FLEXIBLE HOSE - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-10/401.
- (3) Replace hoses if two or more wires in one plait are broken, or if several wires are broken in the same area. [See Figure 202.]
 - (a) Broken wires can be found by careful visual inspection and/or carefully running a soft cloth over the outside of the hose.
 - (b) To replace the hose use the procedure: FLEXIBLE HOSE - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-10/401.

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- (4) Special attention should be given to inspecting the sleeve and wire braid for damage at the hose end (hose-to-fitting transition). .
 - (a) Replace hoses that have damaged fire sleeves (installed in high temperature areas) using procedure: FLEXIBLE HOSE - REMOVAL/INSTALLATION, PAGEBLOCK 20-10-10/401.
- (5) Do a detailed visual inspection of the hose for bird-caging. [See Figure 203]

NOTE: Bird-caging is a failure condition where the metal braiding is extended to a diameter more than the outer diameter of the braid ring.

- (a) If bird-caging is found in the hose assembly, replace the tube.

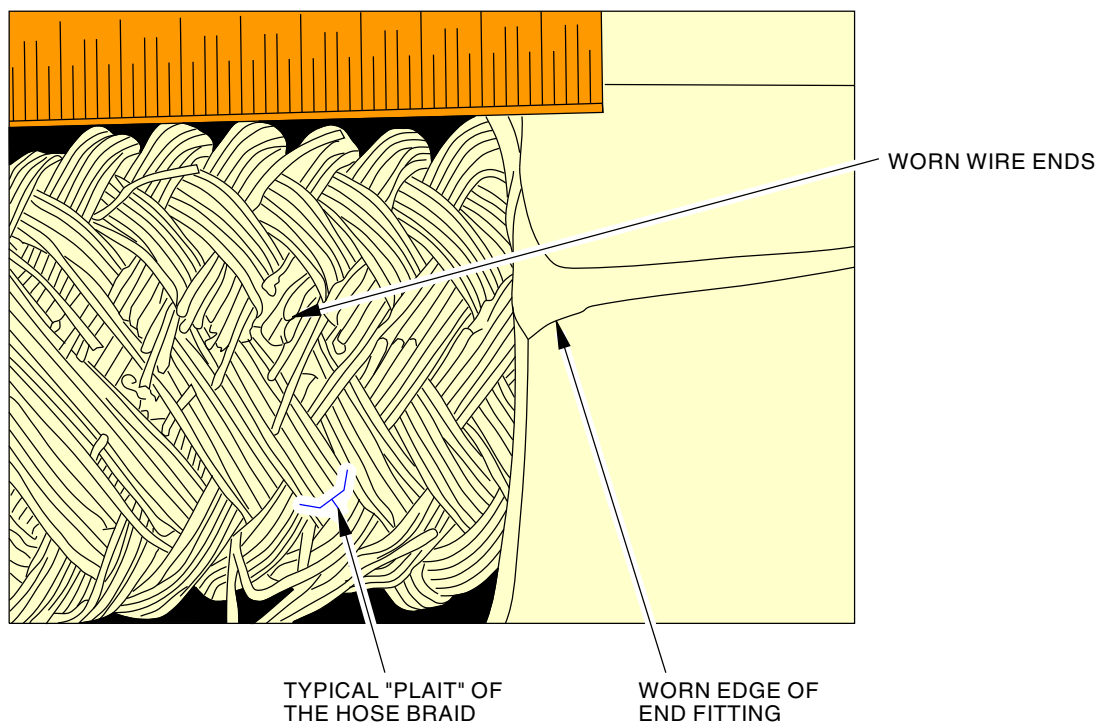
———— **END OF TASK** ————

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CRES BRAIDED HOSE DAMAGE

NOTE:

EXAMPLE OF DAMAGED/FRACTURED WIRES IN HOSE SUPPORT BRAID AT ONE END OF A RUPTURED HOSE CAUSED BY CHAFING AND TWISTING OF THE HOSE IN SERVICE.

2324213 S0000527021_V2

**Hose Leakage Identification
Figure 202/20-10-10-990-813**

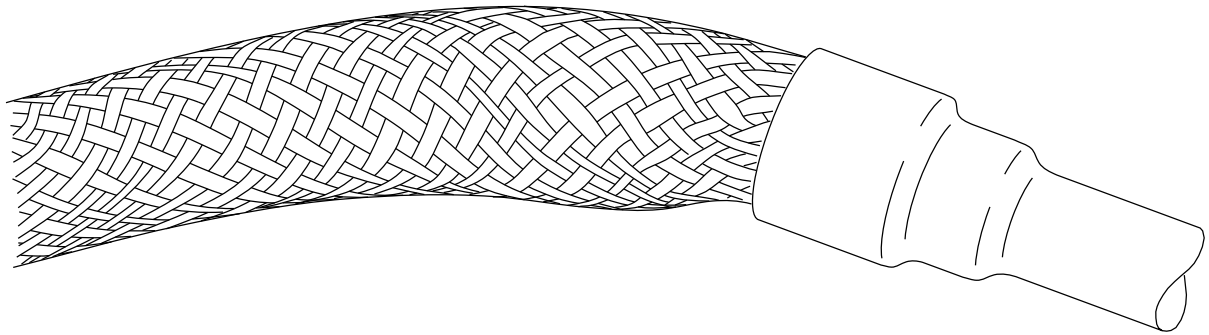
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EXAMPLE OF BIRD-CAGING

2020925 S0000401446_V1

Hose Wear
Figure 203/20-10-10-990-812

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TASK 20-10-10-800-801

4. Spiral sleeving - Installation

A. General

- (1) This task gives the procedure to install spiral sleeving on hydraulic tubes and hoses.
- (2) Teflon or Nylon spiral cut sleeving can be used on hose assemblies or tube assemblies. The approved sleeving material is in Table 201 below.

Table 201/20-10-10-993-801

NAME	SPECIFICATION	RECOMMENDED MATERIALS
Nylon Sleeving	AS1294	Spirap 500036
		Spirap 500037
		V00779
		V05593
Teflon Sleeving		Spirap 500024
		V00779
		V05593
		V09106

- (3) The use of self-fusing silicone tape to secure the ends of the spiral cut sleeving that is installed around the hose or tube should only be used as a temporary repair if heat shrink tubing is not immediately available.

B. Install the Spiral Sleeving

SUBTASK 20-10-10-420-005

- (1) Wrap the spiral cut sleeving around the hose or tube.
 - (a) Make sure that each end of the sleeving is no closer than 0.5 in. (12.7 mm) from the end fitting.
 - (b) Cut the spiral sleeving ends perpendicular to the lead of the coil or the longitudinal axis of the coil.

NOTE: This is to avoid sharp edges.

- 1) Make sure to break any sharp corners at the cut.

SUBTASK 20-10-10-420-006

- (2) Secure the ends of the spiral cut sleeving.
 - (a) If it is available, use heat shrink tubing to secure both ends.
 - 1) See Table 202 below for approved heat shrinkable material.

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Table 202/20-10-10-993-803

NAME	SPECIFICATION	RECOMMENDED MATERIALS
Heat Shrinkable Sleeving	MIL-I-23053	*[1]
	MIL-R-46846	*[1]
		Raychem RT850 (V06090) Raychem RT876 (V06090) Raychem MIL-LT (V06090) Plastronic PLF100 (V00Q87) Raychem RNF100 (V06090)

*[1] Refer to the applicable Qualified Parts List, or equivalent list, of the specification listed for approved material part numbers and vendors.

- (b) If heat shrink tubing is not available, use self-fusing silicone tape until heat shrink tubing is available to use.

NOTE: Boeing recommends that the operator uses self-fusing silicone tape only as a temporary repair.

- 1) Use self-fusing silicone tape and tie wraps to secure the sleeving.
a) See Table 203 below for allowable silicone tape material.

Table 203/20-10-10-993-802

NAME	SPECIFICATION	RECOMMENDED MATERIALS
Silicone Tape		Permacel 2650, V99742
		Scotch 70, V76381

———— **END OF TASK** ————

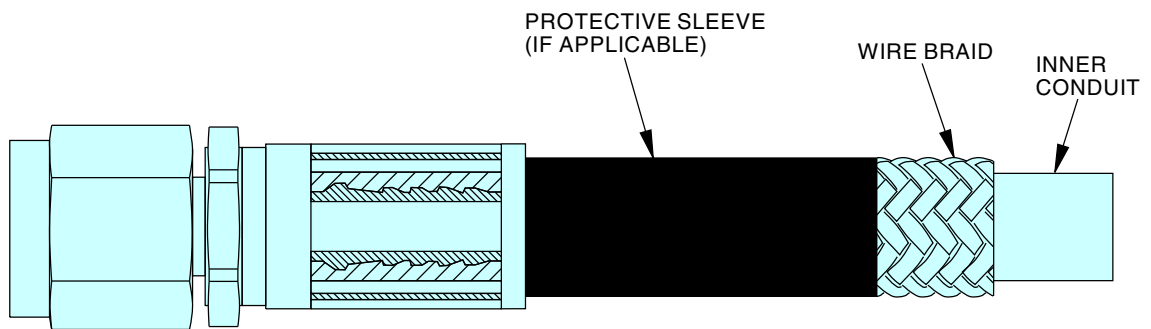
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CRES Spiral Sleeving
Figure 204/20-10-10-990-804

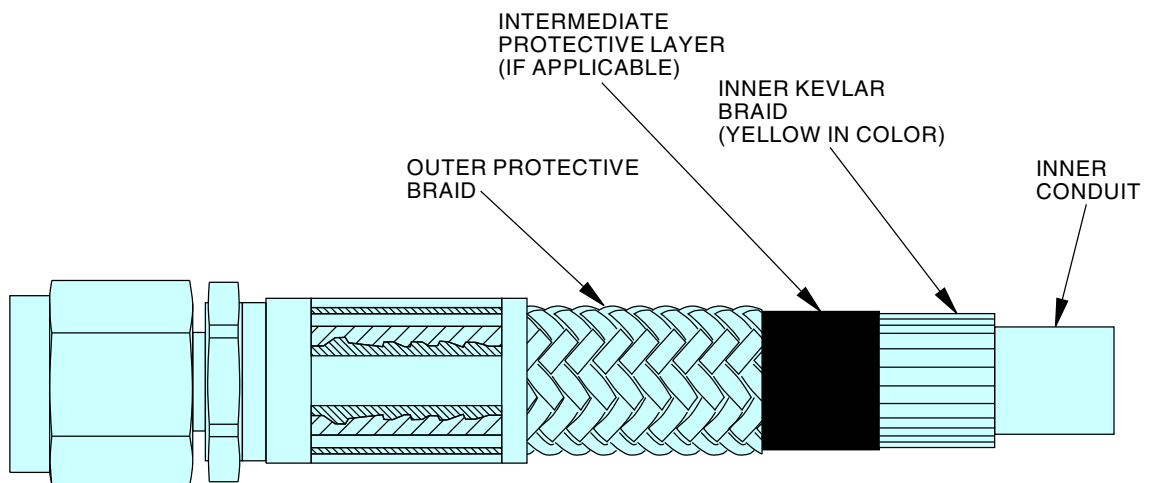
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1971081 S0000377092_V2

Kevlar Spiral Sleeveing
Figure 205/20-10-10-990-805

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TASK 20-10-10-400-802

5. Protective Lacing - Installation

A. Consumable Materials

Reference	Description	Specification
A00027	Adhesive - Silicone Rubber, 1 Part, RTV	BAC5010 Type 60
G00057	Tape - PTFE Flim With Acrylic Adhesive, 3M 63 Tape	
G02503	Lacing - Varflex Nylon Untreated Sleeveing, 1/8 Inch I.D. (Ref P/N 65-96194-1)	A-A-59301

B. Procedure - Install the Protective Lacing

SUBTASK 20-10-10-420-007

- (1) Install the protective Varflex lacing sleeve, G02503, as shown in (Figure 206), steps 1 through 3, except nose landing gear.

SUBTASK 20-10-10-420-008

- (2) Install the protective Varflex lacing sleeve, G02503, on nose landing gear as shown in (Figure 206), steps 1 through 3.
 - (a) Prior to pulling lock lace through, (before step 3), apply adhesive, A00027, to laces.
 - (b) Pull the laces into place, (step 3), this will bond the laces in place.
 - (c) Apply two layers of 3M 63 tape, G00057, over lacing.
 - 1) Spirally wrap each layer with a 50% overlap and reverse the direction of the spiral with each layer.
 - 2) Extend the tape 1.0 in. (25.4 mm) to 1.5 in. (38.1 mm) beyond each end of the lacing.

———— **END OF TASK** ————

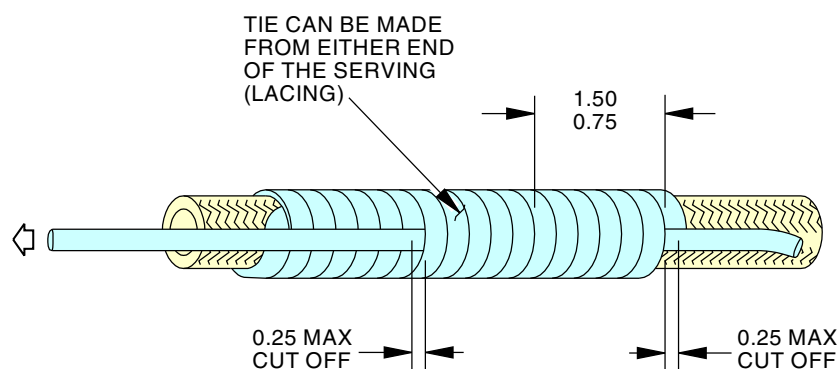
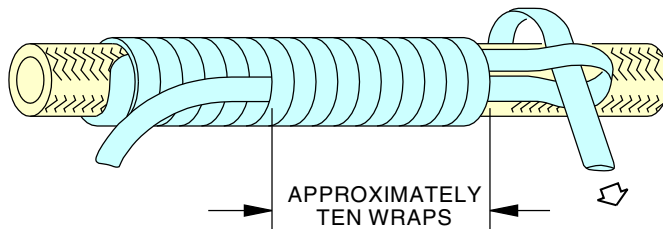
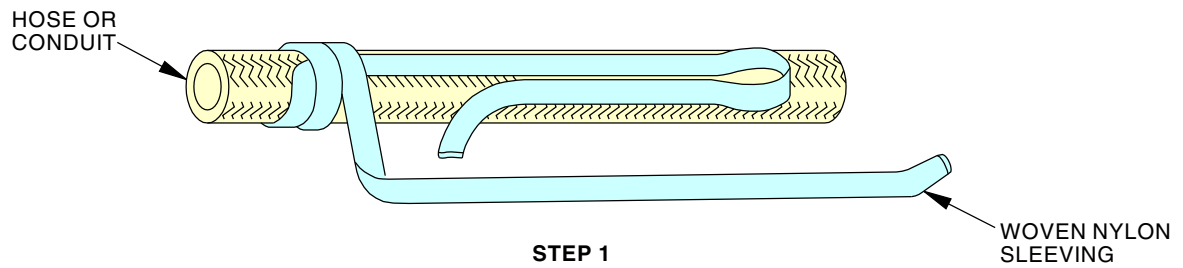
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NOTE:
ALL DIMENSIONS ARE IN INCHES.

FOR TWO OR MORE HOSES

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Protective Lacing Installation
Figure 206/20-10-10-990-806

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TASK 20-10-10-910-801

6. Correct Torque Value Determination for a Hydraulic Hose Assembly

A. General

- (1) This task will help determine the correct torque value for Hydraulic Hose Assembly. For further information, please refer to Service Letter per model (see Table 204).

Table 204/20-10-10-993-810 Service Letter for All Models

Models
737-SL-29-118
747-SL-29-077
757-SL-29-053
767-SL-29-066
777-SL-29-040

B. References

Reference	Title
20-10-09-993-908	Table: Hydraulic Fitting Material Codes (P/B 201)

C. Procedure

SUBTASK 20-10-10-200-002

- (1) Evaluate the hose part number to verify the fitting end sizes and materials on the hose. See example namesplates Table 205, Table 206, Table 207 and Figure 207 for additional data.

Table 205/20-10-10-993-806 Example Hose Definition 1: Hydraulic Hose P/N BACH8A04EN0294K

Breakdown	Definition
BACH8A	Basic Hose Part Number (P/N)
04	Hose size (04 = 0.250 Inch Dia.)
EN	Fitting End Size "E" = Expander End No. 1 — 06 (0.375 inch) "N" = Nominal End No. 2 — 04 (0.250 inch) Note: an "R" code letter appearing here = Reducer
029	Length in Whole Inches 029 X 1.0 = 29.0 Inches
4	Fractional Length in Eighths of an Inch Increments 4 X 0.125 = 0.500
K	Braided Polyester Abrasion Sleeve (Blue Color)

NOTE: Basic hose P/N, BACH8A, defines a 3,000 PSI operating pressure, PTFE inner tube with corrosion resistant Steel (CRES) wire braid reinforcement, lightweight Hydraulic hose with straight flareless CRES end fittings.

Table 206/20-10-10-993-807 Example Hose Definition 2: Hydraulic Hose P/N AS115-06K0344

Breakdown	Definition
AS115	Basic Hose Part Number (P/N)
06	Hose Size (06 = 0.375 Inch Dia.)
K	Integral Braided Polyester Abrasion Sleeve (Blue Color)

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Table 206/20-10-10-993-807 Example Hose Definition 2: Hydraulic Hose P/N AS115-06K0344
(Continued)

Breakdown	Definition
034	Length in Whole Inches 034 X 1.0 = 34.0 Inches
4	Fractional Length in Eighths of an Inch Increments 4 X 0.125 = 0.500 Inch

NOTE: Basic hose P/N, AS115, defines a 3,000 PSI operating pressure, PTFE inner tube with corrosion resistant Steel (CRES) wire braid reinforcement, lightweight hydraulic hose with straight flareless CRES end fittings.

Table 207/20-10-10-993-808 Example Hose Definition 3: "Para-Aramid" Reinforced Hydraulic Hose P/N AS4568G0344SS

Breakdown	Definition
AS4568	Basic Hose Part Number (P/N)
G	Hose Size (G = 0.375 Inch)
-	Sleeve Code, (-) = No Sleeve
034	Length in Whole Inches, 034 X 1.0 = 34.0 Inches
4	Fractional Length in Eighths of an Inch Increments 4 x 0.125 = 0.500 Inch
S	1st Straight Fitting End (Hose Size)
S	2nd Straight Fitting End (Hose Size)

NOTE: Basic hose P/N, AS4568, defines a 3,000 PSI operating pressure, PTFE inner tube with "Para-Aramid" braid reinforcement, lightweight hydraulic hose with straight flareless titanium end fittings, reduce/expander options available.

SUBTASK 20-10-10-200-003

- (2) Use the Illustration Parts Catalog (IPC) to determine the materials of the parts that you will attach the hose ends to.

NOTE: A mating fitting made from aluminum material requires lower torque value than a titanium or CRES fitting.

NOTE: Components that are attached to hose ends usually have flareless union fittings installed to the external ports. See Table 20-10-09-993-908 to identify hydraulic fitting materials.

SUBTASK 20-10-10-910-001

- (3) Select and apply the correct torque values. Use Table 208 to locate the correct torque values per model:

Table 208/20-10-10-993-809 Installation Torque for Flareless Tubing Fitting Table for All Models

Models	Location in AMM
737-300/400/500	20-50-11/201
737-600/700/800/900	20-50-11/201
747-400	20-51-01/201
747-8	20-51-01/201
757	20-11-00/201
767	20-11-00/201

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**Table 208/20-10-10-993-809 Installation Torque for Flareless Tubing Fitting Table for All Models
(Continued)**

Models	Location in AMM
777	20-11-00/201

———— **END OF TASK** ————

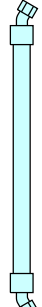
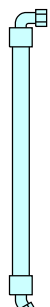
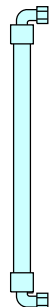
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HYDRAULIC HOSE IDENTIFICATION						
HOSE CONFIGURATION AND USAGE	ILLUSTRATION	PART NUMBER	HOSE SIZES	END SIZES (NON-REDUCER - SAME AS HOSE SIZE)	MATERIAL AND RATING DATA	
					HOSE BRAID MATERIAL/END FITTING MATERIAL	PRESSURE RATING
STRAIGHT-TO-STRAIGHT, NON-REDUCER		AS115	04 THROUGH 16	04 THROUGH 16	CRES/CRES	3,000 PSI
STRAIGHT-TO-45 DEGREE, NON-REDUCER		AS116	04 THROUGH 16	04 THROUGH 16	CRES/CRES	3,000 PSI
STRAIGHT-TO-90 DEGREE, NON-REDUCER		AS117	04 THROUGH 16	04 THROUGH 16	CRES/CRES	3,000 PSI
45 DEGREE-TO-45 DEGREE, NON-REDUCER		AS118	04 THROUGH 16	04 THROUGH 16	CRES/CRES	3,000 PSI
45 DEGREE-TO-90 DEGREE, NON-REDUCER		AS119	04 THROUGH 16	04 THROUGH 16	CRES/CRES	3,000 PSI
90 DEGREE-TO-90 DEGREE, NON-REDUCER		AS120	04 THROUGH 16	04 THROUGH 16	CRES/CRES	3,000 PSI
EXAMPLE OF PART NUMBER: AS115 08 K 024 2 BASIC P/N HOSE SIZE (08) FRACTION OF HOSE LENGTH IN EIGHTHS OF AN INCH (0.25 INCH) HOSE LENGTH IN WHOLE INCHES K = INTEGRAL BLUE POLYESTER ABRASION SLEEVE BOEING APPROVED SLEEVE CODES: " " = NO SLEEVING B = NYLON ABRASION SLEEVE F = POLYOLEFIN ABRASION H = INTEGRAL SILICONE FIRESLEEVE (15 MINUTE) K = INTEGRAL BLUE POLYESTER ABRASION SLEEVE L = COIL ABRASION SLEEVE PROCUREMENT SPECIFICATION IS AS1339.						

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

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Hydraulic Hose Identification
Figure 207/20-10-10-990-809 (Sheet 1 of 6)

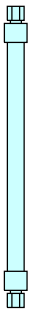
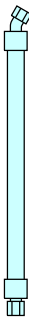
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HYDRAULIC HOSE IDENTIFICATION (CONTINUED)					
HOSE CONFIGURATION AND USAGE	ILLUSTRATION	PART NUMBER	HOSE SIZES	END SIZES (NON-REDUCER - SAME AS HOSE SIZE)	MATERIAL AND RATING DATA HOSE BRAID MATERIAL/END FITTING MATERIAL PRESSURE RATING
STRAIGHT-TO-STRAIGHT, EXPANDER-REDUCER		BACH8A	04 THROUGH 12	04 THROUGH 16	CRES/CRES 3,000 PSI
STRAIGHT-TO-45 DEGREE, EXPANDER-REDUCER		BACH8B	04 THROUGH 12	04 THROUGH 16	CRES/CRES 3,000 PSI
STRAIGHT-TO-90 DEGREE, EXPANDER-REDUCER		BACH8C	04 THROUGH 12	04 THROUGH 16	CRES/CRES 3,000 PSI
EXAMPLE OF PART NUMBER: BACH8A08ER0204B BASIC P/N HOSE SIZE (08) (SEE STANDARD) FITTING ENDS (SEE STANDARD): NO. 1 END - SIZE 10, STRAIGHT NO. 2 END - SIZE 06, STRAIGHT E = EXPANDER N = NORMAL (SAME AS HOSE SIZE) R = REDUCER B = BLUE POLYESTER ABRASION SLEEVE FRACTION OF HOSE LENGTH IN EIGHTHS OF AN INCH (0.5 INCH) HOSE LENGTH IN WHOLE INCHES BOEING APPROVED SLEEVE CODES: " " = NO SLEEVING B = NYLON ABRASION SLEEVE F = POLYOLEFIN ABRASION (15 MINUTE) K = INTEGRAL BLUE POLYESTER ABRASION SLEEVE L = COIL ABRASION SLEEVE PROCUREMENT SPECIFICATION IS AS1339.					

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2331321 S0000527959_V2

Hydraulic Hose Identification
Figure 207/20-10-10-990-809 (Sheet 2 of 6)

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NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.

2331963 S0000527960 V2

Hydraulic Hose Identification
Figure 207/20-10-10-990-809 (Sheet 3 of 6)

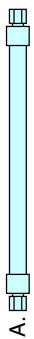
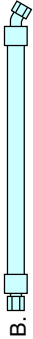
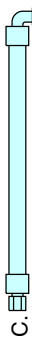
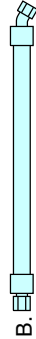
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HYDRAULIC HOSE IDENTIFICATION (CONTINUED)							
HOSE CONFIGURATION AND USAGE	ILLUSTRATION	PART NUMBER	HOSE SIZE	MINIMUM END SIZE	MAXIMUM END SIZE	MATERIAL AND RATING DATA	
						HOSE BRAID MATERIAL/END FITTING MATERIAL	PRESSURE RATING
A. STRAIGHT-TO-STRAIGHT, EXPANDER/REDUCER		BACH5M	04	04	06	CRES/304 CRES OR ALUM*	1,500 PSI
B. STRAIGHT-TO-45 DEGREE, EXPANDER/REDUCER		BACH5P	06	04	08	CRES/304 CRES OR ALUM*	1,500 PSI
C. STRAIGHT-TO-90 DEGREE, EXPANDER/REDUCER		BACH5R	08	06	10	CRES/304 CRES OR ALUM*	1,500 PSI
*NOTE: SEE BOEING STANDARD BACH5MTHRUH5X.							
A. STRAIGHT-TO-STRAIGHT, EXPANDER/REDUCER		BACH5T	12	10	16	CRES/304 CRES OR ALUM*	1,000 PSI
B. STRAIGHT-TO-45 DEGREE, EXPANDER/REDUCER		BACH5V	16	12	20	CRES/304 CRES OR ALUM*	1,000 PSI
C. STRAIGHT-TO-90 DEGREE, EXPANDER/REDUCER		BACH5W	20	16	20	CRES/304 CRES OR ALUM*	1,000 PSI
*NOTE: SEE BOEING STANDARD BACH5MTHRUH5X.							
EXAMPLE OF PART NUMBER: BACH5 P040 6 AT T			L SUFFIX = COUPLING NUTS DRILLED FOR LOCKWIRE BOEING APPROVED SLEEVE CODES: BLANK = NONE F = FIRE SLEEVE S = SPIRAL WRAP POLYAMIDE OR TEFLON ABRASION SLEEVE T = TUBULAR TEFLON ABRASION SLEEVE P = TUBULAR POLYOLEFIN ABRASION SLEEVE CONSULT BOEING STANDARD BACH5MTHRUH5X FOR TABLE SHOWING END FITTING SIZE COMBINATIONS; PROCUREMENT SPECIFICATION IS AS1946				
BASIC P/N							
HOSE SIZE (06)							
HOSE LENGTH IN WHOLE INCHES							

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.
2332071 S0000527961_V2

Hydraulic Hose Identification
Figure 207/20-10-10-990-809 (Sheet 4 of 6)

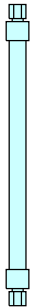
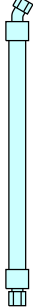
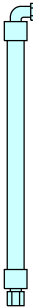
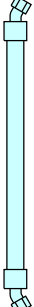
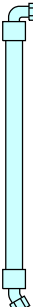
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HYDRAULIC HOSE IDENTIFICATION (CONTINUED)							
HOSE CONFIGURATION AND USAGE	ILLUSTRATION	PART NUMBER	HOSE SIZE	MINIMUM END SIZE	MAXIMUM END SIZE	MATERIAL AND RATING DATA	
						HOSE BRAID MATERIAL/END FITTING MATERIAL	PRESSURE RATING
STRAIGHT-TO-STRAIGHT, NON-REDUCER		AS1633	04 THROUGH 24	04	24	CRES/CRES	1,000 PSI (SIZES 04 THROUGH 20, 750 PSI (SIZE 24)
STRAIGHT-TO-45 DEGREE, NON-REDUCER		AS1634	04 THROUGH 24	04	24	CRES/CRES	1,000 PSI (SIZES 04 THROUGH 20, 750 PSI (SIZE 24)
STRAIGHT-TO-90 DEGREE, NON-REDUCER		AS1635	04 THROUGH 24	04	24	CRES/CRES	1,000 PSI (SIZES 04 THROUGH 20, 750 PSI (SIZE 24)
45 DEGREE-TO-45 DEGREE, NON-REDUCER		AS1636	04 THROUGH 24	04	24	CRES/CRES	1,000 PSI (SIZES 04 THROUGH 20, 750 PSI (SIZE 24)
45 DEGREE-TO-90 DEGREE, NON-REDUCER		AS1637	04 THROUGH 24	04	24	CRES/CRES	1,000 PSI (SIZES 04 THROUGH 20, 750 PSI (SIZE 24)
90 DEGREE-TO-90 DEGREE, NON-REDUCER		AS1638	04 THROUGH 24	04	24	CRES/CRES	1,000 PSI (SIZES 04 THROUGH 20, 750 PSI (SIZE 24)
EXAMPLE OF PART NUMBER: AS1638 H 24 2 H 270 A BASIC P/N — HOSE SIZE (08) — ANGULAR ORIENTATION OF END FITTINGS IN 1 DEGREE INCREMENTS (270 DEGREES) — H = INTEGRAL FIRESLEEVE — FRACTION OF HOSE LENGTH IN EIGHTHS OF AN INCH (0.25 INCH)			HOSE CLASS CODE (A = CLASS 1, B = CLASS 2)		AS1634, AS1635, AS1636, AS1637, AS1638 HOSE SIZE INFORMATION: E = SIZE 04 G = SIZE 06 H = SIZE 08 J = SIZE 10 K = SIZE 12 M = SIZE 16 N = SIZE 20 P = SIZE 24 BOEING APPROVED SLEEVE CODES: B = SPIRAL ABRASION SLEEVE H = INTEGRAL FIRE SLEEVE K = INTEGRAL BLUE POLYESTER ABRASION SLEEVE PROCUREMENT SPECIFICATION IS AS1633; HOSE FITTING PER AS620.		

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSSION DATA.

2332206 S0000527962_V2

Hydraulic Hose Identification
Figure 207/20-10-10-990-809 (Sheet 5 of 6)

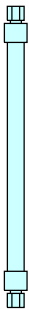
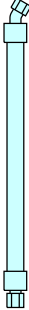
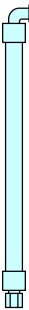
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HYDRAULIC HOSE IDENTIFICATION (CONTINUED)						
HOSE CONFIGURATION AND USAGE	ILLUSTRATION	PART NUMBER	HOSE SIZE	MINIMUM END SIZE	MAXIMUM END SIZE	MATERIAL AND RATING DATA
						HOSE BRAID MATERIAL/END FITTING MATERIAL PRESSURE RATING
STRAIGHT-TO-STRAIGHT, REDUCER/EXPANDER, KEVLAR (767/777 ONLY)		AS4568	04 THRU 24	04	20	KEVLAR (NON-METALLIC)/ CRES OR TITANIUM 3,000 PSI
STRAIGHT-TO-45 DEGREE, REDUCER/EXPANDER, KEVLAR (767/777 ONLY)		AS4569	04 THRU 24	04	20	KEVLAR (NON-METALLIC)/ CRES OR TITANIUM 3,000 PSI
STRAIGHT-TO-90 DEGREE, REDUCER/EXPANDER, KEVLAR (767/777 ONLY)		AS4570	04 THRU 24	04	20	KEVLAR (NON-METALLIC)/ CRES OR TITANIUM 3,000 PSI
EXAMPLE OF PART NUMBER: AS4568 H C 028 2 S E BASIC P/N HOSE SIZE (08) C = POLYOLEFIN SHRINK SLEEVE E = EXPANDER R = REDUCER S = HOSE SIZE 2ND STRAIGHT FITTING (EXPANDER = SIZE 10) 1ST STRAIGHT FITTING (S = HOSE SIZE = SIZE 08) FRACTION OF HOSE LENGTH IN EIGHTHS OF AN INCH (0.25 INCH) HOSE LENGTH IN WHOLE INCHES AS4568, AS4569, AS4570 HOSE SIZE INFORMATION: E = SIZE 04 G = SIZE 06 H = SIZE 08 J = SIZE 10 K = SIZE 12 M = SIZE 16 N = SIZE 20 P = SIZE 24 BOEING APPROVED SLEEVE CODES: BLANK = NONE C = POLYOLEFIN SHRINK ABRASION SLEEVE CONSULT AS4568 STANDARD FOR TABLE SHOWING END FITTING SIZE COMBINATIONS. PROCUREMENT SPECIFICATION IS AS1975.						

NOTE:

NOT KEPT UP TO DATE - ALWAYS CONSULT LATEST REVISION OF FITTING STANDARD FOR P/N AND SUPERSESSION DATA.
2332229 S0000527963_V2

Hydraulic Hose Identification
Figure 207/20-10-10-990-809 (Sheet 6 of 6)

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FLEXIBLE HOSE - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the flexible hose.
 - (2) An installation of the flexible hose.
- B. This procedure gives general instructions for the installation of flexible hoses. If there is a special procedure for a specified system, use the special procedure.
- C. Flexible hoses do not have a specified life limit. Inspect flexible hoses to the applicable operators standard.
- D. Before you do maintenance on oxygen system flexible hoses, refer to safety precautions and general maintenance instructions in AMM Chapter 35.

TASK 20-10-10-000-801

2. Flexible Hose Removal

(Figure 401)

A. Procedure



USE CARE IN HANDLING KEVLAR HOSES TO AVOID KINKING. DO NOT ALLOW PUMPS, VALVES, ACTUATORS OR OTHER COMPONENTS TO HANG FROM HOSES. DISCONNECT HOSES AT BOTH ENDS AND REMOVE IF NECESSARY TO PROVIDE ACCESS. REPLACE HOSES WHICH HAVE BEEN KINKED.

SUBTASK 20-10-10-480-001



PUT CAPS ON THE HOSES AND FITTINGS. UNWANTED MATERIAL CAN CAUSE CONTAMINATION OF HOSES, DAMAGE TO SYSTEM COMPONENTS, AND LEAKAGE OF FLUID. SOME FLUID CAN CAUSE CORROSION OR OTHER DAMAGE.

- (1) Install caps on the hose assemblies and mating connections.

NOTE: Caps keep out moisture and unwanted material until the hose is again connected to its system.

SUBTASK 20-10-10-020-001

- (2) Remove the flexible hose.

————— **END OF TASK** —————

TASK 20-10-10-400-801

3. Flexible Hose Installation

(Figure 401)

A. References

Reference	Title
20-11-00-910-801	Standard Torque Values (P/B 201)

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B. Procedure



USE CARE IN HANDLING KEVLAR HOSES TO AVOID KINKING. DO NOT ALLOW PUMPS, VALVES, ACTUATORS OR OTHER COMPONENTS TO HANG FROM HOSES. DISCONNECT HOSES AT BOTH ENDS AND REMOVE IF NECESSARY TO PROVIDE ACCESS. REPLACE HOSES WHICH HAVE BEEN KINKED.

SUBTASK 20-10-10-211-001

- (1) Prior to hose installation do a visual check of the hose assembly to determine its condition.
 - (a) Look at the hose, fittings, sealing surfaces and outer covering for damage.
 - (b) Do the following if you find broken wires in the outer covering:
 - 1) Put a tag on the hoses that have isolated or random broken wires.

NOTE: This is to identify the hose for future inspections.
 - 2) Do not use the hose if two or more wires in one plait are broken, or if several wires are broken in a concentrated area.

SUBTASK 20-10-10-210-001

- (2) Make sure all the fittings are clean and free of defects.

SUBTASK 20-10-10-640-001

- (3) Lubricate the external threads as necessary with the correct lubricant.

SUBTASK 20-10-10-420-001

- (4) Put the hose in position and tighten the fitting by hand.

SUBTASK 20-10-10-420-002

- (5) Install the clamps and adjust the slack.

SUBTASK 20-10-10-210-002

- (6) Examine the installation for the correct alignment and length.

SUBTASK 20-10-10-420-003



USE THE INDEX LINE ON THE SIDE OF THE HOSE TO MAKE SURE THE HOSE IS NOT TWISTED. IF THE HOSE IS TWISTED, HOSE FAILURE OR HOSE COUPLING LEAKAGE CAN OCCUR.

- (7) Tighten the B-nut to the correct torque (Standard Torque Values, TASK 20-11-00-910-801).

SUBTASK 20-10-10-420-004

- (8) Tighten the coupling-type ends (Standard Torque Values, TASK 20-11-00-910-801).

NOTE: Use two wrenches, one on each end, to prevent twisted flexible tubing.

————— **END OF TASK** —————

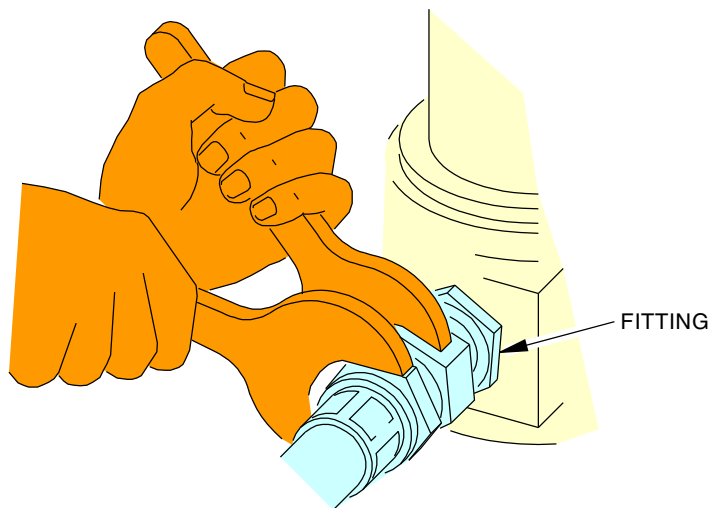
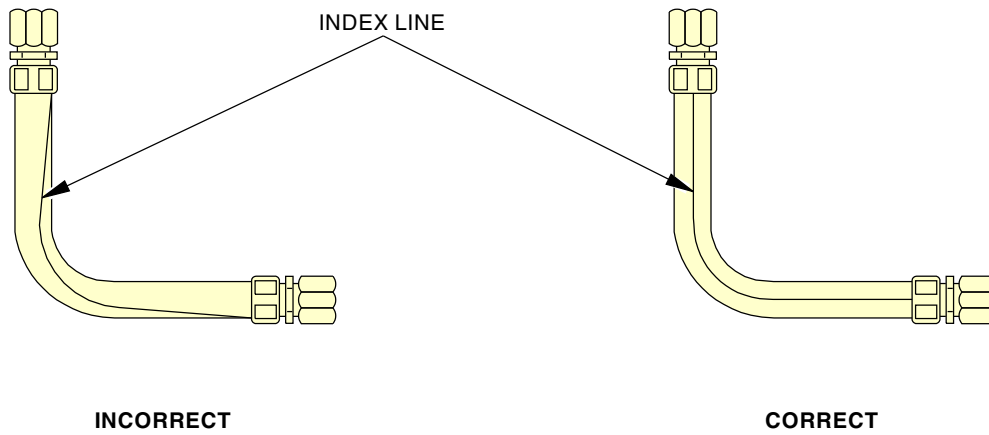
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Flexible Hose Installation
Figure 401/20-10-10-990-801

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FLEXIBLE HOSE - REPAIR

TASK 20-10-10-300-801

1. Temporary Repair of Flexible Hydraulic Hoses

A. General

- (1) This procedure is for the temporary repair of flexible hydraulic hoses with a different flexible hose.
 - (a) It is to the discretion of the operator to determine whether this procedure is applicable to their operations.
- (2) The Boeing Company recommends that the operator do these procedures:
 - (a) Make a record of the flexible hoses that you install as temporary repairs for flexible lines.
 - (b) Make a schedule for the regular inspection of flexible hose installations. Make sure that the installation stays an airworthy repair until the system is put back to its original configuration.
 - (c) Make a procedure to make sure that the flexible hoses that are installed as temporary repairs are replaced as soon as possible. You must replace the hoses no later than the scheduled time check approved by the assigned principal maintenance inspector.
- (3) This procedure is not applicable for replacement of hydraulic hoses on the engines. In general, hydraulic hoses with damaged firesleeves must be replaced.
 - (a) Engine hydraulic hoses are hoses below or forward of the firewall and within the engine cowl.
- (4) Hoses in the hydraulic tubing repair kit, SPL-5276, or equivalent, can be used when temporarily replacing a damaged hydraulic hose with another hydraulic hose.

B. References

Reference	Title
29-11-00 P/B 201	MAIN (LEFT, RIGHT, AND CENTER) HYDRAULIC SYSTEMS - MAINTENANCE PRACTICES

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-5276	Repair Kit, Hydraulic Tubing (Temp. Repairs, operating pressures up to and including 3000 psi) (Approved for Titanium) Part #: 65-92528-1 Supplier: 81205 Part #: 65-92528-11 Supplier: 81205 Part #: 65-92528-4 Supplier: 81205 Part #: 65-92528-5 Supplier: 81205

D. Prepare to Install the Flexible Hose

SUBTASK 20-10-10-350-001

- (1) Choose a flexible hose to do the temporary repair.
 - (a) Choose a flexible hose that is qualified for at least the same operating pressure, temperature, and fluid type as the system in which you will install the flexible hose.
 - (b) Make sure that the new flexible has the same inner diameter (or a larger inner diameter) as the original flexible hose.

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- (c) Make sure that the end fitting sizes and configurations (such as straights, 45 degree bends, or 90 degree bends) on the replacement hose match those of the original flexible hose (Figure 801).
- 1) You can do expansion using one of the methods that follow.
 - a) Use a hose assembly with expander end fittings.
 - b) Use a non-expander replacement hose assembly and reconnectable fittings that have different size ends to make the transition.
 - (d) Make sure that the new flexible hose meets the installation requirements for the items that follow (Figure 802).
 - 1) Slack
 - a) Make sure that you do not install the flexible hose in a way that will cause a mechanical load on the hose.
NOTE: Hoses will change length from +2/-4 percent when pressurized.
 - 2) Flex
 - a) Make sure that there is slack between the rigid fittings where hose assemblies will be exposed to vibration or flexing.
 - b) Make sure that the hose is straight for at least two hose diameters from the end fittings.
NOTE: This will help make sure that the hose will not flex at the end fittings.
 - c) Make sure that you do not use clamps at locations that will stop the hose from flexing.
 - 3) Twisting
 - a) Make sure that you install the hoses without twists.
NOTE: This will help prevent loose nuts and rupture of the hoses.
<1> Use swivel fittings with positioning ends at one or two ends of the temporary replacement hose, if necessary (Figure 801).
NOTE: This will help to closely match the configuration of the original hose and will help relieve the twist stresses.
 - 4) Bending
 - a) Use elbow fittings, hoses with elbow type end fittings or the applicable end fittings, or the applicable bend radii shown in Table 801.
NOTE: This will help prevent sharp bends in the hose assembly.

Table 801/20-10-10-993-804

AS115 HOSE	HOSE INNER DIAMETER (INCH)	MINIMUM HOSE BEND RADIUS MEASURED AT INNER BEND (INCH)
-04	1/4	1.50
-06	3/8	2.50
-08	1/2	2.88
-10	5/8	3.25
-12	3/4	4.00

<1> Make sure to take into account the change in allowable minimum bend radii due to external sleeving.

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<a> For replacement with hoses that have "C" coded sleeves, multiply the minimum hose bend radii by 1.2 to calculate the minimum allowable bend radii (Figure 801).

5) Clearance

- a) Make sure that the hose assembly is clear of all other lines, equipment, and adjacent structure under all operating conditions.
- b) Make sure the hoses meet the minimum clearance requirements in Table 802.

Table 802/20-10-10-993-811 Minimum Hose Clearance

HOSE CLEARANCE TO	MINIMUM CLEARANCE INCHES (mm)
Control Cables and Linkages	1.0 in. (25.4 mm) ^{*[1]}
Cable at Pulleys	0.5 in. (12.7 mm)
Cable at Mid-Span	2.0 in. (50.8 mm)
Electrical Wiring	0.5 in. (12.7 mm)
Hydraulic Tubes or Hoses	0.2 in. (5.1 mm)

*[1] Measured at a relative position where the hose is closest to the cable or linkage.

6) Support

- a) Make sure that the hose assembly has supports at the same points as the original flexible hose (at a minimum).

NOTE: This will help prevent contact with the mating or adjacent parts due to relative motion.

<1> Size clamps as necessary.

NOTE: This will help to account for change in the hose diameter from the original flexible hose (due to extra sleeving, etc.).

E. Install the Flexible Hose

SUBTASK 20-10-10-860-001

- (1) Remove hydraulic pressure from the system on which you will do a repair (PAGEBLOCK 29-11-00/201).

SUBTASK 20-10-10-020-002

- (2) Remove the damaged hose.

SUBTASK 20-10-10-420-009

- (3) If you can replace all of the damaged hose with one flexible hose, install the new temporary flexible hose.

SUBTASK 20-10-10-420-010

- (4) If the damaged hose is too long to replace by one flexible hose, do the steps that follow.
 - (a) Use two or three shorter hoses to make the necessary length hose.
 - 1) Make sure that you do not use more than three shorter hoses to make the necessary length hose.
 - (b) Use a union or similar fitting as a splice between the shorter hoses.

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- (c) Make sure that the total length of the two or three shorter hoses and splice fittings is close to the length of the original, damaged hose.

NOTE: A total length that is too long will create kinks or bends in the hoses; a total length too short will create a tension load on the hoses.

- (d) Use the necessary installation torque on the mating hoses and splice fittings.
- 1) The torque is determined based on size and material of the splice fitting and hose end fittings.

NOTE: For example, when the materials of the two mating parts are dissimilar, select the torque value based on the lower-strength material.

SUBTASK 20-10-10-860-002

- (5) Supply hydraulic pressure to the system on which you did the temporary repair (PAGEBLOCK 29-11-00/201).

SUBTASK 20-10-10-200-001

- (6) Examine the temporary flexible hose repair and connections for leaks.

SUBTASK 20-10-10-720-001

- (7) Make sure that the temporary repair installation operates.
- (a) Do a functional test for the system on which the temporary repair was made, as necessary.
- 1) Make sure that there is clearance with the temporary repair hose.
- 2) Make sure that there is no interference through the range of hose operation.
- 3) Make sure that the temporary repair meets the requirements with the items that follow:
- a) Slack
- b) Flex
- c) Twisting
- d) Bending
- e) Clearance
- f) Support

———— **END OF TASK** ————

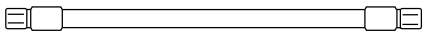
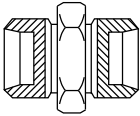
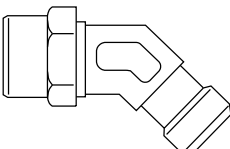
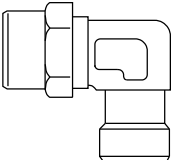
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FITTING TYPE	PART NUMBER	MATERIAL
HYDRAULIC HOSE 	AS115-(SIZE) (C) ¹ (LENGTH-INCHES) (FRACTIONAL LENGTH IN EIGHTHS OF AN INCH) ₂	
TUBE-TO-TUBE FLARELESS UNION 	MS21902V (SIZE) (P)	15-5PH CRES MATERIAL WITH CADMIUM PLATE FINISH
	MS21902 (SIZE) (T)	6AL-4V TITANIUM MATERIAL
FLARELESS SWIVEL TO MALE FLARELESS 45 DEGREE ELBOW 	BACE21BR (SWIVEL LEG SIZE) (MALE PORT LEG SIZE) (P)	15-5PH CRES WITH CADMIUM PLATE FINISH
	BACE21BR (SWIVEL LEG SIZE) (MALE PORT LEG SIZE) (T)	6AL-4V TITANIUM
FLARELESS SWIVEL TO MALE FLARELESS 90 DEGREE ELBOW 	BACE21BT (SWIVEL LEG SIZE) (MALE PORT SIZE) (P)	15-5PH CRES WITH CADMIUM PLATE FINISH
	BACE21BT (SWIVEL LEG SIZE) (MALE PORT SIZE) (T)	6AL-4V TITANIUM



1 CODE LETTER "C" REFERS TO 15 MINUTE FIRESLEEVE PER AS1072

2 TEMPORARY REPLACEMENT OF A DAMAGED HOSE MAY BE MADE USING HOSES OTHER THAN AS115. FOR EXAMPLE, HOSE COMBINATIONS WITH ONE 45 DEGREE ELBOW END FITTING (AS116) OR ONE 90 DEGREE ELBOW END FITTING (AS117), OR WITH A COMBINATION OF FITTING ENDS MORE SIMILAR TO THE DAMAGED HOSE MAY BE USED AS LONG AS THE GUIDELINES IN THE PROCEDURE ARE FOLLOWED.

2108629 S0000450703_V1

Possible Repair of Flexible Hydraulic Hoses Figure 801/20-10-10-990-807 (Sheet 1 of 2)

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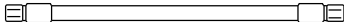
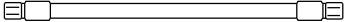
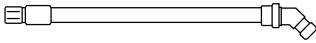
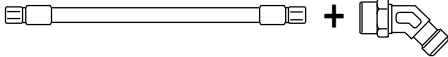
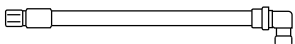
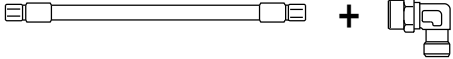
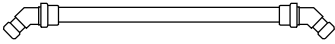
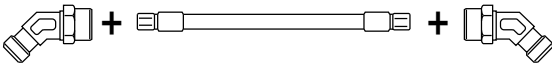
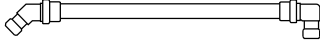
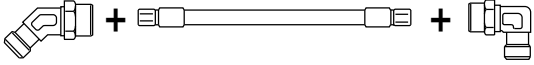
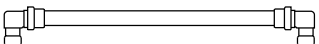
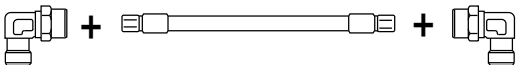
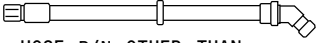
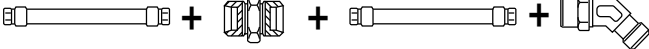
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DAMAGED HOSE	POSSIBLE TEMPORARY REPLACEMENT COMBINATION
 AS115 (STRAIGHT TO STRAIGHT)	 AS115
 AS116 (STRAIGHT TO 45 DEGREE END)	 AS115 BACE21BR
 AS117 (STRAIGHT TO 90 DEGREE END)	 AS115 BACE21BT
 AS118 (45 DEGREE TO 45 DEGREE END)	 BACE21BR AS115 BACE21BR
 AS119 (45 DEGREE TO 90 DEGREE END)	 BACE21BR AS115 BACE21BT
 AS120 (90 DEGREE TO 90 DEGREE END)	 BACE21BT AS115 BACE21BT
 AS115 (STRAIGHT TO STRAIGHT) - LONG LENGTH	 AS115 MS21902 AS115 NOTE: USE A MAXIMUM OF THREE SHORTER HOSES WITH UNION FITTINGS TO MAKE UP THE REQUIRED REPLACEMENT LENGTH FOR THE DAMAGED ORIGINAL HOSE.
 HOSE P/N OTHER THAN AS115, STRAIGHT TO ELBOW (45 DEGREE) - LONG LENGTH	 AS115 MS21902 AS115 BACE21BR NOTE: USE A MAXIMUM OF THREE SHORTER HOSES WITH UNION FITTINGS TO MAKE UP THE REQUIRED REPLACEMENT LENGTH FOR THE DAMAGED ORIGINAL HOSE.

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Possible Repair of Flexible Hydraulic Hoses
Figure 801/20-10-10-990-807 (Sheet 2 of 2)

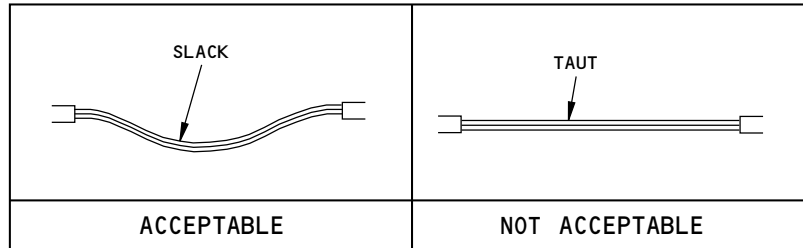
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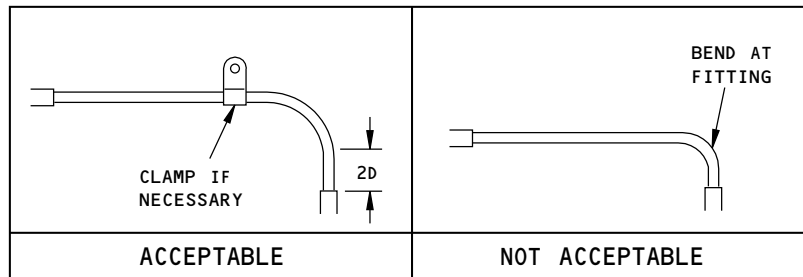
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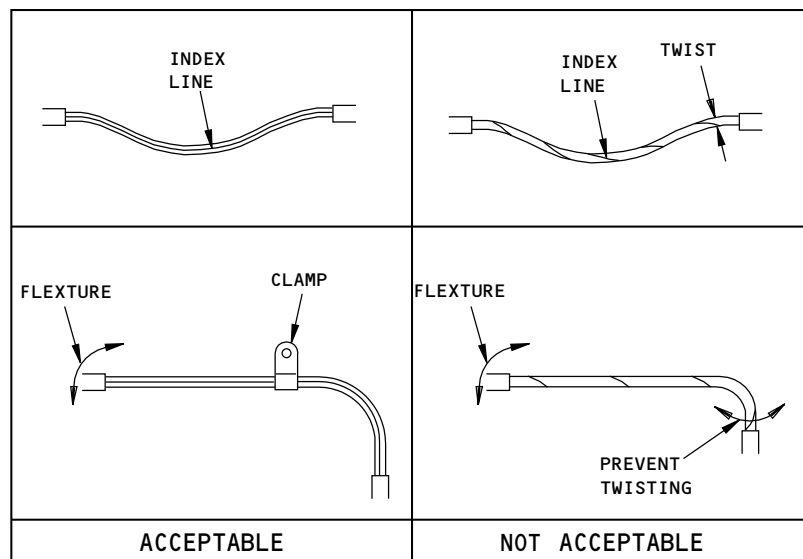
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SLACK



FLEX



TWISTING

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Replacement Flexible Hose Requirements
Figure 802/20-10-10-990-808 (Sheet 1 of 2)

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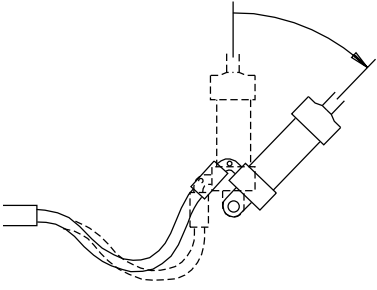
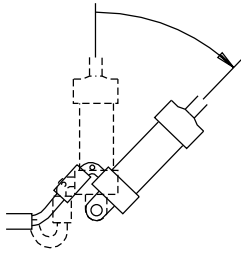
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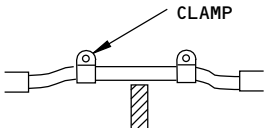
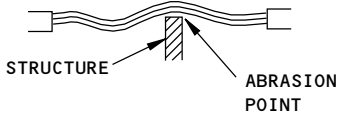
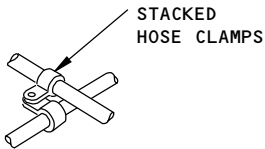
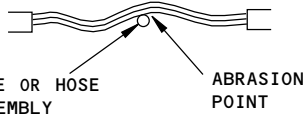
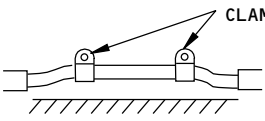
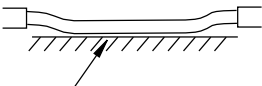
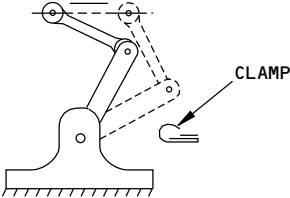
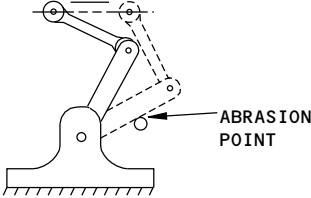
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ELBOW OR HOSE WITH ELBOW END FITTING	
ACCEPTABLE	NOT ACCEPTABLE

BENDING

	
CLAMP	STRUCTURE ABRASION POINT
	
STACKED HOSE CLAMPS	TUBE OR HOSE ASSEMBLY ABRASION POINT
	
CLAMPS	ABRASION POINT
	
CLAMP	ABRASION POINT
ACCEPTABLE	NOT ACCEPTABLE

CLEARANCE

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Replacement Flexible Hose Requirements
Figure 802/20-10-10-990-808 (Sheet 2 of 2)

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FLUID LINE TUBING CLAMPS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the block clamps.
 - (2) An installation of the block clamps.
 - (3) A removal of P-clamps.
 - (4) A installation of P-clamps.
- B. The following are different types of clamps that hold the fluid systems tubing:
- (1) Loop or P-clamps where normal support is required.
 - (2) Saddle clamps where more support is required.
 - (3) Block clamps in the area of high vibration, or where a number of tubes or hoses must be supported in one location.
- C. Loop or saddle clamps holding hydraulic tubes or hoses must be cushioned metal clamps.

TASK 20-10-11-960-801

2. Block Clamps Removal

A. Procedure

SUBTASK 20-10-11-020-001

- (1) Remove the nuts, bolts and washers that hold the block clamp assembly together.

SUBTASK 20-10-11-020-002

- (2) Remove the block clamp assembly.

SUBTASK 20-10-11-020-004

- (3) If there is a tape under the clamp blocks, remove and discard used tape from the tube.

————— **END OF TASK** —————

TASK 20-10-11-400-801

3. Block Clamps Installation

A. Consumable Materials

Reference	Description	Specification
G00150	Tape - Nitto P-421 NAT (Formerly Permacel) PTFE Film Tape	

B. Procedure

SUBTASK 20-10-11-020-003

- (1) Remove and discard all used tape from the tube.

SUBTASK 20-10-11-420-001

- (2) If there was tape under the clamp that was removed, re-install the Nitto P-421 tape, G00150 to the tube.
 - (a) Apply the tape $\pm$ 0.25 in. (6.35 mm) from each end of the block.
 - (b) Apply the tape around the tube 3 times.

SUBTASK 20-10-11-430-001

- (3) Put the tubes in the applicable notches in one-half of the block clamp assembly.

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SUBTASK 20-10-11-420-003

- (4) Put the other half of the block clamp assembly in position.

SUBTASK 20-10-11-430-002

- (5) Put the channel over the half of the block clamp assembly that the bolthead will touch.

SUBTASK 20-10-11-430-003

- (6) Put the washers on the bolts and put the bolts through the holes in the block clamp assembly.

SUBTASK 20-10-11-430-004

- (7) Put the washer and nut on the threaded end of the bolt and tighten the nut.

NOTE: Make sure the washers are under the bolthead and the nut so the bolthead does not wear into the block clamp channel.

————— **END OF TASK** —————

TASK 20-10-11-000-801

4. P-Clamps Removal

A. Procedure

SUBTASK 20-10-11-020-005

- (1) Remove the fastener from the clamp and the structure.

SUBTASK 20-10-11-020-006

- (2) Remove the pan dirt strap from the clamp.

SUBTASK 20-10-11-020-007

- (3) Remove the clamp away from the tubes and structure.

————— **END OF TASK** —————

TASK 20-10-11-400-802

5. P-Clamp Installation

A. Procedure

SUBTASK 20-10-11-420-004

- (1) Put the P-clamp on the tube.

SUBTASK 20-10-11-420-005

- (2) Put the pan dirt strap in the hole of the clamp.

SUBTASK 20-10-11-420-006

- (3) Put the fasteners on the clamp and structure.

SUBTASK 20-10-11-210-001

- (4) Make sure everything is tight.

————— **END OF TASK** —————

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PRESSURE-SENSITIVE DECALS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of the pressure-sensitive decals.
 - (2) An installation of the pressure-sensitive decals.
- B. Apply external decal sections in a sequence where the ends make an overlap downstream from the line of flight.
- C. Apply activator to pressure-sensitive adhesives when you apply decals at ambient temperatures below 60 °F.
- D. Clean plastic film decals with naphtha. Do not use adhesive activator.
- E. You can remove air bubbles in the eight hours after you apply the decal. Make a small hole in the decal film with a sharp pointed instrument, at the edge of bubble, and push air out through the hole.
- F. You can also install interior decals with the same procedure you use for pressure-sensitive placards (Pressure Sensitive Placard Installation, TASK 20-10-13-400-801).

TASK 20-10-12-000-801

2. Pressure-Sensitive Decal Removal

(Figure 401)

A. **References**

Reference	Title
20-30-89-910-801	Final Cleaning of Solvent Sensitive Organic Coatings Prior to Non-structural Bonding (Series 89) (P/B 201)

B. **Tools/Equipment**

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2481	Tool - Sealant Removal, BAC5000, PSD 6-184 Approved Part #: 1-6390-A Supplier: 63318 Part #: 10810 Supplier: \$0855 Part #: 234350 Supplier: \$0857 Part #: 311 Supplier: F6892 Part #: 411B60 Supplier: 3DN12 Part #: 411B90 Supplier: 3DN12 Part #: DAD5013 Supplier: \$0856 Part #: DFD5019 Supplier: \$0856 Part #: J5-0275-2010 Supplier: 435R8 Part #: SCD5019 Supplier: \$0856 Part #: ST982LF-9 Supplier: 62176 Part #: TS1275-4 Supplier: 1DWR5
STD-1081	Flashlight - Explosion Proof
STD-1125	Heater - Blower, Explosion Proof

C. **Consumable Materials**

Reference	Description	Specification
B01009	Solvent - Final Cleaning Of All Organic Ctg's Before Non-Structural Bonding - Series 89	

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(Continued)

Reference	Description	Specification
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

D. Procedure

SUBTASK 20-10-12-020-002

(1) To remove external and internal decals, use heat or solvent.

(a) To remove decals with heat, do these steps:

- 1) Heat the decal with a explosion proof heater, STD-1125 or a explosion proof flashlight, STD-1081 to approximately 120°F (49°C) until the adhesive becomes soft.

NOTE: If you use too much heat, the decal will melt. If the decal melts, remove it with solvent.



ONLY USE APPROVED SCRAPERS ON THE AIRPLANE SKIN. SCRAPERS THAT ARE NOT APPROVED CAN MAKE SCRATCHES ON THE SKIN, AND CAUSE FATIGUE CRACKS.

- 2) Lift the corner of the decal with a sealant removal tool, COM-2481.
- 3) Remove the decal from the surface.
- 4) If necessary, clean the surface.
 - a) Use a cheesecloth pad that is moist with a solution of one-half cleaner and one-half water.

(b) Remove decals with solvent:



DO NOT GET SOLVENT IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME, AND HEAT. THE SOLVENT IS POISONOUS AND FLAMMABLE LIQUID WHICH CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

- 1) Apply Series 89 solvent, B01009 to the decal with a brush or cloth (TASK 20-30-89-910-801).
- 2) When the decal has wrinkles (after approximately two minutes), apply solvent again.
- 3) After approximately two minutes, move the soft decal off of the surface or remove with a spatula.
- 4) If necessary, clean the surface with a cotton wiper, G00034 that is moist with Series 89 solvent, B01009 (TASK 20-30-89-910-801).

————— END OF TASK —————

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TASK 20-10-12-400-801

3. Pressure-Sensitive Decal Installation

(Figure 401)

A. References

Reference	Title
20-30-89-910-801	Final Cleaning of Solvent Sensitive Organic Coatings Prior to Non-structural Bonding (Series 89) (P/B 201)
51-21-00-100-801	Airplane Surface Preparation for Application of Finish (P/B 701)
51-21-03-100-801	Corrosion Removal and Control (P/B 701)
51-31-01 P/B 201	SEALS AND SEALING - MAINTENANCE PRACTICES

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt.", which stands for Optional.

Reference	Description
COM-2481	Tool - Sealant Removal, BAC5000, PSD 6-184 Approved Part #: 1-6390-A Supplier: 63318 Part #: 10810 Supplier: \$0855 Part #: 234350 Supplier: \$0857 Part #: 311 Supplier: F6892 Part #: 411B60 Supplier: 3DN12 Part #: 411B90 Supplier: 3DN12 Part #: DAD5013 Supplier: \$0856 Part #: DFD5019 Supplier: \$0856 Part #: J5-0275-2010 Supplier: 435R8 Part #: SCD5019 Supplier: \$0856 Part #: ST982LF-9 Supplier: 62176 Part #: TS1275-4 Supplier: 1DWR5
SPL-8870	Cutter - Scotchcal

C. Consumable Materials

Reference	Description	Specification
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
B00137	Abrasive - Garnet Coated Paper	
B00151	Solvent - Methyl Isobutyl Ketone	ASTM D1153
B01009	Solvent - Final Cleaning Of All Organic Ctg's Before Non-Structural Bonding - Series 89	
C00012	Coating - Akzo Nobel Clear Polyurethane Topcoat, 683-3-2 Base with X-310A Catalyst (Akzo Nobel Aerospace Coatings)	
C00260	Coating - Chemical And Solvent Resistant Finish, Epoxy Resin Enamel	BMS10-11 Type II
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

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D. Prepare the Surfaces for Installation

SUBTASK 20-10-12-110-001

- (1) Clean corroded aluminum surfaces (TASK 51-21-03-100-801).

SUBTASK 20-10-12-110-002

- (2) Clean wax-coated aluminum surfaces until the area shows a water-break-free surface (TASK 51-21-00-100-801).

SUBTASK 20-10-12-110-003



DO NOT GET SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THESE MATERIALS. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THESE MATERIALS. KEEP THESE MATERIALS AWAY FROM SPARKS, FLAME, AND HEAT. THESE MATERIALS ARE POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

- (3) Use solvent, B00151 cleaner and a cotton wiper, G00034 to clean polyester or phenolic plastics that are not painted.
 - (a) Dry surface with a cotton wiper, G00034.
 - 1) Do not let air dry.

SUBTASK 20-10-12-110-004

- (4) Lightly sand cork surfaces with abrasive, B00137 until you get a clean cork surface.
 - (a) Remove sanding dust with a cotton wiper, G00034.

SUBTASK 20-10-12-110-005



DO NOT GET SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THESE MATERIALS. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THESE MATERIALS. KEEP THESE MATERIALS AWAY FROM SPARKS, FLAME, AND HEAT. THESE MATERIALS ARE POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.



USE ONLY APPROVED TRANSPARENT MATERIALS ON THE ACRYLIC WINDOW PANES. PAINT, MATERIALS THAT ARE NOT TRANSPARENT, AND TRANSPARENT MATERIALS THAT ARE NOT APPROVED CAN PREVENT DETECTION OF DAMAGE. THESE MATERIALS CAN ALSO CAUSE DAMAGE TO THE STRUCTURE OF ACRYLIC WINDOWS. THIS CAN MAKE FLIGHT DANGEROUS.

- (5) Clean all other surfaces thoroughly with solvent, B00083 and cotton wiper, G00034, except in preparation for application of the Refuel Panel Placard (BAC27NFS223) which requires the use of Series 89 solvent, B01009, and a clean dry cloth in place of solvent, B00083 (TASK 20-30-89-910-801).
 - (a) Verify that no grease is present on the surface prior to the application of the Refuel Panel Placard.
 - (b) Dry the surface with a cotton wiper, G00034.
 - 1) Do not let air dry.

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E. Prepare the Decal for Installation

SUBTASK 20-10-12-800-001

- (1) On decals with an area less than one square foot, remove the backing and put the decal face down on a smooth surface.

SUBTASK 20-10-12-420-001

- (2) On decals with an area more than one square foot, use Scotch Flatback Masking Tape 250, G00270 to put the decal on the receiving surface.
 - (a) Cut a sheet of carrier tape approximately four inches longer than the decal and approximately the same width.

NOTE: When you use premasked decals, you can use the premask as a carrier.
 - (b) Put the carrier over the decal, with the edge you will hang two to three inches beyond the decal edge.
 - (c) Hang the carrier on the receiving surface with cotton wiper, G00034.
 - (d) Rub the carrier on with a sealant removal tool, COM-2481.
 - 1) Use short strokes and work from the middle of the joint to the edges.

NOTE: Be sure to remove all wrinkles and air bubbles.
 - (e) Fold the carrier and decal back at the joint, along the surface with the backing up.
 - 1) Use masking tape to hold in this position.
 - (f) Remove the decal backing.

SUBTASK 20-10-12-800-002

- (3) On strip decals, remove about one foot of backing and put the decal face down on a smooth surface.

SUBTASK 20-10-12-800-003



USE A-2 AND A-3 ACTIVATORS AND CYCLOHEXANONE IN AN AREA WITH GOOD AIRFLOW AND DO NOT BREATHE THE FUMES FOR A LONG TIME. A-2 AND A-3 ACTIVATORS AND CYCLOHEXANONE ARE POISONOUS AND FLAMMABLE. INJURY TO PERSONS CAN OCCUR.

- (4) Apply activator or cyclohexanone to the adhesive surface of solvent-activated decals.

NOTE: If the ambient temperature is less than 60°F (16°C), use A-3 activator.

 - (a) Put a felt squeegee into the activator solvent momentarily.
 - (b) Remove unwanted solvent with an absorbent cloth.
 - (c) Move the felt squeegee evenly across the adhesive side of the decal.

NOTE: Do not let the activator touch the film face.

 - 1) Apply activator to strip decals for approximately six inches.
 - 2) Apply activator to the full surface of all other decals with strokes that overlap.

F. Procedure

SUBTASK 20-10-12-420-002

- (1) To apply decal to a smooth (nonbreak) surface, do these steps:
 - (a) Put the decals with areas less than one square foot in position and bond one edge to the surface.
 - 1) Hold the remainder of the decal taut and a small distance from the surface with a piece of backing on the adhesive side.

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- (b) For decals with an area greater than one square foot, move the carrier into position.
 - 1) Hold the free end taut and a small distance from the surface with a piece of backing on the adhesive side.
- (c) Align and bond approximately three inches of strip decals to the receiving surface.
 - 1) Use the applied section as a joint and strip up to three feet of the backing.
 - 2) If necessary, apply activator to the adhesive.
 - 3) Align the stripping and hold it taut and a small distance away from the receiving surface.
- (d) Start at the joint and rub the decal on the surface with a sealant removal tool, COM-2481 with short fan-like strokes.
 - 1) Do not let the adhesive touch the surface until the sealant removal tool, COM-2481 pushes it down.
- (e) Continue to strip, apply activator, and apply strip decals until you apply all of the decal.
- (f) When you apply strip decals around a corner and a splice occurs, overlap decal a minimum of 2 in. (51 mm).

SUBTASK 20-10-12-420-003

- (2) To apply decals to a surface with a butt or overlap joint, do these steps:



CAUTION

DO NOT CAUSE DAMAGE TO THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL DECREASE THE FATIGUE STRENGTH AND LIFE OF THE STRUCTURE.

- (a) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin and the applicable structural repair manual (PAGEBLOCK 51-31-01/201).
- (b) To apply decals on a joint between two surfaces which move with respect to each other or butt joint, do one of these steps:
 - 1) For distances of 0.100 in. (2.540 mm) and more, cut the decal at the approximate center of the distance.
 - a) Fold the decal around the two edges (Figure 401).
 - 2) For distances of less than 0.100 in. (2.540 mm), cut the decal aligned with the forward or top skin edge.
 - a) Fold the decal around the aft or bottom skin edge (Figure 401).
- (c) To apply decals across overlap joints, do one of these steps:
 - 1) Fold the decal smoothly and continuously around the edge of the overlap joint (Figure 401).

NOTE: This is the recommended procedure.
 - 2) Cut the decal aligned with the overlap edge and touch the remainder of the decal to the overlap edge (Figure 401).

NOTE: You can use this method when the decal extends along the overlap joint for a long distance.

SUBTASK 20-10-12-420-004

- (3) To apply decals over surfaces with raised or recessed rivets and fasteners, do these steps:

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CAUTION

DO NOT CAUSE DAMAGE TO THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL DECREASE THE FATIGUE STRENGTH AND LIFE OF THE STRUCTURE.

- (a) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin and the applicable structural repair manual (PAGEBLOCK 51-31-01/201).
- (b) Use tool scotchcal cutter, SPL-8870 to cut decals, except pressure-sensitive Polyester, around the heads of fasteners or rivets.
- (c) Cut and remove an area of film, of pressure-sensitive polyester decals, and approximate the size of a nonflush rivet or fastener, with a scotchcal cutter, SPL-8870.
- (d) Push the decal firmly in position around the rivet or fastener.
- (e) Make a small hole in the decal film, with a sharp pointed instrument, at each rivet on decals applied over pressurized areas.

SUBTASK 20-10-12-400-001

- (4) To apply decals to external emergency exit handles, do these steps:
 - (a) Before you remove the backing paper, put the decal on the handle and cut the decal overlap around each rounded corner (Figure 401).
 - (b) Remove the backing paper and apply the decal.
 - 1) Push the overlap around the edges of the handle.

SUBTASK 20-10-12-800-004

- (5) To remove carrier, or premask and masking tape, pull back parallel to the decal surface.

NOTE: If you will paint the adjacent area, leave the premask in position.

SUBTASK 20-10-12-390-001

- (6) Seal the edges or overcoat.
 - (a) For edge seal, do these steps:



WARNING

USE ONLY APPROVED TRANSPARENT MATERIALS ON THE ACRYLIC WINDOW PANES. PAINT, MATERIALS THAT ARE NOT TRANSPARENT, AND TRANSPARENT MATERIALS THAT ARE NOT APPROVED CAN PREVENT DETECTION OF DAMAGE. THESE MATERIALS CAN ALSO CAUSE DAMAGE TO THE STRUCTURE OF ACRYLIC WINDOWS. THIS CAN MAKE FLIGHT DANGEROUS.

- 1) If you painted up to the edges of decals, seal the edges of the decal with paint.
 - a) If the decal has a premask, remove the premask only after you apply the last layer of paint up to the decal.

NOTE: The paint will flow sufficiently well to seal the edges. If this condition does not occur, seal the edges by the recommended procedure.
- 2) Use a brush to apply clear base Akzo Nobel 683-3-2 coating, C00012 to the edges of the decals that follow:
 - a) Make sure you have a dry film thickness of 0.0015 in. (0.0381 mm) to 0.0020 in. (0.0508 mm).
 - b) Solvent-activated vinyl decals
 - c) BMS10-26, Type 1 and 3 pressure-sensitive elastomeric vinyl decals

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- d) Solvent-activated reflective decals
 - e) Pressure-sensitive reflective decals
 - f) Pressure-sensitive aluminized, mylar decals
- 3) Seal the edges of pressure-sensitive polyester decals with clear base Akzo Nobel 683-3-2 coating, C00012.
 - 4) Use a brush to apply the applicable color of coating, C00260 enamel on all open exposed rivet or fastener heads on pressure-sensitive polyester decals.
 - 5) Make an overlap on the edge of the decal of 0.250 in. (6.350 mm).
 - 6) For reflective (fluorescent) vinyl decals:

NOTE: Make sure you have a dry film thickness of 0.0015 in. (0.0381 mm) to 0.0020 in. (0.0508 mm).

- a) If applying markers before the final application of topcoat, completely seal edges of markers using the topcoat that will be applied to the part.
- b) If applying markers after the final application of topcoat:
 - <1> Sand to reactivate area where marker is to be applied.
 - <2> Completely seal edges of markers using the topcoat/coating that was applied to the part so that all edges are protected from erosion.

- (b) For overcoat, do this task:

NOTE: Some decals may not accept clearcoat due to the design and chemical composition of the decal face.

- 1) Use a brush to apply the clearcoat in a single layer on the full decal and extend a minimum of 0.05 inches overlap on the edge.
- 2) Let the clearcoat fully dry.

———— **END OF TASK** ————

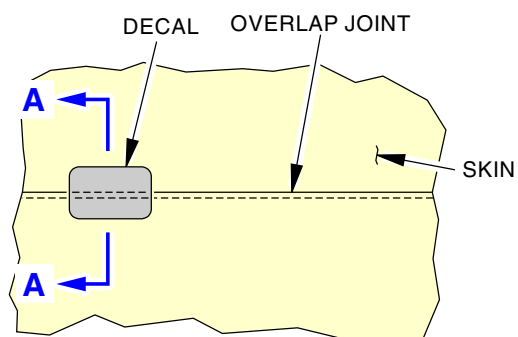
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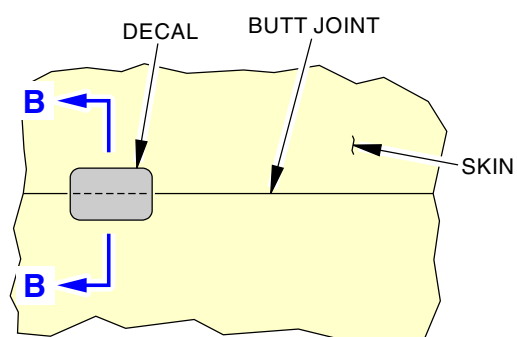
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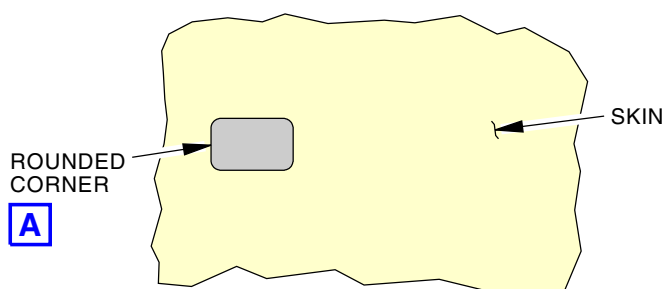
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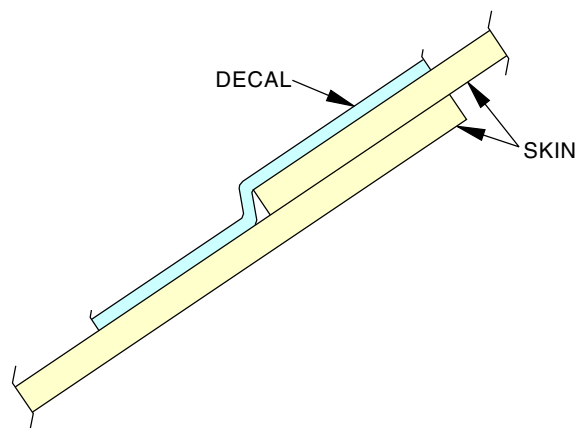
OVERLAP JOINT



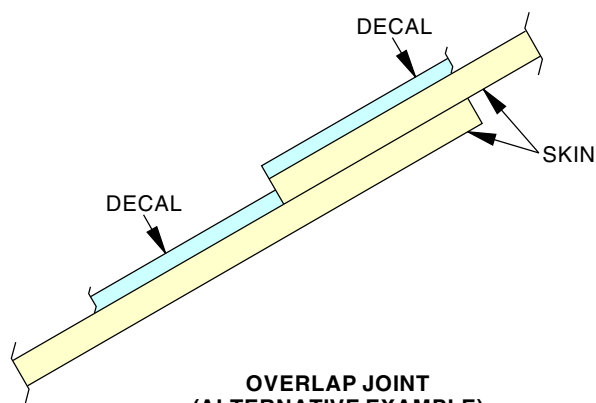
BUTT JOINT



**PANELS AND HANDLES
EXAMPLES OF IRREGULAR SURFACES**



**OVERLAP JOINT
(RECOMMENDED EXAMPLE)
A-A**



**OVERLAP JOINT
(ALTERNATIVE EXAMPLE)
A-A**

C73427 S0006402469_V2

**Decal Application Over Irregular Surfaces
Figure 401/20-10-12-990-801 (Sheet 1 of 2)**

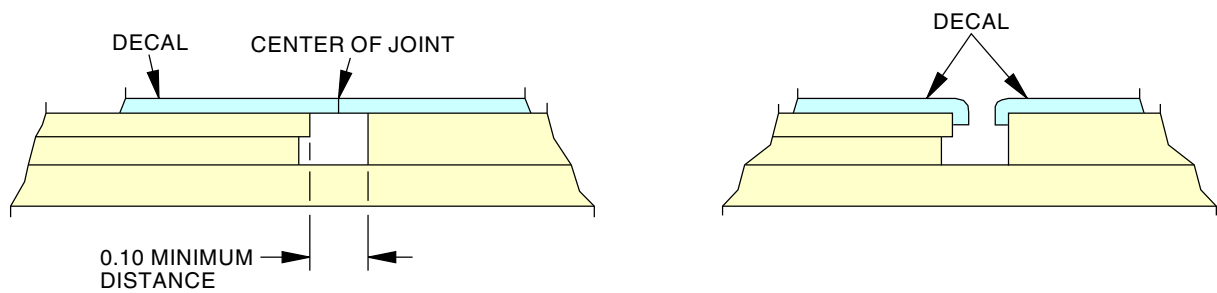
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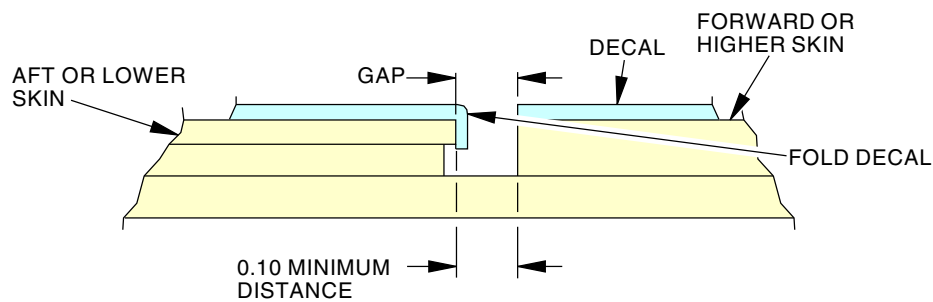
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DECAL BEFORE CUT

DECAL AFTER CUT

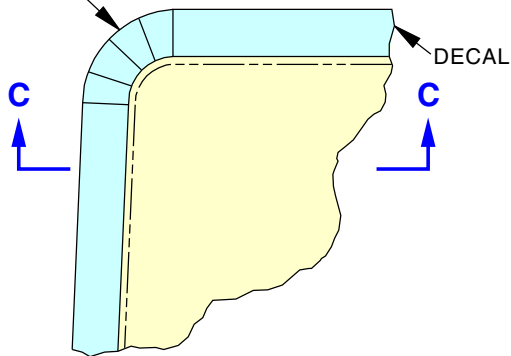
**BUTT JOINT
(MINIMUM DISTANCE)
(EXAMPLE)
B-B**



**BUTT JOINT
(MAXIMUM DISTANCE)
(EXAMPLE)
B-B**

CUT BEFORE
INSTALLATION

1

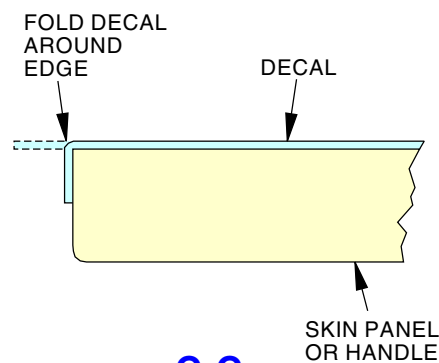


ROUNDED CORNER

A

1

CUT DECAL TO MAKE SURE IT
CONFORMS TO CORNER RADII



C-C

C73453 S0006402470_V3

**Decal Application Over Irregular Surfaces
Figure 401/20-10-12-990-801 (Sheet 2 of 2)**

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PRESSURE-SENSITIVE DECALS - REPAIRS

1. General

- A. This procedure contains one task. The task is to repair external decals.
- B. To repair damaged external decals, apply patches of equivalent decals. Replace damaged internal decals.

TASK 20-10-12-000-802

2. Repair External Pressure Sensitive Decals

A. References

Reference	Title
20-10-12-400-801	Pressure-Sensitive Decal Installation (P/B 401)
51-31-01 P/B 201	SEALS AND SEALING - MAINTENANCE PRACTICES

B. Procedure

SUBTASK 20-10-12-030-001



DO NOT CAUSE DAMAGE TO THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL DECREASE THE FATIGUE STRENGTH AND LIFE OF THE STRUCTURE.

- (1) Cut away all loose decal film but be careful not to cut the airplane skin.
 - (a) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin (PAGEBLOCK 51-31-01/201) and the applicable structural repair manual.

SUBTASK 20-10-12-800-005

- (2) Cut a patch of decal film of the same type and color as the initial decal.
 - (a) Make sure the patch is of sufficient size to make an overlap of 1/4 inch on the part of the decal that is not damaged.

SUBTASK 20-10-12-430-001

- (3) Do this task: Pressure-Sensitive Decal Installation, TASK 20-10-12-400-801.

SUBTASK 20-10-12-390-002

- (4) Seal all around the repair with the applicable edge sealer.

——— **END OF TASK** ———

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PRESSURE SENSITIVE PLACARDS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the pressure sensitive placards.
- (2) An installation of the pressure sensitive placards.

B. Vinyl placards are prepared on a material that will not easily follow the contour of rough or textured surfaces. The placard will touch only the high spots and have a poor bond. Use an adhesive with vinyl placards to get a smooth surface and a firm bond for the placard. Foil markers are made on a soft metal that, when applied, will have the contour of the surface and make a good bond. If the surface is textured, you can apply adhesive to get a smoother surface and more satisfactory installation of foil markers.

TASK 20-10-13-000-801

2. Pressure Sensitive Placard Removal

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2481	Tool - Sealant Removal, BAC5000, PSD 6-184 Approved Part #: 1-6390-A Supplier: 63318 Part #: 10810 Supplier: \$0855 Part #: 234350 Supplier: \$0857 Part #: 311 Supplier: F6892 Part #: 411B60 Supplier: 3DN12 Part #: 411B90 Supplier: 3DN12 Part #: DAD5013 Supplier: \$0856 Part #: DFD5019 Supplier: \$0856 Part #: J5-0275-2010 Supplier: 435R8 Part #: SCD5019 Supplier: \$0856 Part #: ST982LF-9 Supplier: 62176 Part #: TS1275-4 Supplier: 1DWR5

B. Consumable Materials

Reference	Description	Specification
B00068	Alcohol - Denatured, Ethyl (Ethanol)	AMS 3002, MIL-E-51454 Type II
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
B00130	Alcohol - Isopropyl	TT-I-735
B00143	Solvent - Trichlorotrifluorethane (Freon)	MIL-C-81302

C. Removal

SUBTASK 20-10-13-210-001

- (1) Do a check of the placard to see if it is sufficiently bonded.

NOTE: If the placard is bonded firmly and the new placard is the same size, you can install the new placard over the used placard.

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SUBTASK 20-10-13-020-001



CAUTION

ONLY USE APPROVED SCRAPERS ON THE AIRPLANE SKIN. SCRAPERS THAT ARE NOT APPROVED CAN MAKE SCRATCHES ON THE SKIN, AND CAUSE FATIGUE CRACKS.

- (2) Lift the corner of the placard with a sealant removal tool, COM-2481.

SUBTASK 20-10-13-110-001



WARNING

DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (3) Remove remaining adhesive film with solvent, B00143, solvent, B00083, alcohol, B00068, or alcohol, B00130.

————— END OF TASK —————

TASK 20-10-13-400-801

3. Pressure Sensitive Placard Installation

A. Consumable Materials

Reference	Description	Specification
A00016	Adhesive - Pressure Sensitive Film For Interior Non-Structural Bonding	BMS5-91
A00119	Adhesive - Synthetic Rubber Cement, Naphtha Soluble	BMS5-55
B00068	Alcohol - Denatured, Ethyl (Ethanol)	AMS 3002, MIL-E-51454 Type II
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
B00130	Alcohol - Isopropyl	TT-I-735
B00137	Abrasive - Garnet Coated Paper	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

B. Prepare for the Installation

SUBTASK 20-10-13-800-001

- (1) If the placard uses adhesive, A00016, no special placard preparation is necessary.

SUBTASK 20-10-13-840-001

- (2) If the placard has no backing adhesive, prepare placard as follows:
- (a) Make the rear surface of the placard rough with abrasive, B00137.
 - (b) Clean the placard with solvent, B00083.
 - (c) Remove the release paper from one side of the adhesive, A00016.
 - (d) Apply the adhesive, A00016 to the rear of placard.

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- (e) Cut the unwanted adhesive, A00016.
- (f) Laminate the adhesive, A00016 to the placard with one of these steps:
 - 1) Roll placard on hot roll laminator heated to 140 °F.
 - 2) Heat the placard to not more than 140 ° F with a dry air blast or other applicable source and rub release paper with cotton wiper, G00034.

NOTE: Heat makes the bond between the adhesive and the release paper soft. Be careful not to move the release paper.

C. Installation

SUBTASK 20-10-13-110-002



WARNING

DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (1) Clean the surface with , solvent, B00083, alcohol, B00130, or alcohol, B00068.

SUBTASK 20-10-13-800-002

- (2) Dry fully.

SUBTASK 20-10-13-420-001

- (3) Install the placard.

NOTE: You can install the new placard immediately if you did not remove the old placard. If you removed the old placard, do the steps that follow.



CAUTION

MAKE SURE THE MASKED AREA IS IN THE CORRECT POSITION. YOU CAN REMOVE DRY ADHESIVE WITH NAPHTHA CLEANER. IF YOU TRY TO REMOVE CURED ADHESIVE, YOU WILL CAUSE DAMAGE TO THE SURFACE.

- (a) Mask an area approximately 1/16 inch smaller than the placard with masking tape or attach a mask of necessary size.
- (b) Use a brush to apply adhesive, A00119 to the prime contact area.
- (c) Let the adhesive dry fully (approximately 15 minutes).
- (d) Remove the Scotch Flatback Masking Tape 250, G00270 or mask.
- (e) Remove the release paper from the placard.
- (f) Apply the placard to the center of the surface, but be careful to prevent air pockets.
- (g) Rub the placard with firm hand pressure and a cheesecloth pad.
- (h) If the primed surface shows around the placard, remove unwanted adhesive with solvent, B00083.

————— END OF TASK —————

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ALUMINUM FOIL MARKERS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of aluminum foil markers.
 - (2) An installation of aluminum foil markers.
- B. Replace aluminum foil markers that have creases, damaged edges, or words you cannot read.
- C. Replace aluminum foil markers that are not satisfactorily bonded to external primed or painted surfaces.
- D. Replace aluminum foil markers that are not satisfactorily bonded to internal primed or painted surfaces.
- E. Remove and replace aluminum foil markers that are not satisfactorily bonded to bare metal surfaces.

NOTE: For aluminum foil markers that you install on textured surfaces or that do not bond satisfactorily, you can use the procedure for internal vinyl pressure sensitive placards. This gives a better installation (TASK 20-10-13-400-801).

- F. Do not install a new aluminum foil marker on a used aluminum foil marker. Remove the used aluminum foil marker and install the new aluminum foil marker.

TASK 20-10-14-000-801

2. Aluminum Foil Markers Removal

A. References

Reference	Title
20-30-88-910-801	Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-12342	Scrapers, BAC5000, PSD 6-184 Approved Part #: 234350 Supplier: \$0857 Part #: 311 Supplier: F6892 Part #: 411B60 Supplier: 3DN12 Part #: J5-0275-2010 Supplier: 435R8 Part #: TS1275-4 Supplier: 1DWR5

C. Consumable Materials

Reference	Description	Specification
B00344	Solvent - Xylene, Nitration Grade	ASTM D843
B01008	Solvent - Final Cleaning Of Metal Prior To Non-Structural Bonding - Series 88	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

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D. Procedure

SUBTASK 20-10-14-020-001



ONLY USE APPROVED SCRAPERS ON THE AIRPLANE SKIN. SCRAPERS THAT ARE NOT APPROVED CAN MAKE SCRATCHES ON THE SKIN, AND CAUSE FATIGUE CRACKS.

- (1) Put scraper, COM-12342, or equivalent object, under the edge of the placard and remove the marker from the adhesive area.

SUBTASK 20-10-14-110-001

- (2) On primed, painted, or plastic interior surfaces, use solvent, B00344 to remove all adhesive from surfaces and markers.

SUBTASK 20-10-14-110-002



DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (3) On metal surfaces, use a cotton wiper, G00034 that is wet with Series 88 solvent, B01008 (Final Cleaning of Metal Prior to Non-structural Bonding (Series 88), TASK 20-30-88-910-801) to remove all adhesive from surfaces and markers.

————— END OF TASK —————

TASK 20-10-14-400-801

3. Aluminum Foil Markers Installation

A. Consumable Materials

Reference	Description	Specification
A00119	Adhesive - Synthetic Rubber Cement, Naphtha Soluble	BMS5-55
A00134	Adhesive - Synthetic Rubber, Buna-N, 1 Part, Fuel Resistant	BMS5-14
A00253	Adhesive - Room Temperature Curing Two Part Epoxy	BMS5-109 Type II Class 2
A50194	Adhesive - Room Temperature Curing Two Part Epoxy	BMS5-109
B00046	Acid - Corrosion Removing, Metal Conditioning, Phosphoric	MIL-C-10578
B00068	Alcohol - Denatured, Ethyl (Ethanol)	AMS 3002, MIL-E-51454 Type II
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
B00130	Alcohol - Isopropyl	TT-I-735
B00137	Abrasive - Garnet Coated Paper	
B00148	Solvent - Methyl Ethyl Ketone (MEK)	ASTM D740
B00344	Solvent - Xylene, Nitration Grade	ASTM D843

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(Continued)

Reference	Description	Specification
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

B. Prepare for installation

SUBTASK 20-10-14-020-002

- (1) Do not install a new aluminum foil marker on a used aluminum foil marker.

SUBTASK 20-10-14-080-001

- (2) Remove the used foil marker, clean the surface and then install the new foil marker.

SUBTASK 20-10-14-820-001

- (3) If it is necessary, use an electric typewriter with pica type set at the highest impression level to add data to the placard.

SUBTASK 20-10-14-820-002

- (4) Make sure all typed data is clear with letters that do not cut through the aluminum foil marker.

SUBTASK 20-10-14-800-001

- (5) If it is necessary, cut the aluminum foil marker to the necessary dimension before you remove the protective backing.

SUBTASK 20-10-14-100-001

- (6) Clean the surface to apply the aluminum foil marker.

- (a) To clean aluminum surfaces, do these steps:

- 1) Clean aluminum surfaces that have corrosion with a wire brush.



WARNING

DO NOT GET SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE SOLVENT. KEEP MEK AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENTS ARE POISONOUS AND CAN BE FLAMMABLE WHICH CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- 2) Clean surfaces that have grease with solvent, B00083.

- 3) Apply a solution of one-fourth phosphoric acid and three-fourths water, by volume, with a brush, rag, or sponge to the surface.

- 4) Let the acid, B00046 stay on the metal approximately 1/2 minute.

- 5) Rub the surface with a damp cotton wiper, G00034 and then with a dry cotton wiper, G00034 until the surface is dry and free of corrosion.

- (b) Use solvent, B00344 xylene to clean polyester, epoxy, phenolic or polyurethane surfaces that are not painted.

- (c) To clean aluminized paint (EC-843) coated surfaces, do these steps:

- 1) Sand with abrasive, B00137.

- 2) Clean with solvent, B00083.

- (d) To clean cork surfaces, do these steps:

- 1) Lightly sand with abrasive, B00137 until you get a clean cork surface.

- 2) Rub the surface with a clean cotton wiper, G00034 to remove any dust.

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- (e) Clean all other surfaces with solvent, B00083.

SUBTASK 20-10-14-800-002

- (7) On cadmium-plated surfaces, laminated not painted polyester materials, laminated not painted phenolic materials, and rough surfaces that are not painted, do these steps:
 - (a) Apply a light layer of adhesive, A00134 to the cleaned surface.
 - (b) Let the adhesive dry for 5 to 20 minutes. The adhesive must be tacky but will not bond to a clean finger when lightly touched.

SUBTASK 20-10-14-800-003

- (8) Do these steps on primed or painted rough interior surfaces:

NOTE: Do not use this procedure on external surfaces open to the weather.

- (a) Apply a light layer of adhesive, A00119 to the cleaned surface.
- (b) Let the adhesive dry for 5 to 20 minutes. The adhesive must be tacky but will not bond to a clean finger when lightly touched.

C. Install the Aluminum Foil Marker

SUBTASK 20-10-14-480-001

- (1) Use supports for surfaces of thin panels during the installation of markers.

SUBTASK 20-10-14-420-006

- (2) Do not use an aluminum foil marker that is not flat or is damaged.

SUBTASK 20-10-14-840-001

- (3) Do not touch or contaminate the adhesive on the aluminum foil marker after you remove the protective backing.

SUBTASK 20-10-14-840-002

- (4) Make sure the aluminum foil marker and the open surface are free of moisture.

SUBTASK 20-10-14-840-003

- (5) During the installation of a large or complicated aluminum foil marker, keep a small section of backing attached.

NOTE: A small section of backing will help you to touch and move the aluminum foil marker.

SUBTASK 20-10-14-420-001

- (6) To install a cellophane-backed aluminum foil marker, do these steps:
 - (a) Put the aluminum foil marker in water (50 to 120 °F) for approximately 30 to 120 seconds.
 - (b) Remove the aluminum foil marker from the water and remove unwanted water with a clean, cotton wiper, G00034.
 - (c) With dry hands, move a finger across the edge of the aluminum foil marker and move back the cellophane.
 - (d) Carefully remove the backing from the aluminum foil marker.

SUBTASK 20-10-14-420-002

- (7) To install a paper-backed aluminum foil marker, do these steps:
 - (a) Remove the paper backing from the aluminum foil marker, but be careful not to touch the adhesive coating.
 - 1) Where the paper backing has a cut, bend the paper backing lightly along the cut line. Hold the backing and move it slowly away from the aluminum foil marker to prevent damage to the marker.

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- 2) Where the paper backing does not have a cut, move a finger across the edge of the aluminum foil marker to move back one edge of the paper backing.

NOTE: The backing can also have a tab which will help to remove the backing.

SUBTASK 20-10-14-420-003

- (8) To install aluminum foil markers without self-contained adhesive, do these steps:
 - (a) On primed, painted, or plastic interior airplane surfaces that are not open to the weather, do these steps:
 - 1) Apply a light layer of adhesive, A00119 to the rear of the aluminum foil marker.
 - 2) Let the adhesive dry until it is tacky but will not bond to a clean finger when lightly touched.
 - (b) On bare metal surfaces, do these steps:
 - 1) Apply a light layer of adhesive, A00134 to the rear of the aluminum foil marker.
 - 2) Let the adhesive dry until it is tacky but will not bond to a clean finger when lightly touched.

SUBTASK 20-10-14-420-004

- (9) Put the aluminum foil marker in the correct position and push down to attach it.

SUBTASK 20-10-14-420-005

- (10) Use a roller and start at one end of the marker and roll the marker into position. Be careful to prevent air bubbles. To prevent roll marks, do not let the edge of the roller touch the aluminum foil marker.

SUBTASK 20-10-14-800-004

- (11) To remove air bubbles, make a small hole with a pin and make a smooth surface with a roller.

SUBTASK 20-10-14-110-003



DO NOT GET SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE SOLVENT. KEEP SOLVENT AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENTS CAN BE POISONOUS AND FLAMMABLE WHICH CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- (12) If it is necessary, remove unwanted adhesive. Use solvent, B00148, alcohol, B00130, or alcohol, B00068 for adhesive, A00134 or solvent, B00083 for adhesive, A00119.

SUBTASK 20-10-14-020-003

- (13) To remove the protective paper facing, strip it parallel to the surface of the aluminum foil marker.

SUBTASK 20-10-14-210-001

- (14) Make sure there is a good bond on the edge of the aluminum foil marker.

NOTE: Be careful not to lift the edge.

SUBTASK 20-10-14-390-001

- (15) For protection of markers from fuel, hydraulic fluid, or outdoor weather do the following
 - (a) Seal the marker edges or put an overcoat on the markers by brush or spray with adhesive, A00253 or adhesive, A50194.

————— **END OF TASK** —————

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STENCIL MARKINGS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of the stencil markings.
 - (2) An installation of the stencil markings.
- B. For decorative finishes used on airplane external surfaces, (Decorative Exterior Paint System Repair, TASK 51-21-10-300-801).
- C. Paint used for markings is determined by the surface you will paint and the type of finish necessary. Paint must be compatible with the initial surface finish.

TASK 20-10-15-000-801

2. Stencil Markings Removal

A. References

Reference	Title
51-21-01-150-801	Paint Stripping (P/B 701)
51-21-10-300-801	Decorative Exterior Paint System Repair (P/B 701)

B. Consumable Materials

Reference	Description	Specification
C00319	Primer - Urethane Compatible, Corrosion Resistant	BMS10-79 Type II

C. Removal

SUBTASK 20-10-15-420-001

- (1) Remove old markings if necessary:
 - (a) Remove the markings (TASK 51-21-01-150-801).
 - (b) Prepare the surface for the coating (TASK 51-21-10-300-801).
 - (c) Apply primer, C00319 that is equivalent to the initial material (TASK 51-21-10-300-801).

———— **END OF TASK** ————

TASK 20-10-15-400-801

3. Stencil Markings Installation

A. General

- (1) Make sure clean surfaces do not become dirty when you clean adjacent surfaces.
- (2) Use a polyethylene wash bottle to apply solvents. Identify contents.
- (3) Do not contaminate adjacent areas when you spray.
- (4) Make sure all coatings or finishes are uniform, homogeneous, and free from gelled particles.
- (5) Apply primer, C00319 and coating, C00032 with spray equipment only.
- (6) Make sure all coating or finish materials are correctly mixed and labeled. Discard materials with expired pot life.
- (7) Make sure painted markings are well made and have a solid, homogeneous color.

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B. References

Reference	Title
20-30-98-910-801	Cleaning of Specific Polymerics (Series 98) (P/B 201)
51-10-00-200-801	Examine the Skin Waviness at the Static Ports (P/B 601)
51-21-10-300-801	Decorative Exterior Paint System Repair (P/B 701)

C. Tools/Equipment

Reference	Description
STD-1104	Bottle - HDPE Polyethylene, Capacity 500ml, with LDPE Polyethylene Internal Plug and Self Seal Polypropylene Screw Cap
STD-1133	Gun - Spray, Paint, with Interchangeable Nozzles

D. Consumable Materials

Reference	Description	Specification
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
B01018	Solvent - Cleaning Of Specific Polymerics - Series 98	
C00032	Coating - Protective Enamel, General Use	BMS10-60 Type I
C00033	Coating - Protective Enamel, Flexibility Use	BMS10-60 Type II
C00319	Primer - Urethane Compatible, Corrosion Resistant	BMS10-79 Type II
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G00251	Abrasive - Mat, Non-Woven, Non-Metallic	A-A-58054
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

E. Prepare Surface for Stencil Markings

SUBTASK 20-10-15-950-001

- (1) Mask or put a protective cover on all adjacent surfaces which you will not clean, treat, or coat.

SUBTASK 20-10-15-110-001

- (2) Clean the surface:
- (a) Remove loose soil and unwanted grease or oil.
- 1) Do not get dirt on a larger area than necessary.



DO NOT GET SOLVENTS IN YOUR MOUTH, EYES, OR SKIN. DO NOT BREATHE FUMES FROM SOLVENTS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING. SOLVENTS ARE HAZARDOUS MATERIALS AND MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT.



SOLVENTS ARE TOXIC AND HIGHLY FLAMMABLE. AVOID PROLONGED INHALATION OF VAPORS OR CONTACT WITH THE SKIN. TAKE PRECAUTIONS AGAINST FIRE.

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(WARNING PRECEDES)



DO NOT USE SOLVENTS OTHER THAN THOSE SPECIFIED. THEY CAN CAUSE DAMAGE TO THE FINISH.

- (b) Use the applicable solvent:
 - 1) For Tedlar, Teflon, and solvent resistant finishes, use Series 98 solvent, B01018 (TASK 20-30-98-910-801).
 - 2) For acrylic surfaces, use solvent, B00083.
 - 3) For all other surfaces and for hydraulic fluid contamination, use solvent, B00083.
- (c) Use a polyethylene bottle (500ml), STD-1104 to apply solvent to the work surface or to a clean wiper.
 - 1) Do not put the wiper into the solvent container.
- (d) Rub the surface with a cotton wiper, G00034 or a soft brush.
- (e) Rinse the surface with clean solvent.
 - 1) Use clean wipers.
- (f) Remove unwanted solvent.
- (g) Let the surface drain, then rub dry.

SUBTASK 20-10-15-110-002

- (3) Clean the surface again:
 - (a) Put solvent on a clean wiper.
 - 1) Do not put the wiper into the solvent container.
 - (b) Rub the surface with a solvent-soaked cotton wiper, G00034.
 - (c) Immediately rub dry with a clean, dry cotton wiper, G00034.
 - 1) Do not let the solvent air dry.
 - (d) Replace the dirty cotton wiper, G00034 frequently with clean ones.
 - (e) Do the last three steps until the wiper shows no dirt.

NOTE: If a clean surface becomes dirty, clean it again.

SUBTASK 20-10-15-120-001

- (4) For plastic laminates and painted surfaces, do these steps:
 - (a) If necessary, clean the surface.



DO NOT RUB THE PAINTED SURFACE AROUND THE DECAL EDGE WITH ABRASIVES IF CLEAR HYDRAULIC FLUID RESISTANT COATING WAS USED AS AN EDGE SEALER FOR THE DECAL. DAMAGE TO THE SEAL CAN OCCUR.

- (b) Lightly sand the surface with abrasive mat, G00251 or finer abrasive paper.
- (c) Do again the two steps to clean the surface.

F. Install Stencil Markings

SUBTASK 20-10-15-420-002

- (1) Refer to TASK 51-10-00-200-801 for a guide when painting near Reduced Vertical Separation Minimum (RVSM) Extra Critical Areas (ECAs).

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- (2) Install the stencil.
 - (a) Make sure all stencil cuts are sharp and clear of burrs.
 - (b) Attach the stencil tightly with Scotch Flatback Masking Tape 250, G00270 so the paint does not go under the edges.

SUBTASK 20-10-15-370-001

- (3) Prepare the stencil paint.
 - (a) Make sure you use a marking enamel or lacquer that agrees with the surface finish.
 - (b) Prepare primer, C00319 and coating, C00032 (preferred) or coating, C00033 (alternate) (TASK 51-21-10-300-801).

SUBTASK 20-10-15-380-001



DO NOT GET THE FINISHES, CLEANERS, THINNERS AND SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN OR CLOTHES. DO NOT BREATHE THE FUMES FROM THESE MATERIALS. MAKE SURE THAT THE AIR FLOWS FREELY THROUGH THE WORK-AREA. USE THE NECESSARY RESPIRATORY PROTECTION. KEEP THESE MATERIALS AWAY FROM SPARKS, FLAME AND HEAT. THESE MATERIALS ARE POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY OR DAMAGE.

- (4) Apply coating, C00032 (preferred) or coating, C00033 (alternate) or lacquer with the paint spray gun with interchangeable nozzles, STD-1133.
 - (a) In areas where a BMS3-11 resistant finish is necessary, apply coating, C00033.
 - (b) When letter sizes are greater than 2 in. (51 mm) in height, use coating, C00033 for the letters.

NOTE: Optimum conditions for pain application are between 50°F (10°C) to 95°F (35°C) and Relative Humidity is less than 85%.
 - (c) Make sure there is a sufficiently wet layer to give uniform flow but not to cause runs and sags.

SUBTASK 20-10-15-800-001

- (5) Remove the rough edges from the markings with solvent, B00083 or with a burnishing tool after the marking cures.

NOTE: An alternative procedure to remove the rough edges is to remove the masking tape while the paint is still wet. This permits paint to flow out.

————— **END OF TASK** —————

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RECESSED BOSS SEAL FITTINGS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) Removal of adapter fittings and positioning fittings (boss fittings).
- (2) Installation of adapter (straight) fittings.
- (3) Installation of the positioning (elbow) fittings.

TASK 20-10-16-000-801

2. Boss Fitting Removal

(Figure 401)

A. **Procedure**

SUBTASK 20-10-16-030-001

- (1) Loosen the jamnut.

SUBTASK 20-10-16-030-002

- (2) Disconnect the hose or tube, from the fitting as applicable.

SUBTASK 20-10-16-020-001

- (3) Remove the fitting from the boss.

————— **END OF TASK** —————

TASK 20-10-16-400-801

3. Adapter (Straight) Fitting Installation

(Figure 401)

A. **References**

Reference	Title
20-11-00-910-801	Standard Torque Values (P/B 201)

B. **Procedure**

SUBTASK 20-10-16-640-001

- (1) Lubricate a new O-ring and backup ring and install them in the fitting groove.

SUBTASK 20-10-16-430-001

- (2) Lubricate a new O-ring and put it in the groove under the nut hex.

SUBTASK 20-10-16-420-001



INSTALL THE BACK-UP RING CORRECTLY. IF YOU DO NOT INSTALL THE BACK-UP RING CORRECTLY, YOU CAN CAUSE DAMAGE TO EQUIPMENT.

- (3) Install the fitting (Figure 401) into the boss and tighten to the correct torque for the size of the fitting (Standard Torque Values, TASK 20-11-00-910-801).

————— **END OF TASK** —————

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TASK 20-10-16-400-802

4. Positioning (Elbow Type) Fitting Installation

(Figure 401)

A. References

Reference	Title
20-11-00-910-801	Standard Torque Values (P/B 201)

B. Procedure

SUBTASK 20-10-16-430-002

- (1) Install the jamnut on the fitting and turn it to the stop.

SUBTASK 20-10-16-640-002

- (2) Lubricate a new O-ring and install it in the groove between the two sets of threads.

SUBTASK 20-10-16-430-003

- (3) Lubricate a new O-ring and backup ring with the applicable system lubricant and install them in the fitting groove.

SUBTASK 20-10-16-420-002



CAUTION

INSTALL THE BACK-UP RING CORRECTLY. IF YOU DO NOT INSTALL THE BACK-UP RING CORRECTLY, YOU CAN CAUSE DAMAGE TO EQUIPMENT.

- (4) Install the fitting into the boss until it touches bottom, then loosen until the fitting aligns with the hose or tube (one turn maximum) (Figure 401).

SUBTASK 20-10-16-420-003

- (5) Hold the fitting stable and tighten the jamnut to the correct torque for the size of the fitting (Standard Torque Values, TASK 20-11-00-910-801).

SUBTASK 20-10-16-430-004

- (6) Connect the hose or tube to the fitting.
(a) Tighten the fitting (Standard Torque Values, TASK 20-11-00-910-801).

———— **END OF TASK** ————

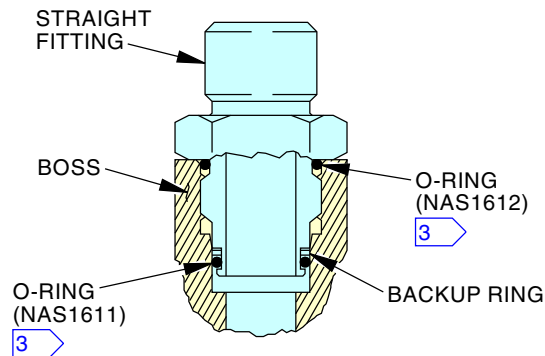
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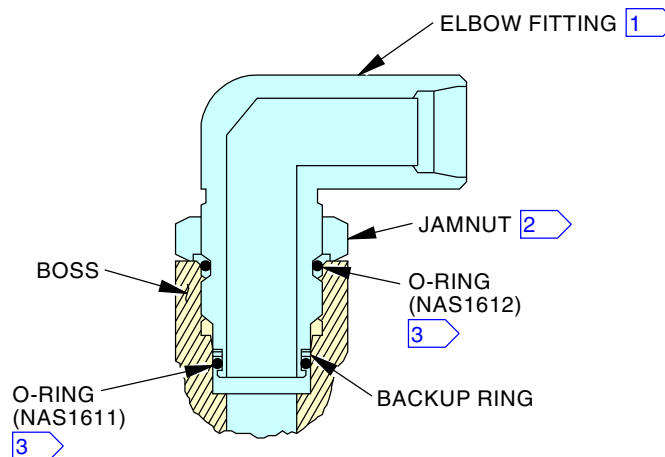
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STRAIGHT (STYLE E) FITTINGS



ELBOW (STYLE S) FITTINGS

- 1 YOU CAN USE A 45 OR 90° ELBOW JAMNUTS NAS1410DD AND AN6298 WITH
- 2 BACKUP RING MS28773 ARE OPTIONAL USE ONLY PHOSPHATE ESTER FLUIDS
- 3 WITH NAS1611 AND NAS1612 O-RINGS

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Recessed Boss Seal Fitting Installation
Figure 401/20-10-16-990-801

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TEFLON BACKUP RINGS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of teflon backup rings, MS28783.
- (2) An installation of teflon backup rings.

TASK 20-10-17-000-801

2. Teflon Backup Rings Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-17-020-001

- (1) If you see a broken teflon ring, remove it.
 - (a) Use an appropriate hook or tool.
 - (b) Use care not to scratch the groove or the adjacent surfaces.

———— **END OF TASK** ————

TASK 20-10-17-400-801

3. Teflon Backup Rings Installation

(Figure 401)

A. Procedure

SUBTASK 20-10-17-420-001

- (1) Install split-teflon backup rings, MS28783, with the direction of the spiral clockwise.
 - (a) Make sure the scarfed ends face as shown in (Figure 401).

———— **END OF TASK** ————

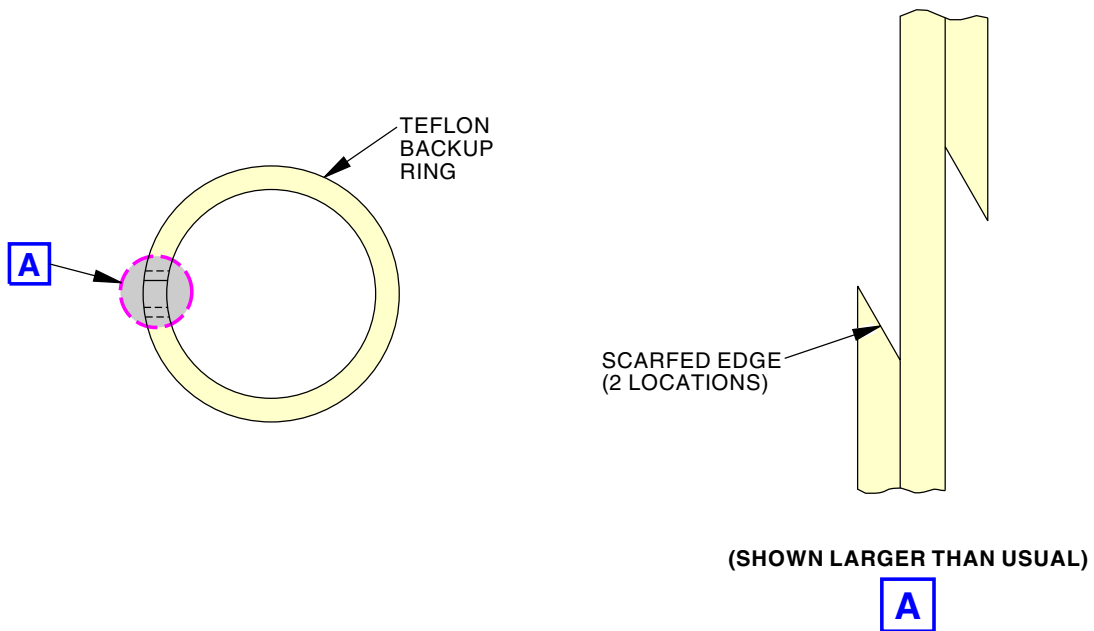
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Teflon Backup Ring Installation
Figure 401/20-10-17-990-801

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O-RINGS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of O-Rings.
 - (2) An installation of O-Rings.
- B. You may install O-Rings over sharp edges. Sharp edges include threaded fasteners, keyways, slots, splines, and ports.

TASK 20-10-19-000-801

2. O-Rings Removal

(Figure 401)

A. Removal

SUBTASK 20-10-19-210-001

- (1) Examine the old O-rings for cuts, abrasions, deformities, and surface defects.

SUBTASK 20-10-19-020-001

- (2) Remove the defective O-Rings with an appropriate hook or tool.
 - (a) Be careful not to scratch the groove or adjacent surfaces.

———— **END OF TASK** ————

TASK 20-10-19-400-801

3. O-Rings Installation

(Figure 401)

(Table 401)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1575	Kit - O-Ring Tool, Installation Part #: SP-0786 Supplier: 62209 Part #: ST848 Supplier: 81205 Part #: ST848R Supplier: 81205 Opt Part #: PSAT-KIT Supplier: 1V757

B. Procedure

SUBTASK 20-10-19-800-001

- (1) Fuel system O-rings are sensitive to UV and ozone. Make sure that you remove O-rings from their packaging only immediately before installation.
- (2) Use one of the installation tools in the O-ring toolkit, SPL-1575 shown in (Table 401):

Table 401/20-10-19-993-802 Installation Tools

TOOL NO.	TUBE OR HOSE FITTING SIZE
ST848-187	1/16
-250	1/4

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Table 401/20-10-19-993-802 Installation Tools (Continued)

TOOL NO.	TUBE OR HOSE FITTING SIZE
-312	5/16
-375	3/8
-500	1/2
-625	5/8
-750	3/4
-1000	1
-1250	1-1/4
-1500	1-1/2
-1750	1-3/4

SUBTASK 20-10-19-640-001



REPLACE USED O-RINGS WITH NEW O-RINGS. USED O-RINGS CAN CAUSE LEAKAGE.

- (3) Lubricate the O-ring with a thin layer of the fluid used with the component or system.

SUBTASK 20-10-19-420-004



DO NOT MAKE THE ELASTOMERIC O-RING INNER DIAMETERS LARGER BY MORE THAN 50% DURING INSTALLATION. DO NOT MAKE THE TEFLON AND PLASTIC O-RING INNER DIAMETERS LARGER BY MORE THAN 5% DURING INSTALLATION. FAILURE CAN OCCUR.

- (4) Put the thimble over the fitting.

SUBTASK 20-10-19-420-001

- (5) Put the O-ring on the thimble.

SUBTASK 20-10-19-420-002

- (6) Move the expanding body over the thimble and against the O-ring, then push the O-ring into the groove.

SUBTASK 20-10-19-020-004

- (7) Use the extracting rod to remove the expanding body from the thimble.

SUBTASK 20-10-19-020-005

- (8) Remove the thimble.

SUBTASK 20-10-19-210-002



DO NOT PINCH THE O-RINGS. MAKE SURE ATTACHED BOLTS ARE CORRECTLY TIGHTENED. FAILURE CAN OCCUR.

- (9) Examine the O-ring for twists and pinches caused by installation.
(a) Make sure you align the O-ring with no twists before you close the gland.

———— **END OF TASK** ————

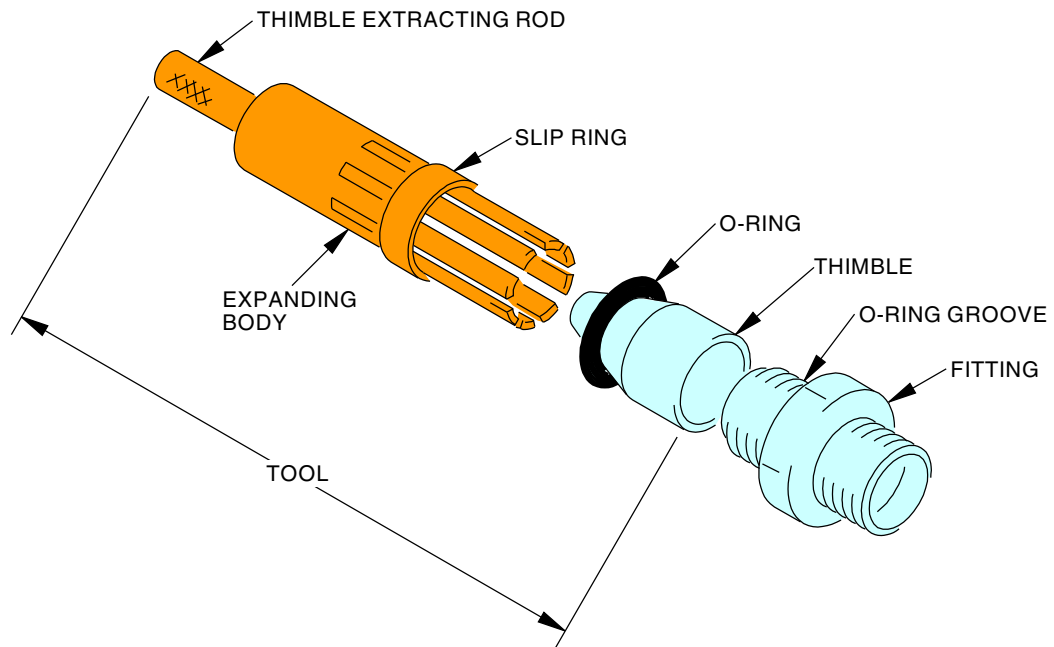
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O-Ring Installation
Figure 401/20-10-19-990-801

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METAL SURFACES - CLEANING/PAINTING

1. General

- A. Use this procedure for faying surface bonds and bonding jumper installation. Do not use abrasives or wire brushes on CRES, plated surfaces, or clad aluminum that is not painted.
- B. This procedure is for cleaning by one of the following methods:
 - (1) Hand Clean Metal Surfaces with Abrasives.
 - (2) Clean Metal Surface with a Rotary Bonding Brush.
 - (3) Clean with a Rotary Abrasive Disk.
 - (4) Remove Paint from Metal Surfaces with solvent, B00139 or solvent, B00083.
 - (5) Clean Bare, Clad, or Plated Metal with solvent, B00139.

TASK 20-10-22-120-801

2. Hand Clean Metal Surfaces with Abrasives

A. General

- (1) Do not use abrasives on plated surfaces, clad aluminum, or CRES.
- (2) This is the only procedure you can use to clean titanium.

B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

C. Procedure

SUBTASK 20-10-22-100-001

- (1) Make the surface wet with solvent, B00062 and wipe or scrub the surface with a cotton wiper, G00034
 - (a) Spray or flow the solvent, B00062 on the surface to assist in cleaning or rinsing.
 - (b) Wipe up the excessive solvent and allow the surface to drain dry.

SUBTASK 20-10-22-120-001



CAUTION

DO NOT LET PARTICLES FROM THE ABRASIVE CAUSE CONTAMINATION OF THE MECHANISMS OR ELECTRICAL EQUIPMENT. DAMAGE CAN OCCUR.

- (2) Manually use a circular or elliptical movement of the abrasive to get an equally smooth surface.

————— **END OF TASK** —————

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TASK 20-10-22-140-801

3. Clean Metal Surfaces with a Rotary Bonding Brush

(Figure 701)

A. General

- (1) Use this procedure to remove paint from metal or to remove Alodine, Iridite, or light anodize from aluminum. Do not use a bonding brush on plated surfaces or on metals that are not painted, for example, CRES, titanium, or clad aluminum. Clean these surfaces with solvent.

B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00102	Abrasive - Aluminum Oxide Coated Cloth	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

C. Procedure

SUBTASK 20-10-22-930-001

- (1) Identify the bonding brush housings by color.

NOTE: Remove paint from metal surfaces with lacquer thinner or solvent. The colors show which bonding brush housings you will use on which metal. The chart below gives color codes for identification of bonding brushes for individual metals.

Table 701/20-10-22-993-801

BONDING BRUSH COLOR CODE		
METAL	COLOR CODE	COLOR IDENTIFICATION
Aluminum	None	None
Ferritic	Blue	J7-42-5200
Magnesium	Green	J7-42-5700
Beryllium	Brown	J7-42-5400

SUBTASK 20-10-22-140-001



CAUTION

DO NOT USE CARBON STEEL BONDING BRUSHES. STEEL PARTICLES ON METAL SURFACES COULD CAUSE CORROSION.



CAUTION

DO NOT USE ROTARY WIRE BRUSHES OR ABRASIVE DISKS ON TITANIUM. DAMAGE CAN OCCUR. HAND CLEAN TITANIUM WITH ABRASIVES OR CLEAN WITH A SOLVENT.

- (2) Use a drill motor or other applicable drive to apply a stainless steel bonding brush of the correct size to clean the necessary diameter.

- (a) Apply brush intermittently and keep the cutting face parallel with the surface.
- (b) Examine results after each time you apply the brush and continue operation until necessary area is clean.

NOTE: Keep the decrease in surface metal to a minimum.

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- (c) If it is a problem to get through an anodic film, clean it with abrasive cloth, B00102.

SUBTASK 20-10-22-100-002

- (3) Make the surface wet with solvent, B00062 and wipe or scrub the surface using a cotton wiper, G00034.
- (a) Spray or flow the solvent, B00062 on the surface to assist in cleaning or rinsing.
- (b) Wipe up the excessive solvent and allow the surface to drain dry.

————— END OF TASK —————

TASK 20-10-22-120-802

4. Clean with a Rotary Abrasive Disk

(Figure 701)

A. General

- (1) Use this task to remove anodize, Iridite, Alodine, BMS 3-11 resistant finish, or equivalent hard finishes that are not painted. You can also remove paint with this task, but the disk will become quickly clogged.
- (2) Do not use this procedure on plated surfaces or metals that are not painted, for example, CRES, titanium, or clad aluminum.

B. Consumable Materials

Reference	Description	Specification
B00102	Abrasive - Aluminum Oxide Coated Cloth	

C. Procedure

SUBTASK 20-10-22-120-002

 CAUTION	DO NOT LET PARTICLES FROM THE ABRASIVE CAUSE CONTAMINATION OF THE MECHANISMS OR ELECTRICAL EQUIPMENT. DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Use a drill motor or other applicable drive to apply an abrasive disk (abrasive cloth, B00102) (Figure 701) of correct size to clean the necessary diameter.
- (a) Apply the disk intermittently with light pressure and keep the face of the disk parallel to the metal surface.
- (b) Examine results after each time you apply the disk and continue operation until necessary area is clean.

NOTE: Keep the decrease in surface metal to minimum.

————— END OF TASK —————

TASK 20-10-22-110-801

5. Remove Paint from Metal Surfaces with Lacquer Thinner or Solvent

A. General

- (1) Use this procedure to remove lacquer-based primer or enamel from clad aluminum or other metal surfaces. Do not use lye, alkaline paint remover, or hydroxides to clean surfaces.

B. References

Reference	Title
20-30-84-910-801	Final Cleaning of Metal Prior to Painting (Series 84) (P/B 201)

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C. Consumable Materials

Reference	Description	Specification
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
B01004	Solvent - Final Cleaning Of Metal Prior To Painting - Series 84	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

D. Remove Paint

SUBTASK 20-10-22-110-001



WARNING

DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

- (1) Apply Series 84 solvent, B01004 (TASK 20-30-84-910-801) to the specified area with a cotton wiper, G00034.

SUBTASK 20-10-22-110-002

- (2) Use a clean part of the cloth each time you apply solvent, B00083 to the surface.
 - (a) Make sure you do not get solvent, B00083 on adjacent surfaces.

SUBTASK 20-10-22-110-003

- (3) When the specified area is fully clean, immediately rub dry with cotton wiper, G00034.

————— END OF TASK —————

TASK 20-10-22-110-802

6. Clean Bare, Clad, or Plated Metal with Solvent

A. General

- (1) Use this procedure to clean plated surfaces and CRES, titanium, or clad aluminum that is not painted.

B. Consumable Materials

Reference	Description	Specification
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

C. Procedure

SUBTASK 20-10-22-110-004

- (1) Apply solvent, B00083 to bonding surfaces with a cotton wiper, G00034.

SUBTASK 20-10-22-110-005

- (2) Rub with the necessary force to remove contamination you can see.

SUBTASK 20-10-22-110-006

- (3) Immediately dry surfaces with a cotton wiper, G00034.

————— END OF TASK —————

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BRUSH OR DISK DIA. (INCH)	PILOT DIA. (INCH)	SHANK DIA. (INCH)	BONDING BRUSHES			
			WIRE SIZE (INCH)		OSBORN NO.	MORRIS NO.
			MAX	MIN		
11/32	1/4	1/4	0.005	0.004		
1/2	3/32	1/4	0.005	0.004	94-SV-37	P-31-SS
1/2	1/8	1/4	0.005	0.004	94-SV-47	P-32-SS
1/2	5/32	1/4	0.005	0.004	94-SV-48	P-33-SS
1/2	3/16	1/4	0.005	0.004	94-SV-36	P-34-SS
3/4	3/16	1/4	0.006	0.005		P-31-516-SS
3/4	1/4	1/4	0.006	0.005		P-31-517-SS
3/4	5/16	1/4	0.006	0.005		P-31-53-SS
1.0	3/16	1/4	0.008	0.006		P-36-SS
1.0	1/4	1/4	0.008	0.006		P-36-S1-SS
1.0	5/16	1/4	0.008	0.006		P-36-S5-SS

BONDING BRUSHES			DISK MANDRELS
BRUSH OR DISK DIA. (INCH)	MANUFAC- TURERS BRUSH CO.	BOEING ST NO.	BOEING ST NO.
11/32		ST913K-34-24	ST913M-34-24
1/2	220-NN	ST913K-50-09	ST913M-50-09
1/2	221-NN	ST913K-50-12	ST913M-50-12
1/2	222-NN	ST913M-50-16	ST913M-50-16
1/2	223-NN	ST913M-50-19	ST913M-50-19
3/4	224-NN	ST913K-75-19	ST913M-75-19
3/4	225-NN	ST913K-75-25	ST913M-75-25
3/4	226-NN	ST913K-75-31	ST913M-75-31
1.0	227-NN	ST913K-100-19	ST913M-100-19
1.0	228-NN	ST913K-100-25	ST913M-100-25
1.0	229-NN	ST913K-100-31	ST913M-100-31

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**Rotary Bonding Brushes and Abrasive Disk Mandrels
Figure 701/20-10-22-990-801**

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LOCKING DEVICES - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the lockwire, cotter pins, and lockrings.
- (2) An installation of the lockwire, cotter pins, and lockrings.
- (3) A removal of the safety cable.
- (4) An installation of the safety cable.

TASK 20-10-23-000-801

2. Lockwire, Cotter Pins, and Lockrings - Removal

(Figure 401, Figure 402, Figure 403)

A. Remove the Lockwire, Cotter Pins, and Lockrings

SUBTASK 20-10-23-020-001

- (1) Cut and remove the lockwire or remove the cotter pin or lockring.

——— **END OF TASK** ———

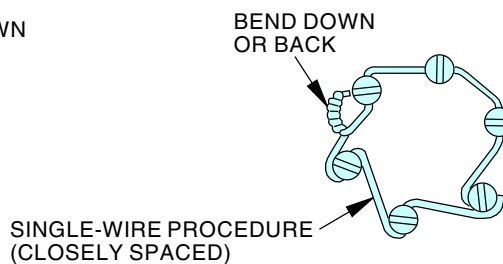
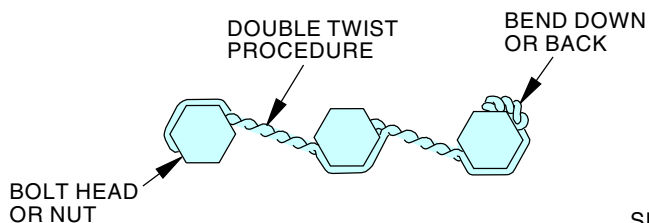
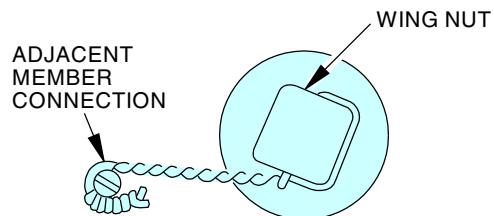
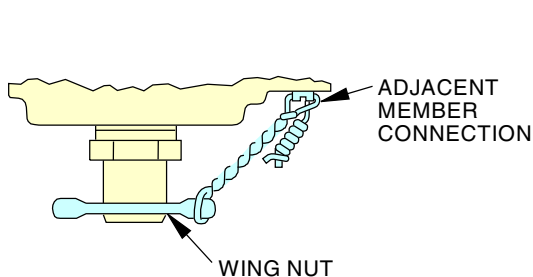
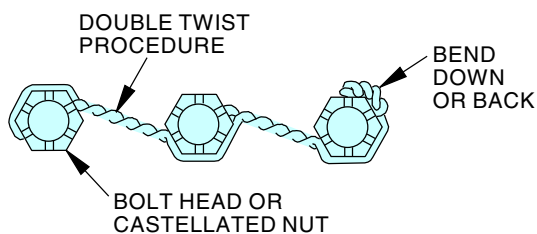
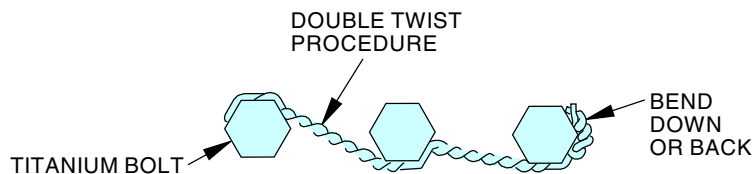
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Lockwire Installation
Figure 401/20-10-23-990-804

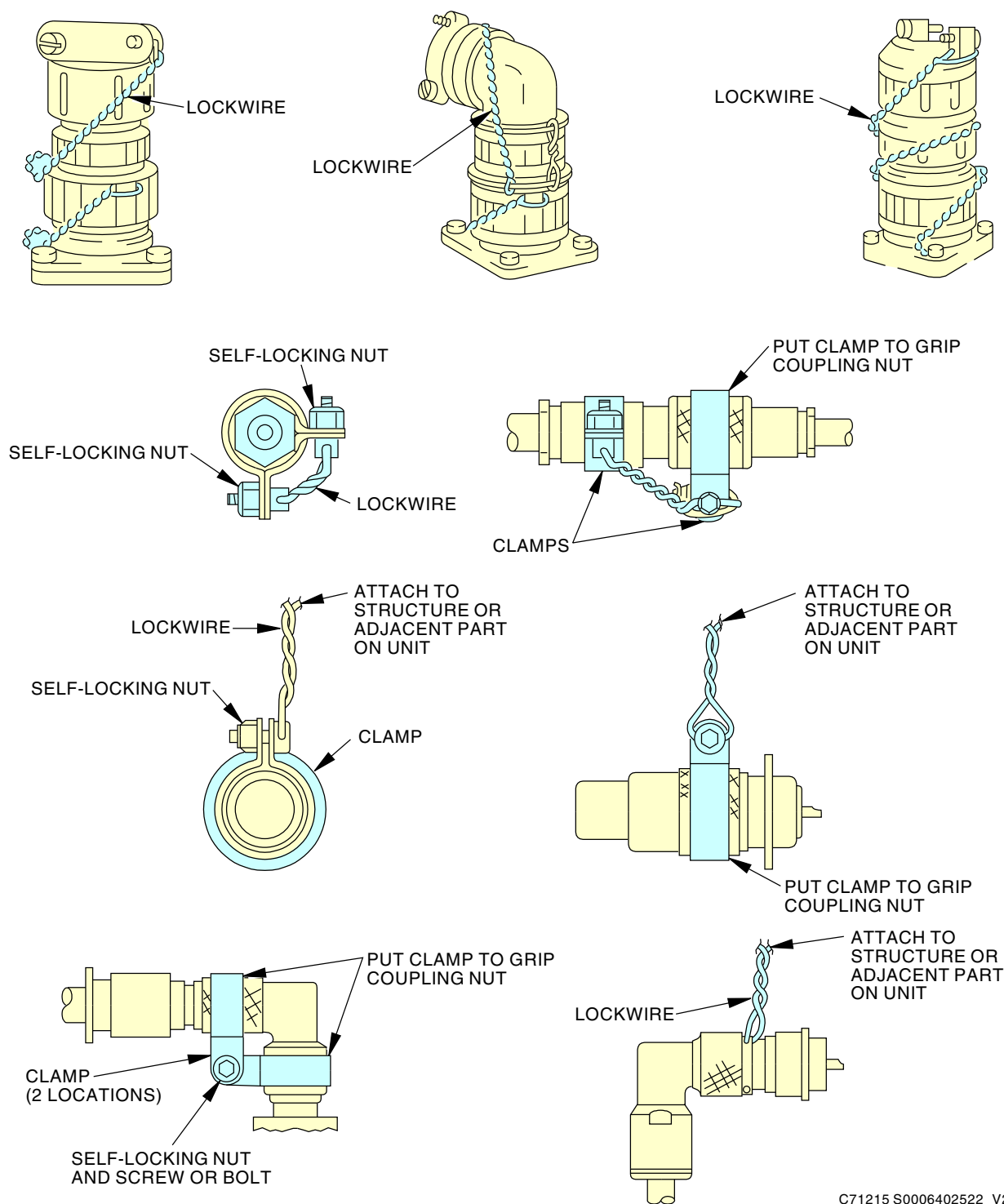
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Connector Lockwire Installation
Figure 402/20-10-23-990-805

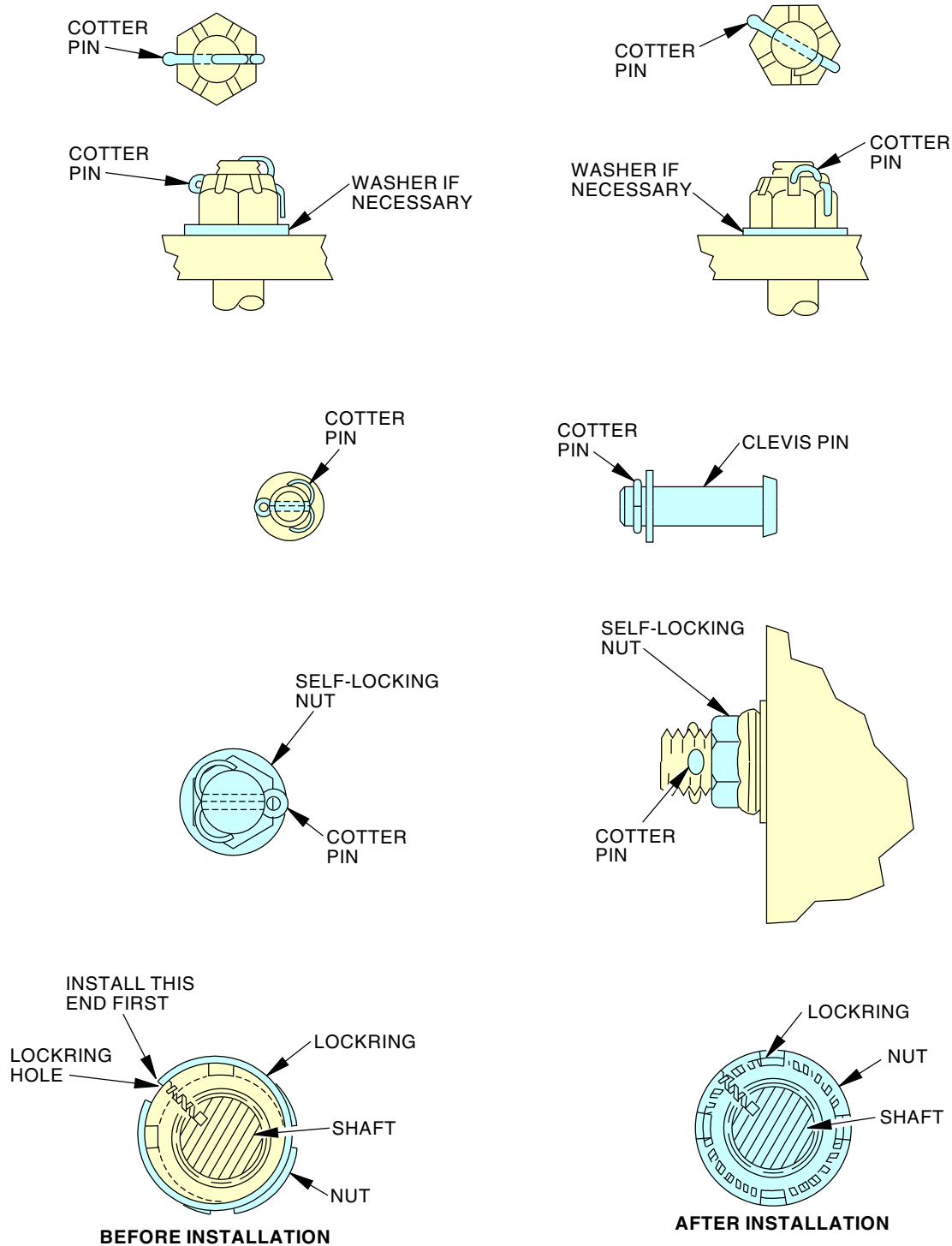
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**Locking Pins Installation
Figure 403/20-10-23-990-806**

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TASK 20-10-23-400-801

3. Lockwire, Cotter Pins, and Lockrings - Installation

A. General

- (1) CRES, MONEL, and INCONEL lockwire (safety wire) interchangeability:
 - (a) CRES, MONEL, and INCONEL lock wire are interchangeable when the same length and diameter are used, except for airplane areas/systems where temperatures exceed 700°F (371°C) or the magnetic properties of CRES do not meet the necessary requirements.
 - (b) INCONEL must be used for all areas which exceed 700°F (371°C).
 - (c) If a specific lockwire material is listed in a maintenance procedure, Boeing recommends to use the listed material if available. Otherwise, follow the interchangeability information above.
- (2) Copper wire (Wire sealing):
 - (a) Wiresealing is a practice for the security of selected switches, levers, switchguards, etc., to deter inadvertent operation, to allow for physical breakout in an emergency, to identify to the Flight Crew and Engineers that, when present and intact, the relevant switches, levers, switchguards, etc., are in their correct configuration positions, to show that no person has used the emergency equipment.
 - (b) Emergency equipment includes portable fire extinguishers, first aid kits, emergency valves, and oxygen regulators.
 - (c) Copper wire is not interchangeable with CRES, MONEL, and INCONEL lockwire.
 - (d) Use copper wire, 0.020 in. (0.508 mm) in diameter for wire sealing emergency equipment. Use copper wire, 0.015 in. (0.381 mm) in diameter for wire sealing switch guards.
- (3) Clad 5056 Aluminum alloy wire should be used for lockwire which touches magnesium to prevent galvanic corrosion.
- (4) Lockwiring guidelines:
 - (a) Do not use lockwire more than once.
 - (b) Install lockwire so it is in tension when the parts become loose.
 - (c) Make three to six twists at the end of the wire. Bend the twists back or under to give the ends protection so they will not catch something.
 - (d) Use the double twist procedure for all lockwire unless a single wire procedure is specified.
 - (e) Install and twist the safety wire so the loop around the head stays down. (If the loop tended to come up over the bolt head there would be a slack loop.)
 - (f) For multiple fasteners spaced less than 4 in. (10 cm) apart, the maximum number which can be safety wired together shall be the number than can be wired with a 24 in. (61 cm) length of wire.
 - (g) For fasteners 4 in. (10 cm) to 6 in. (15 cm) apart, wire together in series no more than three fasteners.
 - (h) Where fasteners are more than 6 in. (15 cm) apart, do not tie them in series unless tie points are provided on adjacent parts to shorten the wire span to less than 6 in. (15 cm).
 - (i) Use a right-handed twist for all double twist installations.
 - (j) Safety wire diameter shall be between 1/3 and 3/4 of the hole diameter, 0.032 in. (0.813 mm) diameter minimum.

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- (k) Safety wire 0.020 in. (0.508 mm) in diameter may be used if:
- 1) The safety wire hole is 0.045 in. (1.143 mm) diameter or smaller, or
 - 2) The spacing between parts is less than two inches and the safety wire hole diameter is between 0.045 in. (1.143 mm) and 0.062 in. (1.575 mm) in diameter.

TWIST PER INCH					
SAFETY WIRE DIA. INCH	LESS THAN 0.019	0.019 TO 0.026	0.023 TO 0.042	0.043 TO 0.065	MORE THAN 0.065
Twist/Inch	11 to 14	9 to 12	7 to 10	5 to 8	4 to 7

Lockwire Material Specification

NASM20995()	
CRES	C
MONEL	NC
INCONEL	N
Copper	CY

B. Consumable Materials

Reference	Description	Specification
G01912	Lockwire - MS20995NC32, Monel - 0.032 Inch (0.8128 mm) Diameter	NASM20995
G02479	Lockwire - MS20995CY20, Copper - 0.020 Inch (0.508 mm) Diameter	NASM20995
G50307	Lockwire - Nickel Alloy (CRES) Inconel 600, 0.025inch (0.64mm) Diameter	MS9226-03

C. Install the Lockwire, Cotter Pins, and Lockrings

SUBTASK 20-10-23-800-001

- (1) Use these types of wires for lockwire:
- (a) Use monel MS20995NC32 lockwire, G01912, inconel lockwire, G50307, or corrosion-resistant lockwire, G50307 in high temperature areas.
 - (b) Use copper MS20995CY20 lockwire, G02479, on emergency equipment only.
NOTE: Use it where a seal is necessary on emergency equipment to show no person has used the equipment. Emergency equipment includes portable fire extinguishers, first aid kits, emergency valve, and oxygen regulators.
 - (c) Use Clad 5056 aluminum alloy wire for lockwire that touches magnesium to prevent galvanic corrosion.
 - (d) This table shows BAC standard wire sizes.

Table 401/20-10-23-993-802

BAC Standard Wire Sizes	
MATERIAL	SIZE (INCH)
Monel or Inconel	0.020 in. (0.508 mm)
	0.032 in. (0.813 mm)
	0.040 in. (1.016 mm)
	0.051 in. (1.295 mm)
	0.091 in. (2.311 mm)

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Table 401/20-10-23-993-802 (Continued)

BAC Standard Wire Sizes	
MATERIAL	SIZE (INCH)
Corrosion Resistant Steel	0.020 in. (0.508 mm)
	0.032 in. (0.813 mm)
	0.040 in. (1.016 mm)
	0.051 in. (1.295 mm)
	0.091 in. (2.311 mm)
Aluminum Alloy	0.020 in. (0.508 mm)
	0.032 in. (0.813 mm)
	0.040 in. (1.016 mm)
	0.051 in. (1.295 mm)
	0.091 in. (2.311 mm)

SUBTASK 20-10-23-420-001

- (2) Use these steps to install lockwire to bolts and screws:
- On all fittings where you install lockwire, attach the fitting to the mating part or an adjacent part.
 - Install lockwire for right threads as shown in (Figure 401).
 - Install lockwire for left threads opposite to that shown in (Figure 401).
 - Make sure the loop of double wire goes around, not above, the head of the bolt or screw.



CAUTION

NEVER LOOSEN OR TIGHTEN A NUT OR BOLT OUT OF ITS SPECIFIED TORQUE RANGE. DAMAGE CAN OCCUR.

- When you install lockwires on nuts and bolts, tighten the nuts and bolts to the low values of the torque range.

NOTE: If necessary, continue to tighten until a slot aligns with the safety hole.

SUBTASK 20-10-23-420-002

- (3) To install lockwire on electrical connectors, (Figure 402).
- Use the instructions for the installation of lockwires to bolt and screws when you install lockwires on electrical connectors, (Figure 401).

SUBTASK 20-10-23-420-003

- (4) To install cotter pins (Figure 403), do the applicable step:
- To install cotter pins in castellated nuts, install the pin with the head parallel to the slot in the nut.
 - Bend the cotter pin ends to the bolt end or to the castellated nut's slit adjacent to the pin end.
 - To install cotter pins and washers on clevis pins, put the pin through the hole on the bolt and bend the pin ends around the side of the bolt.
 - To install cotter pins in non-castellated nuts, install the pin through the hole on the bolt and bend the pin ends back on each side of the bolt approximately 90 degrees.

SUBTASK 20-10-23-420-004

- (5) To install lock rings (Figure 403), do these steps:

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- (a) Put the bent hook of the lock ring into an aligned locking hole in the shaft and nut but do not spring the ring.
- (b) Move the lock ring over the flange into the groove with minimum expansion of the lock ring.

————— END OF TASK —————

TASK 20-10-23-000-802

4. Safety Cable Removal

A. Remove the Safety Cable

SUBTASK 20-10-23-020-004

- (1) Cut and remove the safety cable.

————— END OF TASK —————

TASK 20-10-23-420-805

5. Safety Cable Installation

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2046	Tool - Installation, Safety Cable, 0.032 Inch Dia, 5 Inch Tool Nose Part #: BM325 Supplier: 70958 Opt Part #: M305 Supplier: 70958
COM-2048	Tool - Installation, Safety Cable, 0.020 Inch Dia Part #: BM203 Supplier: 70958 Part #: SCT203 Supplier: 11851 Part #: SCT207 Supplier: 11851

B. Install the Safety Cable

SUBTASK 20-10-23-800-002

- (1) The use of corrosion and heat resistant safety cable is acceptable in place of safety wire only if specified by engineering documents.
- (2) A maximum of 3 fasteners can be safety-cabled together in series.
- (3) The maximum space between fasteners to be safety-cabled together must not exceed 6 inches.
- (4) Nicks, frays, kinks and other mutilations of the safety cable between tension points are not acceptable. The safety cable shall be installed so that the only tension imposed on the cable is from the safety cable installation tool, COM-2048, safety cable installation tool, COM-2046.
- (5) Maximum hole diameter shall be in accordance with this table.

Maximum Cable Hole Diameters

CABLE DIAMETER	MAX HOLE DIAMETER
0.020 in. (0.508 mm) to 0.026 in. (0.660 mm)	0.035 in. (0.889 mm)
0.032 in. (0.813 mm) to 0.038 in. (0.965 mm)	0.080 in. (2.032 mm)
0.040 in. (1.016 mm) to 0.046 in. (1.168 mm)	0.080 in. (2.032 mm)

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- (6) Safety cable must meet the flex requirements of this table.

Safety Cable Flex Limits

Space Between Fastener	Maximum Flex at Center
0.0 in. (0.0 mm) to 0.5 in. (12.7 mm)	0.125 in. (3.175 mm)
0.5 in. (12.7 mm) to 1.0 in. (25.4 mm)	0.250 in. (6.350 mm)
1.0 in. (25.4 mm) to 2.0 in. (50.8 mm)	0.375 in. (9.525 mm)
2.0 in. (50.8 mm) to 3.0 in. (76.2 mm)	0.375 in. (9.525 mm)
3.0 in. (76.2 mm) to 4.0 in. (101.6 mm)	0.500 in. (12.700 mm)
4.0 in. (101.6 mm) to 5.0 in. (127.0 mm)	0.500 in. (12.700 mm)
5.0 in. (127.0 mm) to 6.0 in. (152.4 mm)	0.625 in. (15.875 mm)

- (7) Correctly crimped ferrules have a general triangular shape. The die indentation must extend a minimum length from the outer end of the ferrule as specified in this table.

Minimum Die Indentation Length

Cable Diameter	Minimum Extension
0.032 in. (0.813 mm), 0.040 in. (1.016 mm)	0.10 in. (2.54 mm)
0.020 in. (0.508 mm)	0.075 in. (1.905 mm)

- (a) The cut cable shall extend a maximum of .06 inch beyond the installed ferrule.

———— **END OF TASK** ————

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RIG PINS - MAINTENANCE PRACTICES

1. General

- A. This procedure has one task:
- (1) Rig pin maintenance practices.

TASK 20-10-24-910-801

2. Rig Pin Maintenance Practices

A. General

- (1) This procedure gives a list of rig pin sets with a list of the rig pins contained in each set.
- (2) The list gives:
 - (a) Rig pin number.
 - (b) Assembly number.
 - (c) Rig pin part number (P/N).
 - (d) Rig pin size (diameter and length).
- (3) The rig pin numbers include letter prefixes that tell where you can use a rig pin (Table 201).

Table 201/20-10-24-993-801

Table I Rig Pin Prefix		
AMM Rig Pin Prefix	Nomenclature	ATA No.
D1,D2,D3	Passenger Entry Door	52-11, 52-12
E1,E2,E3	Elevator Control	27-31
LCD1,LCD2,LCD3,LCD4	Large Cargo Door	52-34,52-37
LDG1	Nose Landing Gear Ext/Ret System	32-34
LGB1,LGB2,LGB3,LGB4	Landing Gear Brake	32-41
LGE1,LGE2	Landing Gear Extension	32-32
LGU1,LGU2	Landing Gear Uplock	32-32
NS1,NS2,NS3,NS4 NS5,NS6,NS7	Nose Gear Steering	32-51
R1,R2,R3,R4,R5	Rudder Control	27-21
SCD1,SCD2,SCD3, SCD4,SCD5,SCD6	Small Cargo Door	52-35
SP1,SP2,SP3,SP4, SP5,SP6,SP7	Spoiler and Speed Brake	27-61
ST1,ST2,ST3,ST4, ST5,ST6,ST7	Horizontal Stab	27-41

B. Procedure

SUBTASK 20-10-24-480-001

- (1) Use the correct rig pin for the application (Table 202).

Table 202/20-10-24-993-803

RIG PIN SET J20003			RIG PIN SIZE	
			LENGTH	DIAMETER
RIG PIN NUMBER	ASSEMBLY NUMBER	RIG PIN P/N	± 0.06 inch	+0.00-0.002 inch

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Table 202/20-10-24-993-803 (Continued)

	RIG PIN SET J20003		RIG PIN SIZE	
D1, D2	J20003-6	J20003-22	3.75	0.248
D3	J20003-11	J20003-27	6.00	0.311
E1, E2, E3	J20003-11	J20003-27	6.00	0.311
LCD1, LCD2	J20003-2	J20003-18	3.00	0.186
LCD3, LCD4	J20003-3	J20003-19	6.75	0.186
LDG1	J20003-6	J20003-22	3.75	0.248
LGB1, LGB2	J20003-8	J20003-24	3.25	0.311
LBG3, LBG4	J20003-10	J20003-26	5.00	0.311
LGE1, LGE2	J20003-7	J20003-23	4.50	0.248
LGU1, LGU2	J20003-6	J20003-22	3.75	0.248
NS1, NS2	J20003-8	J20003-24	3.25	0.311
NS3	J20003-12	J20003-28	7.75	0.311
NS4	J20003-11	J20003-27	6.00	0.311
NS5	J20003-10	J20003-26	5.00	0.311
NS6	J20003-12	J20003-28	7.75	0.311
NS7	J20003-35	J20003-37	2.50	0.311
R1, R2	J20003-15	J20002-31	12.00	0.311
R3	J20003-12	J20003-28	7.75	0.311
R4, R5	J20003-14	J20003-30	11.00	0.311
SCD1, SCD2	J20003-8	J20003-24	3.25	0.311
SCD3, SCD4	J20003-9	J20003-25	4.50	0.1875±0.001
SCD5	J20003-5	J20003-21	4.50	0.1250±0.001
SCD6	J20003-4	J20003-20	4.50	0.311
SP1, SP2, SP5, SP6, SP7	J20003-11	J20003-27	6.00	0.311
SP3, SP4	J20003-16	J20003-32	13.25	0.311
ST1, ST2, ST5, ST6, ST7	J20003-10	J20003-26	5.00	0.311
ST3, ST4	J20003-13	J20003-29	9.00	0.311

————— END OF TASK —————

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FLOOR PANEL PROTECTION - MAINTENANCE PRACTICES

1. General

- A. This procedure tells you how to prevent damage to floor panels caused by the legs of ladders, stands, or other scaffolding equipment.
- B. Always obey this procedure when the legs have sharp edges, rollers, or screws on the surface that holds the weight.
- C. Always obey this procedure if each leg has a surface area that is less than eight square inches.

TASK 20-10-25-940-801

2. Floor Panel Damage Prevention During Maintenance

A. To prevent possible damage to floor panels during maintenance, do these steps:

SUBTASK 20-10-25-980-001

- (1) Let only one person at a time use the ladder, stand, or scaffolding.

SUBTASK 20-10-25-820-001

- (2) Use plywood bearing pads that are a minimum of 0.5 in. (1.3 cm) thick and 1 ft² (929.0 cm²) under each leg, if you have these conditions:
 - (a) You use ladders, stands, or scaffolding with leg-bearing surfaces. Leg-bearing surfaces include rollers, screws, and sharp edges.
 - (b) You have a leg-bearing surface of less than 8 in² (51.6 cm²) for each leg.

———— **END OF TASK** ————

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HEAT DEVICES - MAINTENANCE PRACTICES

1. General

- A. This procedure contains one task:
- (1) Precautions for Heat Devices.

TASK 20-10-26-910-801

2. Precautions for Heat Devices

A. General

- (1) This procedure has the minimum recommended safety procedures for the operation of heat guns, soldering guns, soldering irons, and other heat devices.
- (2) You must also obey the regulations of your airline and local agencies.
- (3) In this procedure heat guns, soldering guns, and soldering irons are referred to as heat devices.
- (4) We recommend you use crimped splices and sleeves with nylon ties in areas that could have flammable fumes.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1768	Alarm - Combustible Gas and Oxygen
	Opt Part #: 1314 Supplier: 51906
	Opt Part #: 1314 SMPN Supplier: 51906
	Opt Part #: 476149 Supplier: 8F723
	Opt Part #: 711409 Supplier: 8F723
	Opt Part #: 72-0026-49 Supplier: 0HTS3
	Opt Part #: 72-6201-10 Supplier: 51906
	Opt Part #: 72-6201-11 Supplier: 51906

C. Precautions

SUBTASK 20-10-26-880-001

 WARNING	DO NOT USE HEAT DEVICES NEAR FLAMMABLE FLUIDS OR FUMES. HEAT OR SPARKS FROM HEAT DEVICES CAN CAUSE EXPLOSIONS AND FIRES. EXPLOSIONS AND FIRES CAN CAUSE INJURY.

- (1) Use heat devices only in safe areas.
 - (a) Do not use heat devices in areas that are less than 100 ft (30.48 m) from the airplane if these conditions are present:
 - 1) Airplane fueling
 - 2) Airplane defueling
 - 3) The fuel tanks are open.
 - (b) Do not use heat devices in areas where smoking is not permitted.

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D. How to Measure Fume Levels

SUBTASK 20-10-26-750-001



WARNING

DO NOT USE HEAT DEVICES NEAR FLAMMABLE FLUIDS OR FUMES. HEAT OR SPARKS FROM HEAT DEVICES CAN CAUSE EXPLOSIONS AND FIRES. EXPLOSIONS AND FIRES CAN CAUSE INJURY.

- (1) Measure the fumes:
 - (a) Use the combustible gas and oxygen alarm, COM-1768 or combustible gas and oxygen alarm, COM-1768 to measure the fume level.

NOTE: The following conditions can occur.

 - 1) A liquid fuel or fume source is near.
 - 2) The local fuel fume level are high or the ventilation is not sufficient.
 - (b) Make sure the fuel fume levels are at zero.
 - (c) Continue to monitor the fume levels during the repair.
 - (d) Keep a good flow of air in the fuel tanks.

NOTE: You can make the fuel tanks safe if you fill the fuel tanks with nitrogen.

E. How to Keep the Area Safe

SUBTASK 20-10-26-800-001

- (1) If it is possible for other persons to move flammable fluids into the area, obey these steps:
 - (a) Do not use a possible ignition source near open fuel tanks, fuel vents, or fuel leaks where fume concentrations cannot be known or controlled.
 - (b) Make sure a person monitors the work area.

NOTE: A person who can measure the risk of the repair to be done must identify the emergency or fire fighting equipment necessary at the work area of the repair. The person must be authorized to monitor airplane fire safety.
 - (c) Do not start or continue to do work on a fuel system component while equipment that can cause the fuel to burn is near.
 - (d) Keep the number of maintenance and safety persons included to a minimum.

————— END OF TASK —————

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PERSONNEL EQUIPMENT SHOCK ABSORBING LANYARD (SAFETY HARNESS) - MAINTENANCE PRACTICES

1. General

- A. This procedure has one task.
 - (1) Attach personnel equipment shock absorbing lanyard (safety harness) to flight control and nacelle surfaces.
- B. There are three safety harness attachment receptacles on the wing top surface, three on the horizontal stabilizer top surface, and two on the engine nacelle surface.
- C. Maintenance persons will attach their safety harness to these receptacles during repair or inspection of these surfaces.

TASK 20-10-27-400-801

2. Attach Flight Control and Nacelle Surfaces Personnel Equipment Shock Absorbing Lanyard (Figure 201)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1578	Equipment - Personnel safety, Horizontal Stabilizer Part #: J20004-1 Supplier: 81205
SPL-1580	Equipment - Personnel, Upper Wing Shock Absorbing Lanyard Part #: J20005-17 Supplier: 81205
SPL-5018	Wrench - Spanner, Safety Lanyard Tiedown Receptacle Part #: G20015-1 Supplier: 81205 Opt Part #: 2ME65B00002 Supplier: 81205
SPL-8818	Equipment - Personnel, Engine Strut Shock Absorbing Lanyard Part #: J20006-24 Supplier: 81205

B. Procedure

SUBTASK 20-10-27-840-001

- (1) Set up the safety equipment
 - (a) Put on the full-body safety harness.
 - (b) Attach the hook end of the lanyard to the body harness.
 - 1) Use this equipment as necessary:
 - a) safety equipment, SPL-1578
 - b) upper wing shock absorbing lanyard equipment, SPL-1580
 - c) engine strut shock absorbing lanyard personnel equipment, SPL-8818
 - (c) Attach the opposite end of the lanyard to the anchor fitting in the attachment receptacle on the surface you are working.
 - (d) Adjust the anchor fitting until it is aligned with the airplane skin.

NOTE: If the fitting is not aligned, it will not hold the designed load.

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- 1) Use a spanner wrench, SPL-5018 to adjust the receptacles.

NOTE: The receptacle must be adjusted until flush with the skin on the wing and stabilizer, otherwise the lanyard attachment may not engage properly.

———— **END OF TASK** ————

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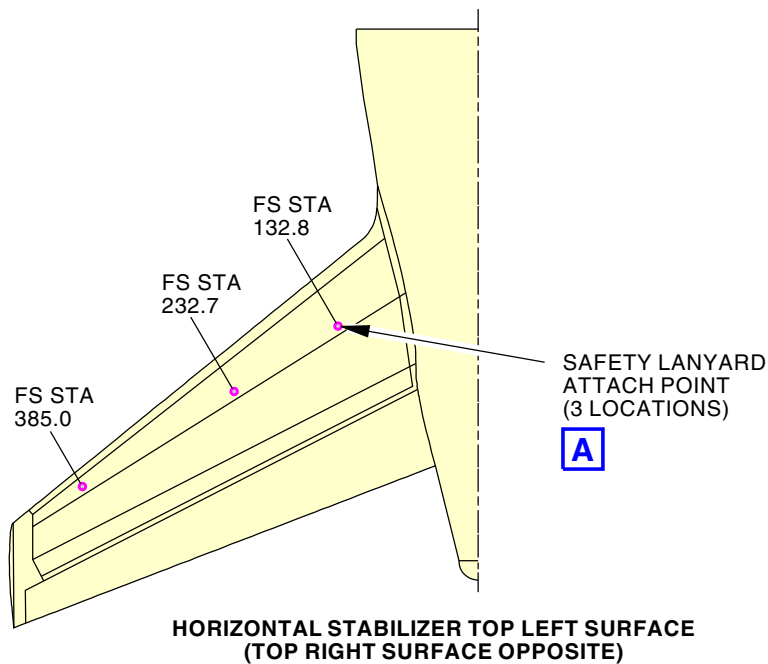
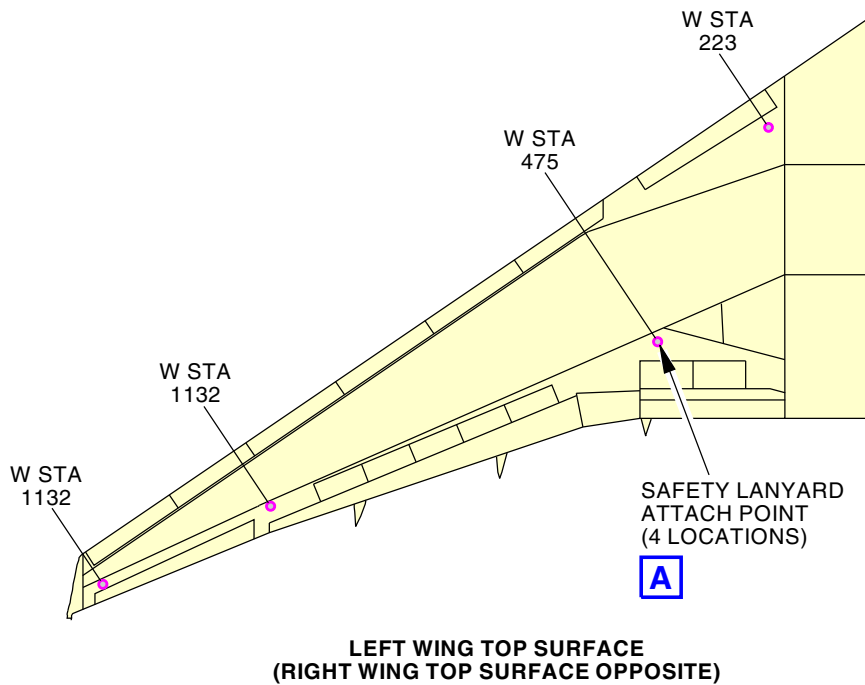
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Flight Control Surfaces Safety Lanyard Attach Points
Figure 201/20-10-27-990-801 (Sheet 1 of 3)

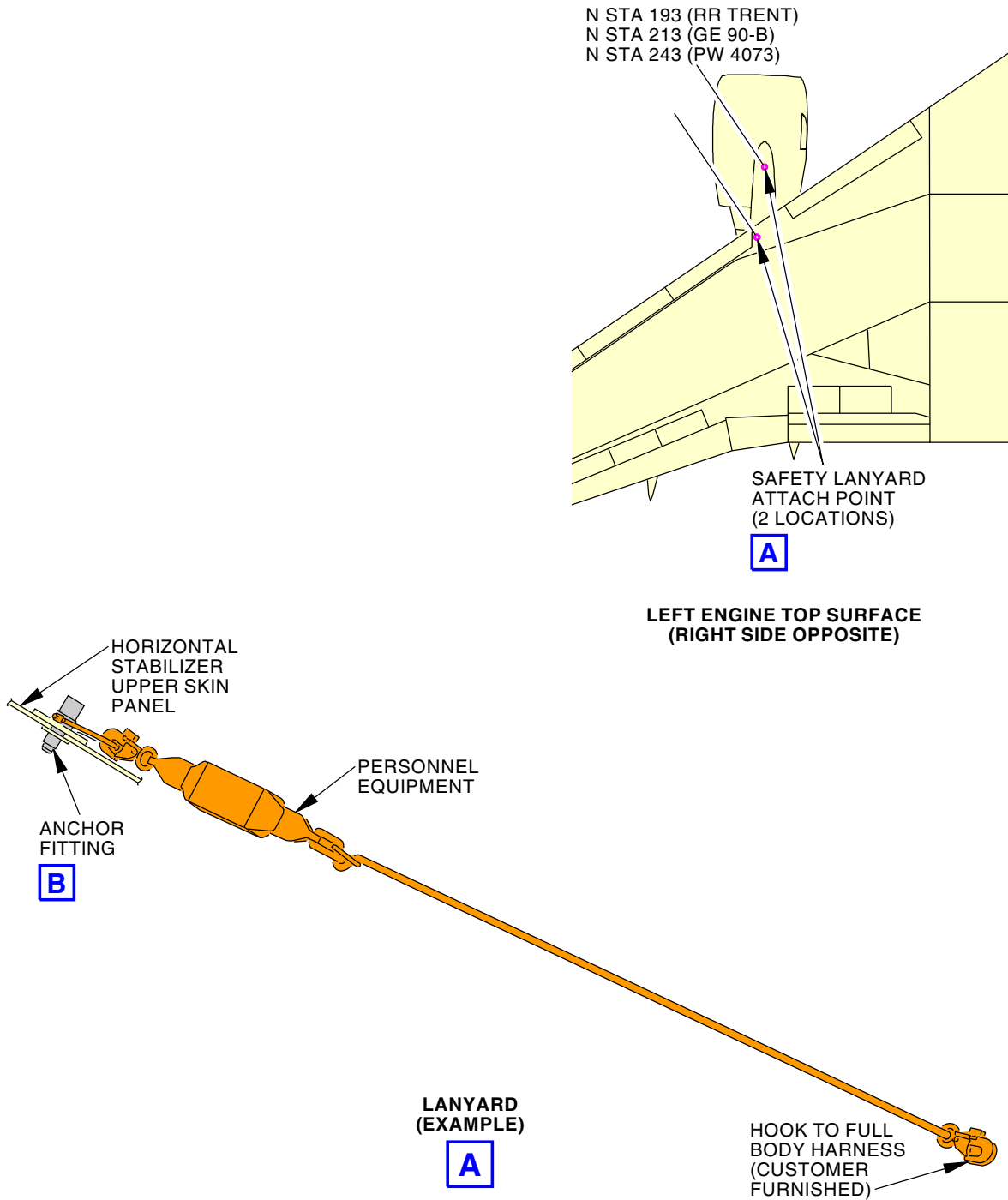
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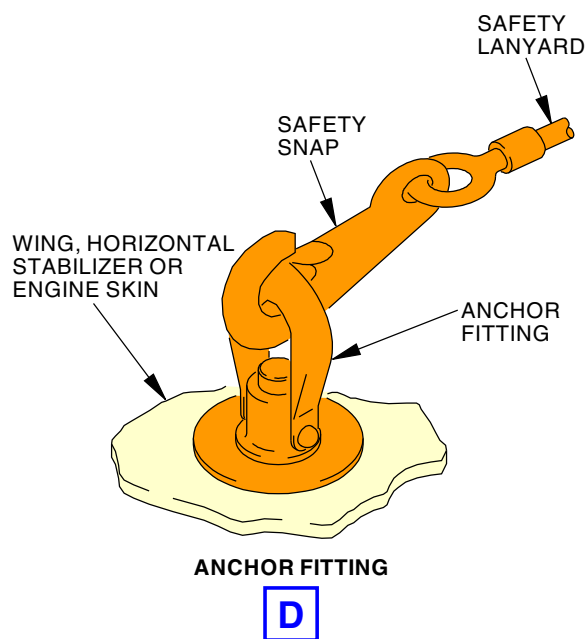
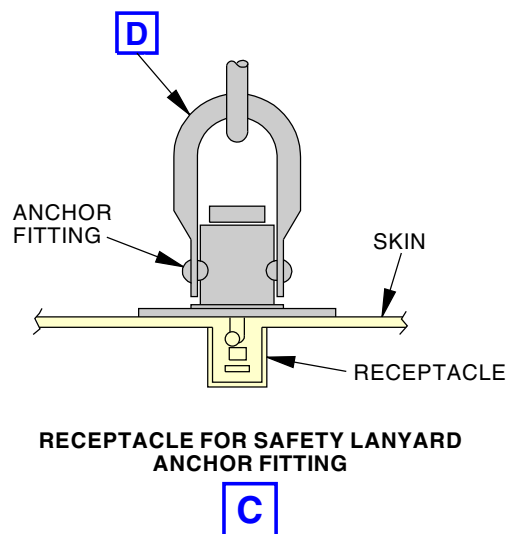
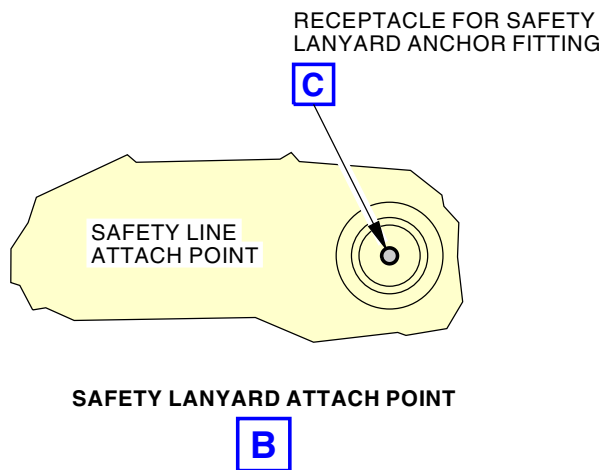
Flight Control Surfaces Safety Lanyard Attach Points
Figure 201/20-10-27-990-801 (Sheet 2 of 3)

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**Flight Control Surfaces Safety Lanyard Attach Points
Figure 201/20-10-27-990-801 (Sheet 3 of 3)**

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TASK 20-10-27-400-802

3. Horizontal Stabilizer Vacuum Arrest System

A. General

- (1) This procedure is to install the vacuum arrest system to the horizontal stabilizer.
- (2) Do not place the vacuum pads on any non-metallic or bonded structure, included aluminum honeycomb bonded panels.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-12524	Equipment - Personnel, Vacuum Pad - Flightline Kit
	Part #: 15701-00 Supplier: U6418
	Part #: 15701-01 Supplier: U6418
	Part #: 15702-00 Supplier: U6418
	Part #: 15702-02 Supplier: U6418

C. Procedure

SUBTASK 20-10-27-480-001

- (1) Install the vacuum pad flightline kit, COM-12524.
 - (a) Install the vacuum pads in the area identified in Figure 202.
 - (b) Make sure that the energy absorber is in place.
 - (c) Make sure there are no slack ropes at the edges.
 - (d) Make sure there are no missing fasteners, temporary fasteners, or fastener removals in the locations that follow.
 - 1) Within 30 in. (762 mm) of the edge of any vacuum pad.
 - 2) At upper stringer to upper rib chord bolt locations at the adjacent internal stabilizer rib locations.
 - a) This includes any rib directly beneath the pad location and one rib inboard and outboard of the vacuum pad location.
 - 3) Make sure that the vacuum pads are located away from panel edges.
 - 4) Make sure that vacuum pads are not placed over splice joints or access panels.

NOTE: This is to maintain vacuum integrity.

SUBTASK 20-10-27-800-001

- (2) Put on the full body safety harness.

SUBTASK 20-10-27-480-002

- (3) Attach the hook end of the vacuum pad assembly to the body harness.

————— **END OF TASK** —————

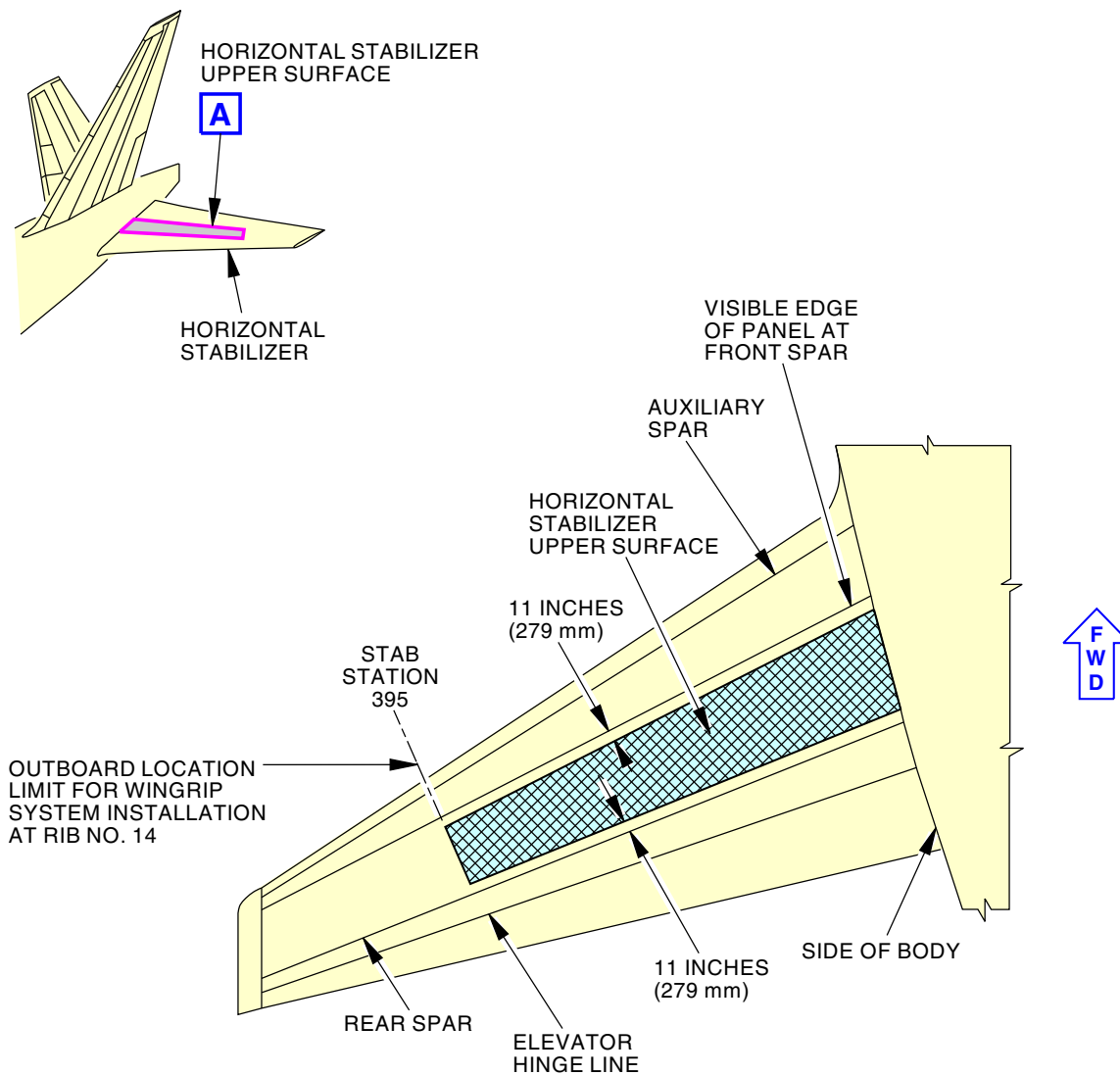
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HORIZONTAL STABILIZER UPPER SURFACE

A



WINGRIP SYSTEM INSTALLATION AREA (PADS MUST NOT BE CLOSER THAN 11 INCHES (279 mm) FROM THE VISIBLE EDGE OF THE HORIZONTAL STABILIZER SKIN PANEL ALONG THE FRONT AND REAR SPARS).

2156311 S0000471728_V2

**Vacuum Arrest System Usage - Horizontal Stabilizer
Figure 202/20-10-27-990-802**

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TASK 20-10-27-400-803

4. Wing Upper Surface Vacuum Arrest System

A. General

- (1) This procedure is to install the vacuum arrest system to the wing upper surface.
- (2) Do not place the vacuum pads on any non-metallic or bonded structure, including aluminum honeycomb bonded panels.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-12523	Equipment - Personnel, Upper Wing - Vacuum Pad - Lifeline Kit Part #: 15705-00 Supplier: U6418
COM-12524	Equipment - Personnel, Vacuum Pad - Flightline Kit Part #: 15701-00 Supplier: U6418 Part #: 15701-01 Supplier: U6418 Part #: 15702-00 Supplier: U6418 Part #: 15702-02 Supplier: U6418

C. Procedure

SUBTASK 20-10-27-480-003

- (1) Install the vacuum pad lifeline kit, COM-12523 or vacuum pad flightline kit, COM-12524.
 - (a) Install the vacuum pads in the area identified in Figure 203.
 - (b) Make sure that the energy absorber is in place.
 - (c) Make sure there are no slack ropes at the edges.
 - (d) Make sure there are no missing fasteners, temporary fasteners, or fastener removals in the locations that follow.
 - 1) Within 30 in. (762 mm) of the edge of any vacuum pad.
 - 2) At upper stringer to upper rib chord bolt locations at the adjacent internal wing rib locations.
 - a) This includes any rib directly beneath the pad location and one rib inboard and outboard of the vacuum pad location.
 - 3) Make sure the vacuum pads are at least 12 in. (305 mm) from the panel visible edges at the front and rear spars.
 - 4) Make sure that vacuum pads are not placed over splice joints or access panels.

SUBTASK 20-10-27-800-002

- (2) Put on the fully body safety harness.

SUBTASK 20-10-27-480-004

- (3) Attach the hook end of the vacuum pad assembly to the body harness.

————— **END OF TASK** —————

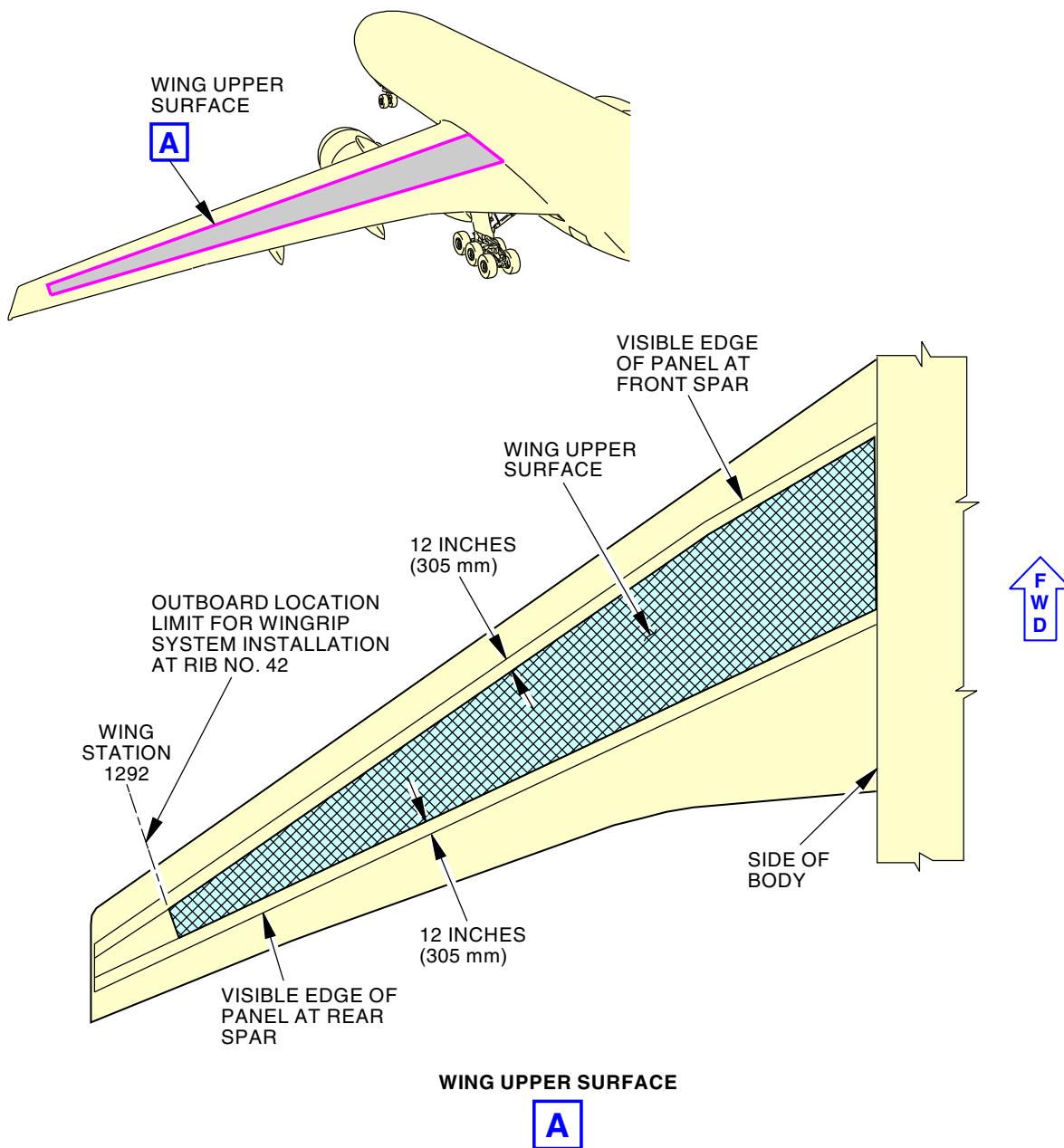
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WINGRIP SYSTEM INSTALLATION AREA (PADS MUST NOT BE CLOSER THAN 12 INCHES (305 mm) FROM THE VISIBLE EDGE OF THE WING SKIN PANELS ALONG THE FRONT AND REAR SPARS).

2156352 S0000471733_V2

Vacuum Arrest System Usage - Wings Figure 203/20-10-27-990-803

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LUBRICATION FITTINGS - SERVICING

1. General

- A. This procedure contains this task.
- (1) A temporary lubrication for blown-out lubrication fittings.

TASK 20-10-29-600-801

2. Temporary Lubrication of Blown Out Lubrication Fittings

A. General

- (1) This task contains temporary lubrication instructions for lubrication fittings that were blown out.
- (2) This procedure is only to be used in the event that a grease fitting has been blown out and the maintenance to repair the fitting is inconvenient, but lubrication is necessary to continue service.
- (a) This procedure is only a temporary and should only be used until the fitting can be conveniently repaired or replaced.

B. References

Reference	Title
20-30-04-910-801	Structure Lubricants (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-7616	Adapter - Rubber Tipped Part #: LX-1418 Supplier: \$1273 Opt Part #: B411 Supplier: 0FKM1
STD-438	Gun - Grease

D. Procedure

SUBTASK 20-10-29-010-001

- (1) Gain access to the blown-out lubrication fitting(s).

SUBTASK 20-10-29-940-001

- (2) Using the applicable grease gun, STD-438 and the proper grease for the location, attach the rubber tipped adapter, COM-7616 to the grease gun, STD-438.
- (a) Refer to Structure Lubricants, TASK 20-30-04-910-801 for a list of appropriate lubricants for the area.

SUBTASK 20-10-29-940-002

- (3) Press the rubber tipped adapter, COM-7616 firmly against the opening where the lubrication fitting was blown out.

SUBTASK 20-10-29-640-001

- (4) Gently pump the grease into the fitting opening, making sure that the rubber tipped adapter, COM-7616 remains firmly seated against the opening.

SUBTASK 20-10-29-140-001

- (5) Clean up any excess grease.

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SUBTASK 20-10-29-410-001

(6) Close any panels opened for access.

SUBTASK 20-10-29-840-003

(7) Return the aircraft to normal.

————— **END OF TASK** —————

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LUBRICATION FITTINGS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
- (1) A removal of the lubrication fitting.
 - (2) An installation of the lubrication fitting.
- B. This procedure contains the installation instructions for a lubrication fitting (press-in type).

TASK 20-10-29-000-801

2. Lubrication Fitting Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-29-020-001

- (1) Remove damaged or broken lubrication fittings.

SUBTASK 20-10-29-160-003

- (2) Clean the area before installing a new fitting.

————— **END OF TASK** —————

TASK 20-10-29-420-801

3. Lubrication Fitting Installation

(Figure 401)

A. General

- (1) This task contains instructions for the installation of new lubrication fittings and lubrication fittings that were blown out.

B. References

Reference	Title
20-30-89-910-801	Final Cleaning of Solvent Sensitive Organic Coatings Prior to Non-structural Bonding (Series 89) (P/B 201)

C. Consumable Materials

Reference	Description	Specification
A00026	Compound - Sealing, Locking And Retaining, Single Component	ASTM D5363
A50086	Primer - Loctite 7471 Primer T Activator	
B01009	Solvent - Final Cleaning Of All Organic Ctgs Before Non-Structural Bonding - Series 89	
G00262	Nitrogen - Liquid	A-A-59503 Type II, MIL-PRF-27401 Type II
G01659	Swab - Cotton Or Rayon, (Disposable)	

D. Procedure

SUBTASK 20-10-29-840-001

- (1) Get an applicable standard fitting to install in the hole.

SUBTASK 20-10-29-160-001

- (2) Do these steps to clean the lubrication fitting hole:

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- (a) Use swab, G01659 to remove as much grease as possible from the inner surface of the lubrication fitting hole.
- (b) Clean the hole to a depth of at least 0.5 in. (1.27 cm) with Series 89 solvent, B01009 (Final Cleaning of Solvent Sensitive Organic Coatings Prior to Non-structural Bonding (Series 89), TASK 20-30-89-910-801) on a clean cotton swab.
- (c) Clean the hole until you can see no more grease or dirt removed from the hole.

SUBTASK 20-10-29-420-001



MAKE SURE YOU USE THE CORRECT TOOL TO INSTALL THE LUBRICATION FITTING. MOVE THE FITTING IN A STRAIGHT LINE TO PREVENT DAMAGE TO THE MATING PART.

- (3) Use a drive tool to install the lubrication fitting.

E. Procedure (For Blown-Out Fittings)

SUBTASK 20-10-29-840-002

- (1) Get a special approved or an oversized fitting to install in the hole.

SUBTASK 20-10-29-160-002

- (2) Do these steps to clean the lubrication fitting hole:
 - (a) Use swab, G01659 to remove as much grease as possible from the inner surface of the lubrication fitting hole.
 - (b) Clean the hole to a depth of at least 0.5 in. (1.27 cm) with Series 89 solvent, B01009 (TASK 20-30-89-910-801) with a clean swab, G01659.
 - (c) Clean the hole until you can see no more grease or dirt removed from the hole.

SUBTASK 20-10-29-390-001

- (3) Do these steps to apply the primer:
 - (a) Use swab, G01659 to apply a thin layer of Loctite 7471 Primer T Activator, A50086 to the inner diameter of the hole.
 - (b) Let the primer air dry at approximately 68°F (20°C) for at least five minutes before you apply the retainer compound, A00026.

SUBTASK 20-10-29-420-002



DO NOT APPLY TOO MUCH ADHESIVE ON THE FITTING AND THE PART IT CONNECTS TO. TOO MUCH ADHESIVE ON THE FITTING WILL CAUSE A BLOCKAGE TO THE LUBRICATION PASSAGES AND CAUSE DAMAGE TO EQUIPMENT.

- (4) Do these steps to install the lubrication fitting:
 - (a) Use swab, G01659 to apply a thin layer of adhesive compound, A00026 to the inner diameter of the hole (between 0.25 in. (6.35 mm) and 0.4 in. (10.16 mm) in depth).
 - (b) Put the lubrication fitting into nitrogen, G00262 for at least one minute to make sure the fitting is fully cool.

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CAUTION

MAKE SURE YOU USE THE CORRECT TOOL TO INSTALL THE LUBRICATION FITTING. MOVE THE FITTING IN A STRAIGHT LINE TO PREVENT DAMAGE TO THE MATING PART.

- (c) Use a drive tool to install the lubrication fitting.

NOTE: Install the lubrication fitting into the hole in the mating part immediately. If you do not install the fitting immediately it will become too warm.

- (d) Let the lubrication fitting cure for 12 hours at approximately 68°F (20°C) before you use it.

———— **END OF TASK** ————

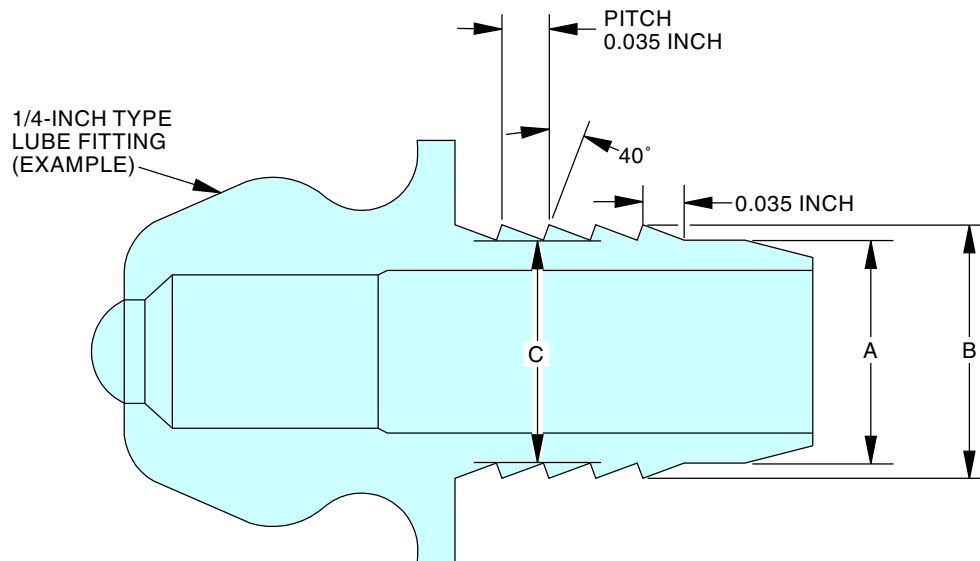
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LUBE HOLE DIA (X) (INCHES)	LUBE FITTING DIA (INCHES)
0.194 MAX	3/16 1
0.195-0.247	1/4 MODIFIED 1
0.248-0.249	1/4 2
0.250-0.254	1/4 1

NOTE:

DESIGN LUBE HOLE DIA IS 0.188/0.189 INCH.

ALL DIMENSIONS ARE IN INCHES
X (NOT SHOWN) = HOLE DIA IN MATING COMPONENT
A = SHANK DIA (X MINUS 0.007/0.012)
B = SERRATION OD (X PLUS 0.005/0.010)
C = SERRATION ROOT OD (X MINUS 0.003/0.010)

- 1 INSTALL WITH ADHESIVE
- 2 INSTALLATION WITH ADHESIVE OPTIONAL

C80490 S0006402545_V2

Lubrication Fitting Modification and Installation Figure 401/20-10-29-990-801

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**SEALS ON OPEN ELECTRICAL TERMINALS IN FLAMMABLE LEAKAGE ZONES - MAINTENANCE
PRACTICES**

1. General

- A. This procedure has this task:
- (1) The task is to seal the uninsulated electrical terminals and connections in the flammable leakage zones.
- B. When you replace or install components on the lighting systems in flammable leakage zones, seal the following uninsulated items:
- (1) Lamp terminals.
NOTE: Lamp terminals with a rubber sleeve are open.
 - (2) Terminal strips.
 - (3) Circuit breakers.
 - (4) Transformers.
 - (5) Switches.
 - (6) Hardwire.
 - (7) Wire junctions.
- C. Do not seal the dual grounds in the flammable leakage zones or the wire junctions in fuel tanks.
- D. Do not seal the generator terminals on the engines or APU.
- E. Install wire and protectors on all secondary switch leads and seal all secondary switch terminals in the flammable leakage zones. Insulated splices are not open.

TASK 20-10-31-390-801

2. Seal the Unprotected Terminals

A. References

Reference	Title
SWPM 20-30-00	ELECTRICAL CONNECTION OF EQUIPMENT AND INSTALLATION OF TERMINAL LUGS

B. Tools/Equipment

Reference	Description
STD-1080	Brush - Paint

C. Consumable Materials

Reference	Description	Specification
B00083	Solvent - VM&P Naphthas	TT-N-95 Type II, ASTM D-3735 Type III
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

D. Procedure

SUBTASK 20-10-31-110-001

- (1) Remove all dirt and grease for a minimum of 1.00 in. (25.40 mm) adjacent to the area you will seal.
 - (a) Use a cotton wiper, G00034 moist with solvent, B00083.

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SUBTASK 20-10-31-390-001



CAUTION

DO NOT SEAL THE SHANK OF LAMP TERMINALS THAT ARE MOVABLE SPRING-LOADED PART OF THE BAYONET LAMP SOCKET BASE. SEAL ONLY THE TERMINAL END AND ATTACHED HARDWARE. SEALANT ON THE SHANK LIMITS MOVEMENT OF THE LAMP CONTACT.

- (2) Use a paint brush, STD-1080 to apply one layer of sealant to the uninsulated areas.
 - (a) Refer to SWPM 20-30-00, Protection of Electrical Connections in a Flammable Leakage Zone, for approved sealants.

SUBTASK 20-10-31-390-002

- (3) On ring tongue terminals, apply sealant as follows:
 - (a) Apply sealant to the uninsulated parts of the terminal (Figure 201).

———— **END OF TASK** ————

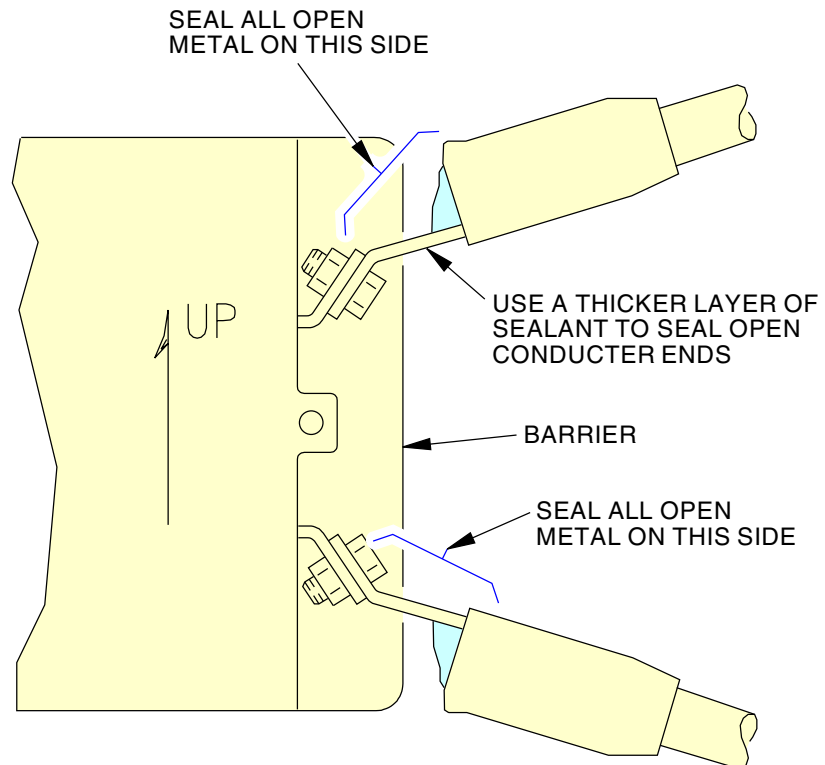
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Sealant Installation on Ring Tongue Terminals
Figure 201/20-10-31-990-802

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COAXIAL CABLE - MAINTENANCE PRACTICES

1. General

- A. A time domain reflectometer, TDR, can be used to check coaxial cables. The TDR is used to locate opens, shorts, crimps and other defects in coax cables up to 2,000 feet long. The TDR can also be used on twisted pair or parallel wires which are the same length.
- B. The TDR transmits pulses of energy down the cable. The TDR then monitors the impedance changes in the pulse energy that is reflected back. You can see these reflections on the liquid crystal display (LCD). You then find failures in the cable from the properties of the waveform shown on the LCD.
- C. Use the time domain reflectometer, COM-5187, or the 3M Advanced System Tester 900AST Series TDR (optional), or the Tektronix Model 1502 TDR (optional) to inspect the coaxial cable.

TASK 20-10-32-210-801

2. Coaxial Cable Inspection

A. General

- (1) Use the time domain reflectometer, COM-5187, the 3M 900AST TDR (optional), or the Tektronix model 1502 TDR (optional) to test the coaxial cable.
- (2) Refer to the TDR instruction manual for information on how to test the coaxial cable.
 - (a) To do a check of a coaxial cable, you must disconnect the cable at each end. Connect the TDR to one end of the cable. You can assemble the adapter cables to connect the TDR to the cable. Use the applicable system wiring diagram to help isolate the failure to a specified connector, cable segment or black box.
 - (b) The TDR has a display to help you. Use the Instruction or Operation Manual for more data.
 - 1) The TDR front panel has these controls:
 - a) NOISE FILTER - uses noise-averaging to decrease the quantity of noise on the waveform.
 - b) VERT SCALE - sets the vertical sensitivity (millirho per division) or vertical gain (dB).
 - c) DIST/DIV - sets the number of feet (meters) for each division across the display.
 - d) Vp - velocity of propagation. You set these controls to the propagation velocity value of the cable.
 - e) POWER - pull for power on, push for power off.
 - f) ΔPOSITION - moves the waveform up or down on the display.
 - g) <>POSITION - moves the vertical cursor across the display. The waveform is also moved when the cursor gets to the far right or left side of the display.
 - h) VIEW INPUT - permits you to view or remove the waveform shown on the display.
 - i) VIEW DIFF - shows the result of the waveform shown minus the waveform in memory.
 - j) STORE - puts the waveform into memory.

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- (c) Vp is the speed of a signal down the cable. This value is different for different types of cables. If you do not know the Vp, refer to Table 201 for approximate values.
NOTE: If the Vp is set incorrectly, the failure will show but the distance will possibly not be accurate.
- (d) Bleed a cable before you attach it to the TDR to remove static from the cable. You can use a 50 ohm terminator and a BNC adapter to bleed a cable.
- (e) You can always see a rising pulse at the start of the waveform. This is the test pulse from the TDR.
- (f) During this procedure the cable that you do a check of will be referred to as the applicable cable.

B. References

Reference	Title
20-10-01-000-801	E/E Box Removal (P/B 401)
20-10-01-400-801	E/E Box Installation (P/B 401)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-5187	Reflectometer - Time Domain (TDR) Part #: 1205CXA Supplier: 93929 Part #: 1270A Supplier: 93929 Part #: 6021-5154 Supplier: 1UW81 Opt Part #: 1205 Supplier: 0GXM1 Opt Part #: 1270 Supplier: 0GXM1 Opt Part #: 1502C Supplier: 80009 Opt Part #: 900AST Supplier: 53387

D. Procedure

SUBTASK 20-10-32-860-001

- (1) Prepare the applicable cable and the TDR, time domain reflectometer, COM-5187:
 - (a) Pull the POWER button to the ON position.
 - (b) Connect an adapter cable to the BNC on the front panel of the TDR.
 - (c) Remove the black box at one end of the applicable cable, do this task: E/E Box Removal, TASK 20-10-01-000-801.
 - (d) Disconnect the applicable cable at the other end.



CAUTION

DO NOT TOUCH THE CONNECTOR PINS, OR OTHER CONDUCTORS. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE COMPONENTS.

- (e) Attach a breakout box to the rack connector were the black box was installed.

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CAUTION

DO NOT ATTACH LIVE CIRCUIT CABLES TO THE INPUT OF THE TDR. VOLTAGES MORE THAN 5 VOLTS CAN CAUSE DAMAGE TO THE SAMPLING GATE OR TUNNEL DIODE.

- (f) Connect the adapter cable from the TDR to the applicable test points on the breakout box.
- (g) Connect a 50 ohm terminator to the open end of the applicable cable.
- (h) Set the NOISE FILTER on the TDR to 1 avg.
- (i) Set the VERT SCALE to 500 mp.
- (j) Set the DIST/DIV switch to show the full cable length.

NOTE: For example, for a 20 foot cable it will be necessary to have 4 divisions on the display if you use 5 ft/DIV. If you do not know the cable length, set the DIST/DIV to 200 ft/DIV and continue to decrease the DIST/DIV until you see the full waveform. With a 50 ohm terminator attached, the applicable cable will show as a length of no limit.

- (k) Set the Vp controls for the applicable cable (Table 201).

NOTE: The left control is the first number and the right control is the second number of the Vp value.

Table 201/20-10-32-993-803

TYPE OF CABLE	PROBABLE Vp
Jelly Filled	.64
Polyethylene (PIC, PE, or SPE)	.66
PTFE (Teflon) or TFE	.70
Pulp Insulation	.72
Foam or Cellular PE (FPE)	.78
Semi-solid PE (SSPE)	.84
Air (Helical spacers)	.98

- (l) Make allowance for the adapter cable and breakout box.
 - 1) Measure the distance from the BNC on the TDR to the start of the applicable cable.
NOTE: This is the length of the adapter cable.
 - 2) Adjust the NOISE FILTER control. Use the manual, if necessary.
 - 3) Turn the <>POSITION control to move the cursor until the distance shown is equal to the adapter cable length.
 - 4) Push STORE.
 - 5) Make sure you see 0.000ft Δ on the display.

NOTE: This is the start of the applicable cable.

SUBTASK 20-10-32-280-001

- (2) Examine the applicable cable:
 - (a) Examine the waveform shown on the display.
 - (b) Make sure that you have a straight line waveform equal to the length of the applicable cable (if known).

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- (c) If it is necessary, turn the NOISE FILTER clockwise to average-out some of the noise.
NOTE: This will increase the time necessary for the TDR to give a waveform output.
- (d) Make sure that these failure conditions do not show:
 - 1) A drop in the waveform, this shows a short circuit in the applicable cable.
 - 2) A rise in the waveform, this shows an open circuit in the applicable cable.
 - 3) Hills and valleys in the waveform, these can show bends, kinks, frays and water in the applicable cable.
- (e) If you see a failure condition in the applicable cable, turn the <>POSITION control.
- (f) Put the cursor on the leading edge of the rising or falling pulse.
- (g) Read the distance in the top right corner of the display.
NOTE: This value is the distance from the start of the applicable cable to the cause of the failure.
- (h) If you do not use a 50 ohm terminator, you will see an open circuit at the end of the applicable cable.
- (i) Make a note of the distance to the open circuit.
 - 1) Use a jumper to cause a short circuit on the other end of the applicable cable.
 - 2) Examine the waveform shown on the display.
 - 3) Make sure that the waveform now shows a short circuit where the open circuit was.
NOTE: The length of the applicable cable is the distance shown on the display.
 - 4) If the waveform continues to show an open circuit at the same distance from the TDR, this is a failure.
NOTE: The distance to the open is the distance to the failure.

SUBTASK 20-10-32-970-001

- (3) Measure the reflection coefficient:
NOTE: The reflection coefficient (p) is a measure of the impedance change at a point in the applicable cable. It is used to find if the failure condition is important or not.
- (a) Adjust the VERT SCALE to make the waveform one division high.
- (b) Turn the <>POSITION control until the line-cursor is on the failure condition.
- (c) Read the reflection coefficient directly off the display above the VERT SCALE control.
 - 1) A good waveform with no failure conditions (flat) will have a reflection coefficient of zero.
 - 2) Small impedance changes from 10mp to 100mp can possibly be a cable connector and are usually not important.
 - 3) Large impedance changes of $\pm 1000\text{mp}$ show an open or a short circuit in the applicable cable.
NOTE: A positive value shows an increase in impedance and will be a hill on the waveform. A negative value shows a decrease in impedance and will be a valley on the waveform.
- (d) The TDR can also calculate and show the impedance, in ohms, at the cursor position on the applicable cable.



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E. Put the Airplane Back to its Usual Condition

SUBTASK 20-10-32-080-001

- (1) Disconnect the TDR adapter cable from the breakout box.

SUBTASK 20-10-32-020-001

- (2) Remove the breakout box.

SUBTASK 20-10-32-080-002

- (3) Remove the 50 ohm terminator (or jumper) from the other end of the applicable cable.

SUBTASK 20-10-32-410-001

- (4) Install the applicable black box, do this task: E/E Box Installation, TASK 20-10-01-400-801.

SUBTASK 20-10-32-420-001

- (5) Connect the applicable cable at the two ends.

———— **END OF TASK** ————

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PNEUMATIC DUCTS - MAINTENANCE PRACTICES

1. General

- A. This procedure is for the maintenance of pneumatic ducts.

TASK 20-10-33-910-801

2. Pneumatic Duct - Maintenance Practices

A. References

Reference	Title
20-10-33-100-801	Duct Cleaning (P/B 701)
20-20-04-200-801	Penetrant Inspection (P/B 601)

B. Consumable Materials

Reference	Description	Specification
C00314	Coating - Low Emissivity Gold Coating	BMS10-82 Type I

C. Procedure

SUBTASK 20-10-33-160-001

(1) General Cleaning Procedure

- (a) Do this task: Duct Cleaning, TASK 20-10-33-100-801

SUBTASK 20-10-33-010-001

(2) Pneumatic System FOD Prevention



CAUTION

DO NOT INSERT ANY TYPE OF PLUG OR WADDING INTO THE DUCTING. THE COVER MUST BE OVER THE OPENING AND TAPED INTO PLACE, NOT INSIDE THE OPENING.



CAUTION

INSPECT DUCTING WITH LIGHT SOURCE TO VISUALLY VERIFY ABSENCE OF FOREIGN MATTER IN DUCTING BEFORE RE-ASSEMBLY.

- (a) Install temporary protective covers on ducting when maintenance is being done on the pneumatic system.

NOTE: If ducting is separated or a component is removed and ducting is left open, a cover must be taped into place to prevent FOD from entering the pneumatic system.

- (b) Visually check for foreign objects before temporarily covering the open ducting.
- (c) Use a cover that is size appropriate and secure with tape.
- (d) Cover the open ducting can be done by following these steps:
- 1) Use a manufactured end cap and tape it into place.
 - 2) Use a formed cardboard that covers the open hole and tape it into place.
 - 3) Use of a flexible rubber glove is permitted if it can be fitted over the opening and secured with tape.
 - 4) If no cap or cover material is available, strips of tape can be used to cover the open hole.

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SUBTASK 20-10-33-210-003

(3) General Check Procedure

- (a) Visually check the duct.
 - 1) Use standard industry procedures to do a visual inspection of the duct assemblies for metal deterioration.
 - 2) Reject the titanium duct assemblies, if they have a dull black residue over bare metal surfaces or any other obvious evidence of deterioration.
- (b) Do a visual inspection of the weld beads for evidence of leakage.
- (c) Do an inspection of the ducts coated with coating, C00314 to make sure that there is uniform coverage.

NOTE: If necessary, reapply the coating.

- (d) If damage is found, do the damaged-area check procedure below.

SUBTASK 20-10-33-210-004

(4) Damaged-area check procedure

- (a) If the duct assembly is damaged, then do the subsequent steps to do an inspection of the duct for damage.
 - 1) Do a check of the duct assemblies to determine the depth of any dents, deep scratches, or gouges in the duct wall.
 - a) If the depth of scratches or gouges are greater than 10 percent of the duct wall thickness.
 - b) Or, if they are within 0.25 in. (6.35 mm) of a primary weld joint, they are to be treated as a crack.
 - c) Do a penetrant inspection Penetrant Inspection, TASK 20-20-04-200-801 of the area to confirm the crack.
 - 2) The following conditions are considered acceptable damage and do not need a repair.
 - a) Slight surface marks and pits.

NOTE: It may be advisable to treat corrosion pitted areas depending on the location and area covered.

- b) Smooth dents, provided that the bottom is rounded and free from cuts and that the depth does not exceed 0.05 in. (1.27 mm) as measured from a straight edge placed longitudinally along the duct assembly.

NOTE: Make sure that the inner surface of the bottom of the dent does not have cracks.

- c) Scratches and gouges, provided that the bottom is smooth and rounded and that the depth does not exceed 10 percent of the nominal duct wall thickness.

- (b) If the damage is greater than the limits given in this section, remove the duct then replace or repair per manufacturers instructions.

NOTE: Pneumatic duct maintenance and repair instructions can be found in Boeing CMM 36-10-07.

————— **END OF TASK** —————

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PNEUMATIC DUCTS - CLEANING/PAINTING

1. General

- A. This cleaning procedure has the data necessary to clean the duct assemblies.

TASK 20-10-33-100-801

2. Duct Cleaning

A. General

- (1) This task contains the information to clean the pneumatic ducts.

B. References

Reference	Title
12-25-01	AIRPLANE CLEANING AND POLISHING

C. Tools/Equipment

Reference	Description
STD-133	Brush - Stiff Bristle, Non-metallic
STD-3723	Gun - Hot Air

D. Consumable Materials

Reference	Description	Specification
B00003	Cleaner - Emulsion Alkaline - GMC 528B	
B00007	Cleaner - Oakite 61B	
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00148	Solvent - Methyl Ethyl Ketone (MEK)	ASTM D740
B00153	Solvent - Toluene, Nitration	JAN-T-171 Grade A
B00216	Cleaner - Turco Vitro-Klene	
B00230	Cleaner - Metal - Altrex B	
B00342	Alcohol - N-Butyl (Butanol)	ASTM D304
B01040	Cleaner - Oakite Isoprep 177	
D50122	Fluid - Hydraulic, Skydrol	BMS3-11 Type IV or Type V
G50316	Cloth - Clean, Dry, Lint-free, White, Cotton	

E. Cleaning Procedure

SUBTASK 20-10-33-100-001

NOTE: For cleaning materials, refer to AIRPLANE CLEANING AND POLISHING, SUBJECT 12-25-01.

- (1) Clean the ducts as shown in AIRPLANE CLEANING AND POLISHING, SUBJECT 12-25-01.

SUBTASK 20-10-33-100-002

- (2) For nickel-based alloy ducts, do the steps that follow.
- (a) Use appropriate alkaline cleaners such as Turco Vitro-Klene cleaner, B00216, Oakite Isoprep 177 cleaner, B01040, Altrex B cleaner, B00230, and Oakite 61B cleaner, B00007, or manual solvent cleaners such as acetone solvent, B00062, butyl alcohol, B00342, or toluene solvent, B00153.

SUBTASK 20-10-33-100-003

- (3) For corrosion resistant stainless steel (CRES) AISI 321 or AISI 347, do the steps that follow.

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- (a) Use appropriate alkaline cleaners such as Turco Vitro-Klene cleaner, B00216, Oakite Isoprep 177 cleaner, B01040, Altrex B cleaner, B00230, and Oakite 61B cleaner, B00007 or equivalent cleaners.

SUBTASK 20-10-33-100-004



DO NOT USE A CHLORINATED SOLVENT SUCH AS TRICHLOROETHANE TO CLEAN TITANIUM BECAUSE IT MAY CAUSE HYDROGEN EMBRITTLEMENT.

- (4) For titanium/titanium alloy ducts, do the steps that follow.
 - (a) For damage to titanium/titanium alloy ducts caused by hydraulic fluid can be prevented if found and removed before you can see visible pitting or etching of the base metal.

NOTE: At temperatures greater than 270°F (132°C), hydraulic fluids, such as Skydrol, will corrode and damage titanium. Black, glassy, and hard or soft tar-like residue are signs of this type of damage.

 - 1) If damage has occurred, then use standard repair procedures to repair the damaged area.
 - (b) For damage to titanium/titanium alloy ducts that DO NOT require treatment against corrosion by high temperature BMS 3-11 hydraulic fluid, D50122, do the subsequent steps.
 - 1) Clean with manual solvent cleaners, such as toluene solvent, B00153 or an emulsion cleaner, such as GMC 528B cleaner, B00003.
 - (c) For damage to titanium/titanium alloy ducts that DO require treatment against corrosion by high temperature BMS 3-11 hydraulic fluid, D50122, do the subsequent step.
 - 1) Preferred elevated temperature procedure
 - a) Wipe the duct with solvent, B00148 to remove the loose residue.
 - b) Soak the ducts in dilute alkaline cleaner at 160°F (71°C) for a minimum of 15 minutes.
 - c) Scrub the ducts with a stiff, non-metallic bristle brush to loosen and to remove any residue.
 - d) Rinse the ducts with hot water (over 100°F (38°C)) for 3 to 5 minutes.

NOTE: If necessary, you can use cold water (under 90°F (32°C)) to rinse the ducts, but the rinse time must be a minimum of 15 minutes.
 - e) Do a visual inspection of the ducts to make sure that all of the cleaner residue has been removed.
 - f) If visible residue remains, then repeat the steps in this elevated temperature procedure, as necessary, until the residue has been removed.
 - g) Permit the ducts to air dry.

NOTE: Ducts must be permitted to completely dry completely to make sure that all moisture has been removed from any possible defects or cracks.
 - h) If necessary, you can use a drying oven, a hot-air gun, or a filtered compressed air to accelerate drying.
 - 2) Optional room temperature procedure
 - a) Wipe the duct with solvent, B00148 to remove the loose residue.

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- b) Soak ducts in dilute alkaline cleaner at room temperature (60°F (16°C) minimum) for 1 to 1-1/2 hours.
- c) Scrub the ducts with a stiff, non-metallic bristle brush, STD-133 to loosen and to remove any residue.
- d) Rinse the ducts with hot water (over 100°F (38°C)) for 3 to 5 minutes.

NOTE: If necessary, you can use cold water (under 90°F (32°C)) to rinse the ducts, but the rinse time must be a minimum of 15 minutes.

- e) Do a visual inspection of the ducts to make sure that all of the cleaner residue has been removed.
- f) If visible residue remains, then repeat the steps in this room temperature procedure, as necessary, until the residue has been removed.
- g) Permit the ducts to air dry.

NOTE: Ducts must be permitted to completely dry completely to make sure that all moisture has been removed from any possible defects or cracks.

- h) If necessary, you can use a drying oven, a hot air gun, STD-3723, or a filtered compressed air to accelerate drying.

3) Optional manual procedure

- a) Wipe the duct with solvent, B00148 to remove the loose residue.
- b) Apply alkaline cleaner at room temperature (60°F (16°C) minimum) from a squeeze bottle.
- c) Scrub the ducts with a stiff, non-metallic bristle brush, STD-133 to loosen and to remove any residue.

NOTE: The use of a circular brush attached to a drill is recommended.

- d) Use dry a cotton cloth, G50316 to soak up the depleted cleaner and add fresh cleaner frequently.
- e) Wipe the excess alkaline cleaner from the ducts with a dry cotton cloth, G50316.
- f) Remove all the residue with a cotton cloth, G50316 that are wet with water, by wiping the ducts with wet rags for a minimum of 5 - 10 minutes to make sure that all the cleaner residue has been removed.
- g) Do a visual inspection of the ducts to make sure that all of the cleaner residue has been removed.
- h) If visible residue remains, then repeat the steps in this manual procedure, as necessary, until the residue has been removed.
- i) Permit the ducts to air dry.

NOTE: Ducts must be permitted to completely dry completely to make sure that all moisture has been removed from any possible defects or cracks.

- j) If necessary, you can use a drying oven, a hot-air gun, or a filtered compressed air to accelerate drying.

———— **END OF TASK** ————

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POWER DEVICE CARTRIDGE - REMOVAL/INSTALLATION

1. General

- A. This procedure contains two tasks.
- (1) The first task is the removal of cartridge.
 - (2) The second task is the installation of cartridge.

TASK 20-10-34-000-802

2. Power Device Cartridge (Squib) Removal

NOTE: This procedure is a scheduled maintenance task.

A. **References**

Reference	Title
20-41-00-910-801	Static Grounding (P/B 201)
24-22-00-860-806	Remove Electrical Power (P/B 201)

B. **Tools/Equipment**

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203
COM-1793	Multimeter - Digital/Analog (or equivalent meter meets task requirements) Part #: 117 Supplier: 89536 Part #: 260-8XPI Supplier: 55026 Part #: 287 Supplier: 89536 Part #: 289 Supplier: 89536 Part #: 87V Supplier: 89536 Part #: FLUKE 27 II Supplier: 89536 Part #: FLUKE-77-4 Supplier: 89536 Opt Part #: 187 Supplier: 89536 Opt Part #: 189 Supplier: 89536 Opt Part #: 260 Supplier: 55026 Opt Part #: 27 Supplier: 89536 Opt Part #: 77 SERIES III Supplier: 89536 Opt Part #: 87 Supplier: 89536 Opt Part #: FLUKE 27 Supplier: 89536 Opt Part #: MODEL 27 Supplier: 89536
STD-1168	Cap - Shorting or Faraday Cap

C. **Procedure**

SUBTASK 20-10-34-940-007

- (1) Ground the airplane, do this task: Static Grounding, TASK 20-41-00-910-801.

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SUBTASK 20-10-34-860-003

- (2) Make sure you remove electrical power before you remove the squib, do this task: Remove Electrical Power, TASK 24-22-00-860-806.

SUBTASK 20-10-34-760-006

- (3) You must wear a static control wrist strap, COM-1565 during the removal of the squib.



USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

- (a) Do the following steps to do a resistance test of the static control wrist strap, COM-1565:
 - 1) Use a digital/analog multimeter, COM-1793 to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.
 - 2) Put the static control wrist strap, COM-1565 on the wrist of the person that will remove the squib.
 - 3) Use a digital/analog multimeter, COM-1793 to make sure the resistance is less than 10 megohms.

SUBTASK 20-10-34-940-008

- (4) Connect the static control wrist strap, COM-1565 to an applicable electrostatic ground jack.

SUBTASK 20-10-34-760-007

- (5) Stray voltage on the airplane can cause the squib to discharge. Make sure any stray voltage is discharged before you remove the aircraft electrical connector.

SUBTASK 20-10-34-020-002

- (6) Remove the electrical connector.

SUBTASK 20-10-34-480-003



PUT CAPS ON THE BOTTLE SQUIBS AND FLOW VALVE SQUIBS. IF YOU DO NOT PUT CAPS ON THE SQUIBS, THE SQUIBS CAN FIRE ACCIDENTALLY AND CAUSE INJURIES TO PERSONNEL.

- (7) Make sure the shorting cap, STD-1168 (protective cap) is installed on the squib whenever the airplane electrical connector is removed from the squib.

SUBTASK 20-10-34-940-009

- (8) After the shorting cap, STD-1168 is attached to the squib, the wrist strap may be removed.

————— END OF TASK —————

TASK 20-10-34-400-802

3. Power Device Cartridge (Squib) Installation

NOTE: This procedure is a scheduled maintenance task.

A. References

Reference	Title
24-22-00-860-806	Remove Electrical Power (P/B 201)

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B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203
COM-1793	Multimeter - Digital/Analog (or equivalent meter meets task requirements) Part #: 117 Supplier: 89536 Part #: 260-8XPI Supplier: 55026 Part #: 287 Supplier: 89536 Part #: 289 Supplier: 89536 Part #: 87V Supplier: 89536 Part #: FLUKE 27 II Supplier: 89536 Part #: FLUKE-77-4 Supplier: 89536 Opt Part #: 187 Supplier: 89536 Opt Part #: 189 Supplier: 89536 Opt Part #: 260 Supplier: 55026 Opt Part #: 27 Supplier: 89536 Opt Part #: 77 SERIES III Supplier: 89536 Opt Part #: 87 Supplier: 89536 Opt Part #: FLUKE 27 Supplier: 89536 Opt Part #: MODEL 27 Supplier: 89536
STD-1168	Cap - Shorting or Faraday Cap

C. Procedure

SUBTASK 20-10-34-860-005

- (1) Make sure you remove electrical power before you install the squib, do this task: Remove Electrical Power, TASK 24-22-00-860-806.

SUBTASK 20-10-34-940-013

- (2) Wear a static control wrist strap, COM-1565 during the installation of the squib.

SUBTASK 20-10-34-760-010



USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

- (3) Do these steps to do a resistance test of the static control wrist strap, COM-1565:
 - (a) Use a digital/analog multimeter, COM-1793 to make sure the static control wrist strap, COM-1565 assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.
 - (b) Put the static control wrist strap, COM-1565 on the wrist of the person that will install the squib.

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- (c) Use a digital/analog multimeter, COM-1793 to make sure the resistance is less than 10 megohms.

SUBTASK 20-10-34-940-014

- (4) Connect the static control wrist strap, COM-1565 to an applicable electrostatic ground jack.

SUBTASK 20-10-34-480-005



PUT CAPS ON THE BOTTLE SQUIBS AND FLOW VALVE SQUIBS. IF YOU DO NOT PUT CAPS ON THE SQUIBS, THE SQUIBS CAN FIRE ACCIDENTALLY AND CAUSE INJURIES TO PERSONNEL.

- (5) Make sure the shorting cap, STD-1168 (protective cap) is installed on the squib whenever the airplane electrical connector is removed from the squib.

SUBTASK 20-10-34-760-011

- (6) Stray voltage on the airplane can cause the squib to discharge. Make sure any stray voltage is discharged before you install the aircraft electrical connector.

NOTE: The shorting cap, STD-1168 is attached to the squib. This protective cap has electrically conductive surfaces to prevent possible squib explosion because of static discharge.

SUBTASK 20-10-34-420-002

- (7) Remove the shorting cap, STD-1168 and install the electrical connector.

SUBTASK 20-10-34-940-015

- (8) After the electrical connector is installed, the static control wrist strap, COM-1565 may be removed.

———— **END OF TASK** ————

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Fiber Optics - Maintenance Practices

1. General

A. This procedure provides instruction for this task:

- (1) Fiber Optic Cable Detailed Inspection

TASK 20-10-35-200-801

2. Fiber Optic Cable - Detailed Inspection

(Figure 201, Figure 202, Figure 203, Figure 204, Figure 205)

A. General

- (1) This task shows how to do a check on a fiber-optic cable for light loss.
- (2) Make sure to do the light loss check for both directions on the fiber-optic cable.
- (3) In this task, the term "Cable Under Test" is for the target fiber-optic cable in the light loss check.
- (4) These are the necessary tools to do this task:

- (a) Stabilized Light Source (SLS) - fiber optic light source, COM-11205
- (b) Optical Power Meter (OPM) - light power meter, COM-11206
- (c) Source Test cable - SC-SC fiber optic cable, COM-11246

NOTE: The Source Test cable is a SC cable that is connected to the light source during the reference measurement. It stays connected to the light source for the remaining of the test procedure.

- (d) Receive Test cable - SC-SC fiber optic cable, COM-11246

NOTE: The Receive Test cable is a SC cable that is connected to the light meter during the reference measurement.

- (e) SC-SC multimode fiber optic adapter, COM-11245

NOTE: A SC adapter is used to connect two SC type cables.

- (f) Breakout Test Assemblies:

- 1) Configuration 1: For ARINC 600 type connectors, use an applicable Breakout box and a SC-SC fiber optic cable, COM-11246.

NOTE: NOTE: These LRUs have the ARINC 600 type connector:

CSS - Cabin Services System

DSU - Digital Server Unit

EFB EU - Electronic Flight Bag Electronic Unit

- 2) Configuration 2: For the connectors that are not ARINC 600 type, use an applicable Adapter Cable.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-11205	Light Source - Fiber Optic, LED Part #: 570XL-SC Supplier: 333V3 Opt Part #: 252A Supplier: 0XY53

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Reference	Description
COM-11206	Power Meter - Light Part #: 560XL Supplier: 333V3 Opt Part #: 555B Supplier: 0XY53
COM-11245	Adapter - Fiber Optic, SC-SC Multimode Part #: F-28SM-03 Supplier: 0LDN2 Opt Part #: F-28SM-01 Supplier: 0LDN2
COM-11246	Cable - Fiber Optic, SC Connector Part #: F0808MT1-A01-003.3 REV A Supplier: 92607
SPL-11781	Adapter Cable - Fiber Optic (BACC65AB2A/BACI10AL12FKAS) Part #: CIT-BFTA100-A03-060 Supplier: 92607
SPL-11790	Adapter Cable - Fiber Optic (BACC65AN2E/BACI10AL12FKAS) Part #: CIT-BFTA100-A11-060 Supplier: 92607
SPL-11798	Breakout Box - Fiber Optic, ARINC 600 Connector (Electronic Flight Bag Electronics Unit) Part #: J46002-9 Supplier: 81205 Opt Part #: J46002-4 Supplier: 81205
SPL-11800	Breakout Box - Fiber Optic, ARINC 600 Connector (Thales In Flight Entertainment System Digital Server Unit) Part #: J46002-13 Supplier: 81205 Opt Part #: J46002-3 Supplier: 81205 Opt Part #: J46002-8 Supplier: 81205

C. Prepare for the Inspection

SUBTASK 20-10-35-860-001

- (1) Remove the electrical power to the Line Replaceable Unit (LRU) at the two ends of the cable under test (Figure 201).
 - (a) Make sure that all test equipment is clean and in a good condition.

D. Procedure

SUBTASK 20-10-35-211-001

- (1) Do the measurement of reference level as follows (Figure 202):



MAKE SURE THAT THE FIBER-OPTIC CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

- (a) Examine the fiber-optic connectors for damage and contamination (Figure 204), (Figure 205).
 - 1) For the inspection and cleaning of fiber-optic connectors, refer to SWPM 20-12-20.
- (b) Connect the source test cable SC-SC fiber optic cable, COM-11246 to the fiber optic light source, COM-11205.
- (c) Use a SC-SC multimode fiber optic adapter, COM-11245 to connect the source test cable to the receive test cable SC-SC fiber optic cable, COM-11246.
- (d) Connect the other end of the receive test cable to the light power meter, COM-11206.
- (e) Turn on power to the fiber optic light source, COM-11205.
- (f) Select operating wavelength (850 nm) of the system to test on both instruments.

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- (g) Allow both instruments to stabilize for a minimum of 2 minutes.
- (h) Set the reference level to 0.00 dB in accordance with the operating instructions for the light power meter, COM-11206.



WARNING

DO NOT LOOK INTO THE END OF A FIBER-OPTIC CABLE. THERE IS A RISK OF LASER RADIATION, WHICH YOU WILL NOT SEE. LASER RADIATION IS DANGEROUS FOR YOUR EYES.



CAUTION

INSTALL THE PROTECTIVE CAPS IMMEDIATELY AFTER YOU DISCONNECT THE CABLE. IT IS EASY TO CAUSE DAMAGE TO THE FIBER-OPTIC CABLE.



CAUTION

DO NOT PULL OR TWIST THE FIBER-OPTIC CABLE WITH A STRONG OR A SUDDEN FORCE. DAMAGE TO THE CABLE OR THE CONNECTOR CAN OCCUR.



CAUTION

DO NOT BEND THE FIBER-OPTIC CABLE MORE THAN THE MINIMUM BEND RADIUS. THE CABLE IS EASILY DAMAGED.

- (i) Disconnect the Receive Test cable from the SC-SC multimode fiber optic adapter, COM-11245.
 - (j) Do not turn off the power on the fiber optic light source, COM-11205 or the light power meter, COM-11206.
 - (k) Do not disconnect the source test cable from the fiber optic light source, COM-11205.
- NOTE: Keep the source test cable connected to the fiber optic light source, COM-11205 to stabilize the light source.
- NOTE: The fiber optic light source, COM-11205, source test cable and the SC-SC multimode fiber optic adapter, COM-11245 should stay connected together throughout the test.

SUBTASK 20-10-35-211-002

- (2) Do the measurement of light loss in one direction, as follows (Figure 202):



WARNING

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WARNING

ALWAYS USE GLOVES IF YOU MUST TOUCH BROKEN FIBER-OPTIC CABLES. IF YOU TOUCH CABLES WITH YOUR BARE HANDS, FIBERS CAN GO INTO YOUR BODY THROUGH YOUR SKIN. THIS WILL CAUSE YOU INJURY.



CAUTION

INSTALL THE PROTECTIVE CAPS IMMEDIATELY AFTER YOU DISCONNECT THE CABLE. IT IS EASY TO CAUSE DAMAGE TO THE FIBER-OPTIC CABLE.

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(CAUTION PRECEDES)



DO NOT PULL OR TWIST THE FIBER-OPTIC CABLE WITH A STRONG OR A SUDDEN FORCE. DAMAGE TO THE CABLE OR THE CONNECTOR CAN OCCUR.



DO NOT BEND THE FIBER-OPTIC CABLE MORE THAN THE MINIMUM BEND RADIUS. THE CABLE IS EASILY DAMAGED.

- (a) Disconnect the connectors at the two ends of the cable under test.
 - 1) If necessary, remove the LRU(s) at the two ends of the cable under test.
 - a) Refer to the AMM for the removal procedure(s) for the applicable LRU(s).



MAKE SURE THAT THE FIBER-OPTIC CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

- 2) Examine the fiber-optic connectors for damage and contamination (Figure 204), (Figure 205).
 - a) For the inspection and cleaning of fiber-optic connectors on the airplane side, refer to SWPM 20-12-20.
- 3) Connect the breakout test assembly-A to one end of the cable under test.
 - a) If the connector at the end of the cable under test is an ARINC 600 type connector, use Configuration 1 for the Breakout Test Assembly-A. Do these steps:

NOTE: In this case, the Breakout Test Assembly-A is an assembly of a correct breakout box from the "Fiber Optic Breakout Box for ARINC 600 Connectors" table and a SC-SC fiber optic cable, COM-11246.

<1> Select the correct breakout box from the Table 201.

Table 201/20-10-35-993-801 Fiber Optic Breakout Box for ARINC 600 Connectors

Connector Location	Breakout Box
Digital Server Unit (DSU)	fiber optic breakout box, SPL-11800
Electronic Flight Bag Electronic Unit (EFB EU)	fiber optic breakout box, SPL-11798

- <2> Connect a SC-SC fiber optic cable, COM-11246 to the correct pin on the breakout box.

NOTE: The breakout box can have multiple pins.

- <3> Connect the breakout box to the cable under test.

<a> Insert the breakout box into the slot for the LRU that removed.

- b) If the connector is not an ARINC 600 type, use Configuration 2 for the Breakout Test Assembly- A. Do these steps:

NOTE: In this case, the Breakout Test Assembly-A is the correct adapter cable.

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- <1> Select the correct adapter cable from the Table 202 for the connector type.

Table 202/20-10-35-993-802 Fiber Optic Adapter Cable

Connector Location	Adapter Cable
Electronic Flight Bag Display Unit (EFB DU)	fiber optic adapter cable, SPL-11781
IFE Cabin Equipment Center (CEC)	fiber optic adapter cable, SPL-11790

- <2> Connect the adapter cable to the cable under test.

- 4) Connect the Breakout Test Assembly-B to the other end of cable under test.
- a) If the connector at the other end of the cable under test is an ARINC 600 type connector, use Configuration 1 for the Breakout Test Assembly-B. Do these steps:

NOTE: In this case, the Breakout Test Assembly-B is an assembly of the correct Breakout box from the "Fiber Optic Breakout Box for ARINC 600 Connectors" table and a SC-SC fiber optic cable, COM-11246.

- <1> Select the correct Breakout box from the Table 201 for the connector type.

- <2> Connect a SC-SC fiber optic cable, COM-11246 to the correct pin on the Breakout box.

NOTE: The Breakout box can have multiple pins.

- <3> Connect the breakout box to the cable under test.

- <a> Insert the breakout box into the slot for the LRU that was removed.

- b) If the connector is not an ARINC 600 type, use Configuration 2 for the Breakout Test Assembly-B. Do these steps:

NOTE: In this case, the Breakout Test Assembly-B is the correct adapter cable.

- <1> Select the correct adapter cable from the Table 202 for the connector type.

- <2> Connect the adapter cable to the cable under test.

- 5) Connect the Breakout Test Assembly-A to the SC-SC multimode fiber optic adapter, COM-11245, Source Test cable and fiber optic light source, COM-11205 assembly.

- a) Make sure that you connect the correct pin on the Breakout Test Assembly-A.

NOTE: A test cable assembly may have many channels or cables associated with the pins on the connector.

- 6) Connect the other end of Breakout Test Assembly-B to the light power meter, COM-11206.

- a) Make sure that you connect the correct pin on the Breakout Test Assembly-B.

NOTE: A test cable assembly may have many channels or cables associated with the pins on the connector.

- 7) Record the light loss in dB on the display of the light power meter, COM-11206.

- 8) Evaluate the recorded light loss as shown below.

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- a) If the recorded light loss is less than 2 dB or less than the maximum permitted limit, measure the light loss in the opposite direction.

SUBTASK 20-10-35-211-003

- (3) Measure light loss in the opposite direction, as follows (Figure 202):

- (a) Make sure that you do not disconnect the Breakout Test Assembly-A and the Breakout Test Assembly-B from the cable under test.



WARNING

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WARNING

ALWAYS USE GLOVES IF YOU MUST TOUCH BROKEN FIBER-OPTIC CABLES. IF YOU TOUCH CABLES WITH YOUR BARE HANDS, FIBERS CAN GO INTO YOUR BODY THROUGH YOUR SKIN. THIS WILL CAUSE YOU INJURY.



CAUTION

DO NOT PULL OR TWIST THE FIBER-OPTIC CABLE WITH A STRONG OR A SUDDEN FORCE. DAMAGE TO THE CABLE OR THE CONNECTOR CAN OCCUR.



CAUTION

DO NOT BEND THE FIBER-OPTIC CABLE MORE THAN THE MINIMUM BEND RADIUS. THE CABLE IS EASILY DAMAGED.



CAUTION

INSTALL THE PROTECTIVE CAPS IMMEDIATELY AFTER YOU DISCONNECT THE CABLE. IT IS EASY TO CAUSE DAMAGE TO THE FIBER-OPTIC CABLE.

- (b) Disconnect the Breakout Test Assembly-A from the SC-SC multimode fiber optic adapter, COM-11245.
- 1) Make sure to keep the SC-SC multimode fiber optic adapter, COM-11245, the source test cable and the fiber optic light source, COM-11205 connected together.
- (c) Move the SC-SC multimode fiber optic adapter, COM-11245, source test cable and the fiber optic light source, COM-11205 to the opposite end of the cable under test.



WARNING

DO NOT LOOK INTO THE END OF A FIBER-OPTIC CABLE. THERE IS A RISK OF LASER RADIATION, WHICH YOU WILL NOT SEE. LASER RADIATION IS DANGEROUS FOR YOUR EYES.



CAUTION

DO NOT PULL OR TWIST THE FIBER-OPTIC CABLE WITH A STRONG OR A SUDDEN FORCE. DAMAGE TO THE CABLE OR THE CONNECTOR CAN OCCUR.

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(CAUTION PRECEDES)



DO NOT BEND THE FIBER-OPTIC CABLE MORE THAN THE MINIMUM BEND RADIUS. THE CABLE IS EASILY DAMAGED.



INSTALL THE PROTECTIVE CAPS IMMEDIATELY AFTER YOU DISCONNECT THE CABLE. IT IS EASY TO CAUSE DAMAGE TO THE FIBER-OPTIC CABLE.

- (d) Disconnect the light power meter, COM-11206 from the Breakout Test Assembly-B.



MAKE SURE THAT THE FIBER-OPTIC CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

- (e) Connect the Breakout Test Assembly-B to the SC-SC multimode fiber optic adapter, COM-11245, source test cable and fiber optic light source, COM-11205.
- (f) Move the light power meter, COM-11206 to the opposite end of cable under test.



MAKE SURE THAT THE FIBER-OPTIC CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

- (g) Connect the light power meter, COM-11206 to the Breakout Test Assembly-A.
- (h) Record the light loss in dB on the display of the light power meter, COM-11206.
- (i) Evaluate the recorded light loss as shown below.

SUBTASK 20-10-35-211-004

- (4) Evaluate the light loss measurement, as follows (Figure 203):

- (a) Make sure that the measured light loss is less than 2 dB.

NOTE: When measuring a concatenated or non-concatenated cable assembly, 2 dB or less will be the permitted light loss. If the light loss is more than 2 dB, the maximum permitted limit must be calculated.

- 1) If the light loss is more than 2 dB, do these steps to calculate the maximum permitted loss:
 - a) Add together the number of connectors in the cable under test and connectors on test cable assemblies used.
 - b) Divide the number of connectors by 2 to get the number of mated pairs.
 - c) If Configuration 2 is used for Breakout Test Assembly A, add one mated pair.

NOTE: This additional mated pair is for the connection between the Breakout box and the SC cable.
 - d) If Configuration 2 is used for Breakout Test Assembly B, add one mated pair.

NOTE: This additional mated pair is for the connection between the Breakout box and the SC cable.

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- e) If the total number of the mated pairs is equal or less than 4, the light loss is failed.
NOTE: Only calculate the maximum permitted limit when the total number of the mated pairs is equal or more than four.
- f) Multiply the number of measured mated pairs by 0.5 dB.
NOTE: The allowed light loss for each mated pair of multi-mode connectors, taking into account measurement inaccuracy, is 0.5 dB.
- g) Add 0.4 dB as an uncertainty factor to get the maximum permitted limit.
- h) Make sure that the measured light loss is less than the maximum permitted limit.

E. Put the Airplane Back to Its Usual Condition

SUBTASK 20-10-35-860-002

- (1) Power off the fiber optic light source, COM-11205 and the light power meter, COM-11206.



WARNING

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WARNING

ALWAYS USE GLOVES IF YOU MUST TOUCH BROKEN FIBER-OPTIC CABLES. IF YOU TOUCH CABLES WITH YOUR BARE HANDS, FIBERS CAN GO INTO YOUR BODY THROUGH YOUR SKIN. THIS WILL CAUSE YOU INJURY.



CAUTION

INSTALL THE PROTECTIVE CAPS IMMEDIATELY AFTER YOU DISCONNECT THE CABLE. IT IS EASY TO CAUSE DAMAGE TO THE FIBER-OPTIC CABLE.



CAUTION

DO NOT PULL OR TWIST THE FIBER-OPTIC CABLE WITH A STRONG OR A SUDDEN FORCE. DAMAGE TO THE CABLE OR THE CONNECTOR CAN OCCUR.

- (a) Disconnect all test cable assemblies from the fiber-optic cable under test.



CAUTION

MAKE SURE THAT THE FIBER-OPTIC CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.



CAUTION

DO NOT BEND THE FIBER-OPTIC CABLE MORE THAN THE MINIMUM BEND RADIUS. THE CABLE IS EASILY DAMAGED.

- (b) Make sure that you inspect all fiber-optic connectors and/or LRU(s) before you make a connection.
 - 1) Inspect of the fiber-optic connectors on the airplane side.
- (c) Connect the connectors at the two end of the cable under test to the airplane.
 - 1) If you removed the LRU(s) at the end(s) of the cable under test, install the LRU(s).

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- a) Refer to the AMM for the installation procedures of the applicable LRU(s).

———— **END OF TASK** ————

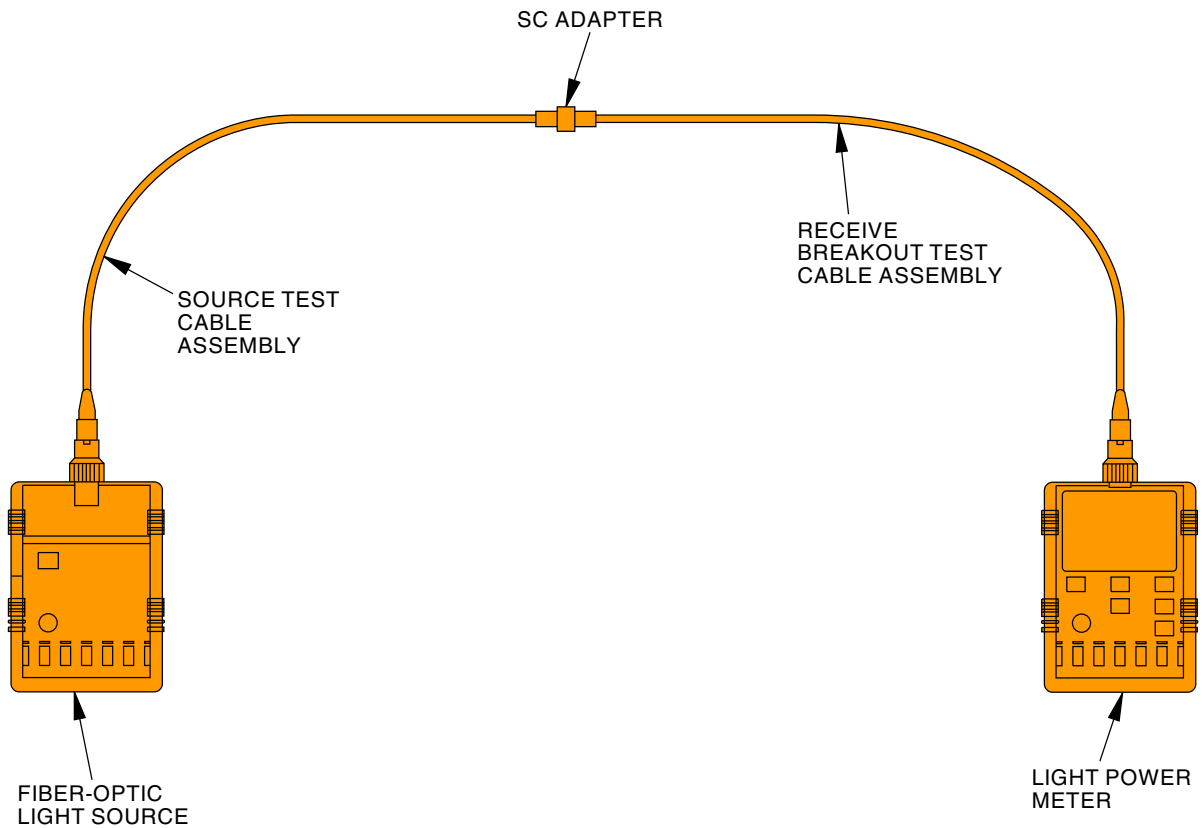
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Reference Level Measurement
Figure 201/20-10-35-990-801

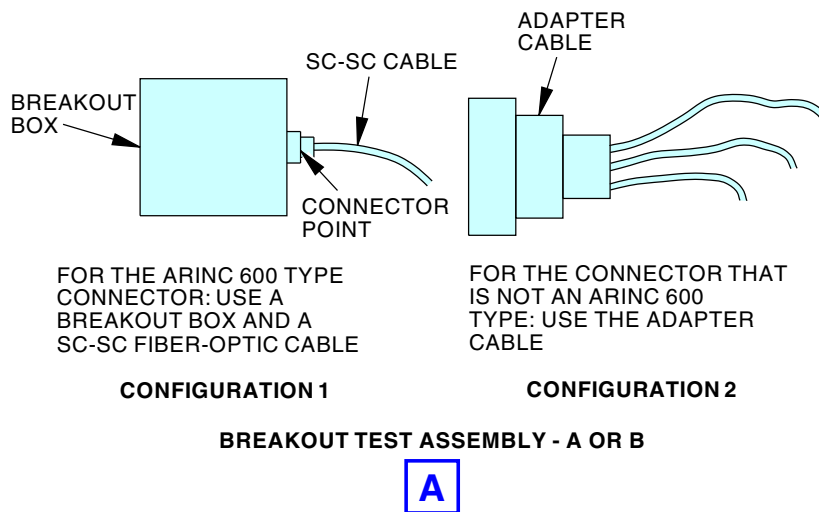
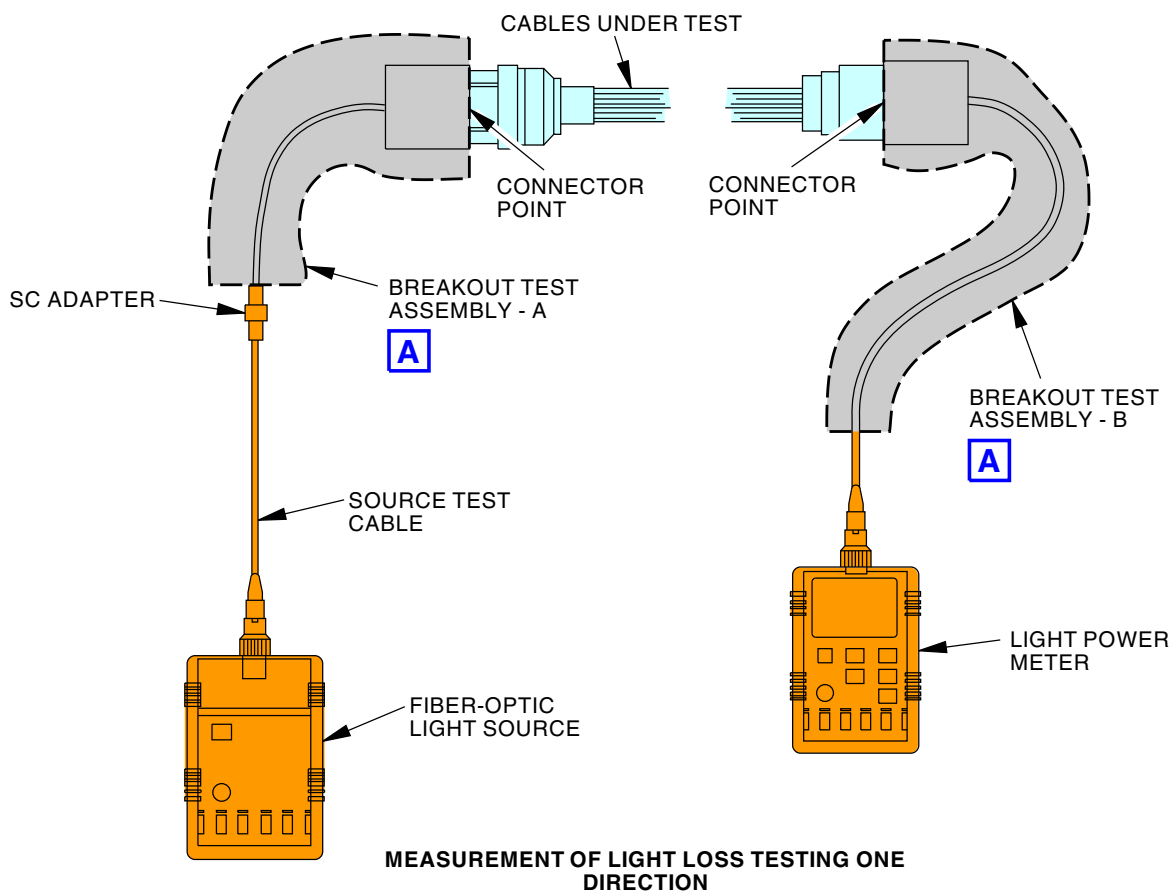
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2123831 S0000457840_V4

Measurement of Light Loss
Figure 202/20-10-35-990-802 (Sheet 1 of 2)

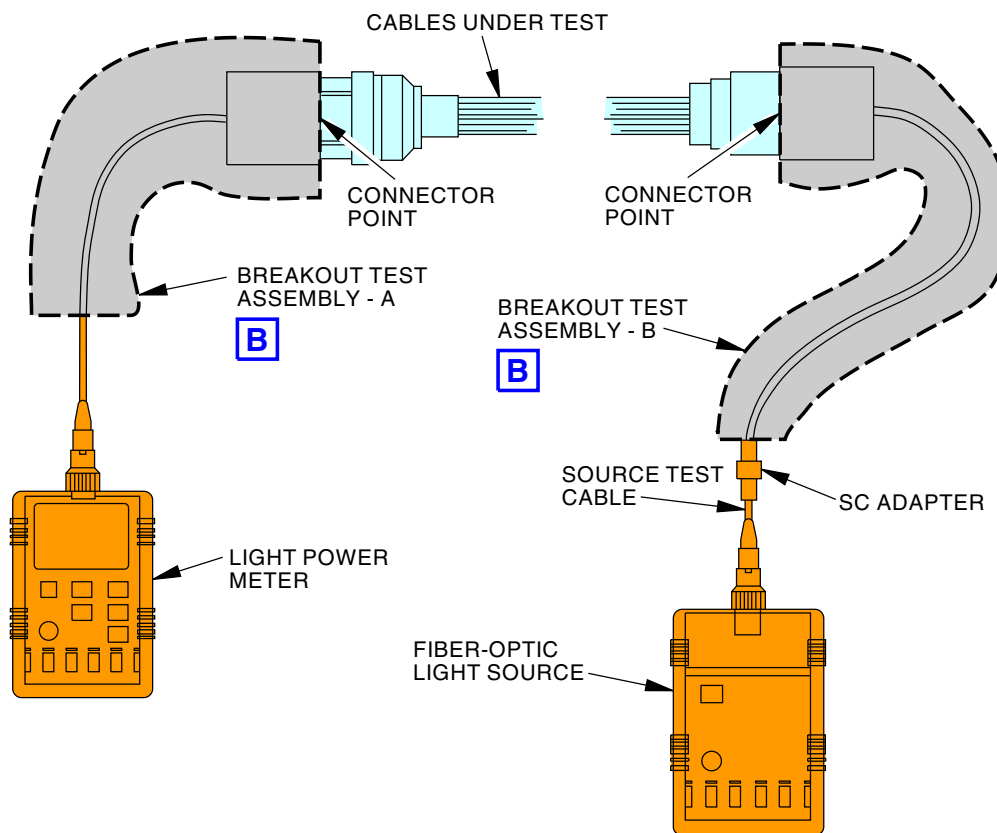
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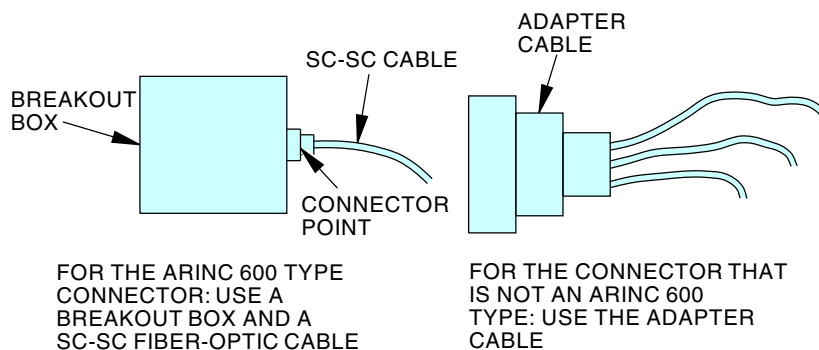
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MEASUREMENT OF LIGHT LOSS TESTING THE OTHER DIRECTION



CONFIGURATION 1

CONFIGURATION 2

BREAKOUT TEST ASSEMBLY - A OR B

B

2123832 S0000457827_V5

Measurement of Light Loss
Figure 202/20-10-35-990-802 (Sheet 2 of 2)

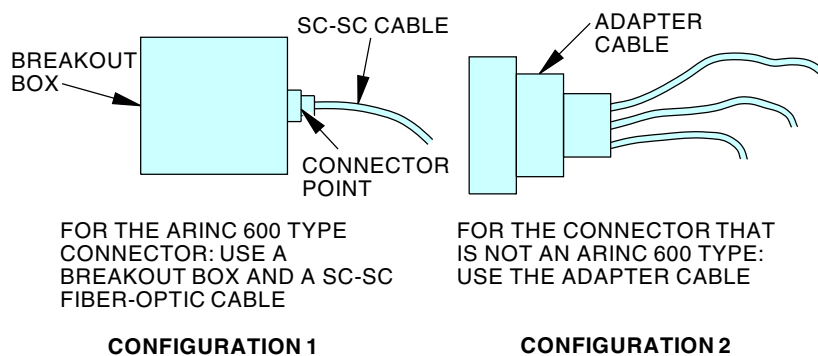
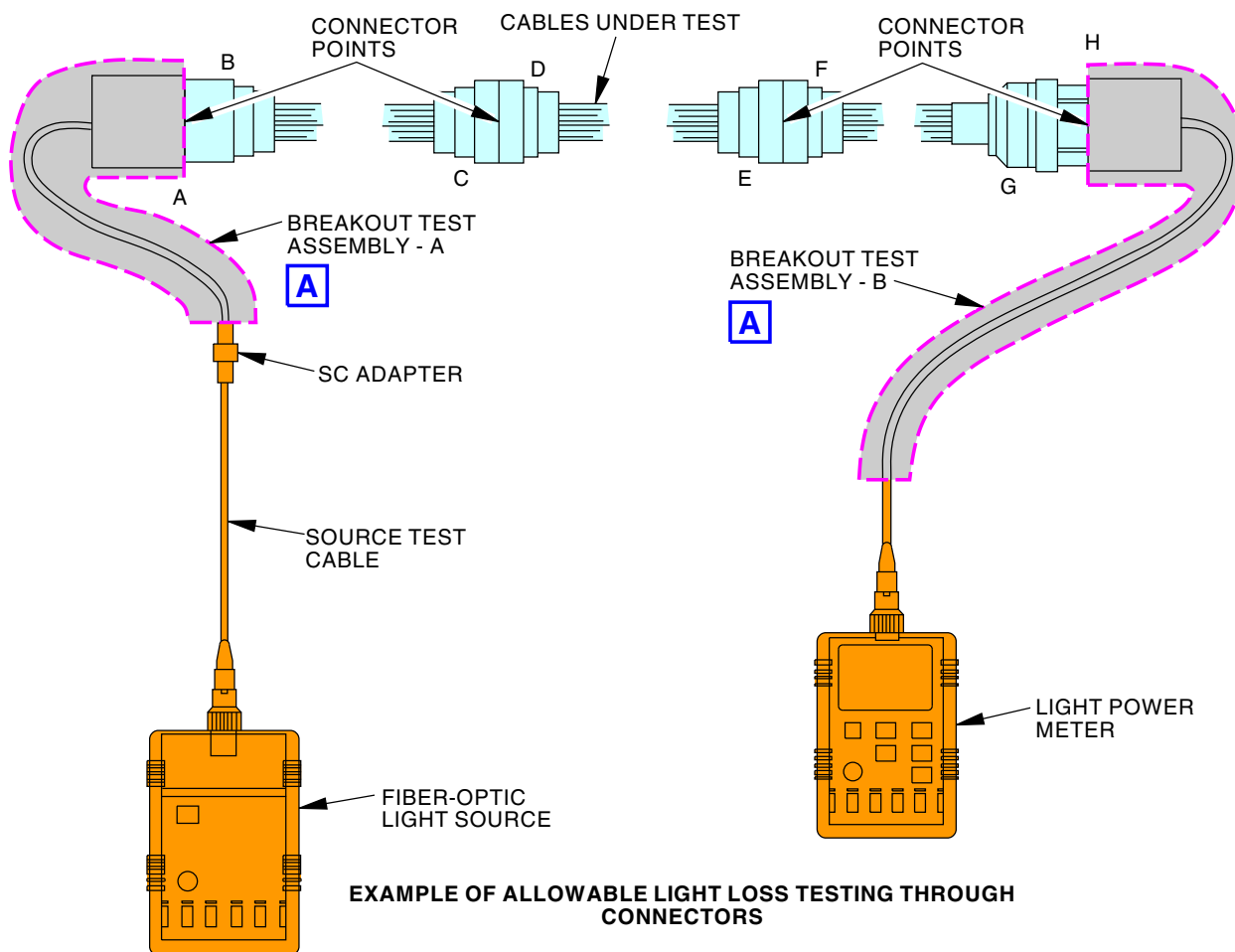
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BREAKOUT TEST ASSEMBLY - A OR B

A

2123834 S0000457828_V4

Example of Allowable Light Loss Through Connectors
Figure 203/20-10-35-990-803

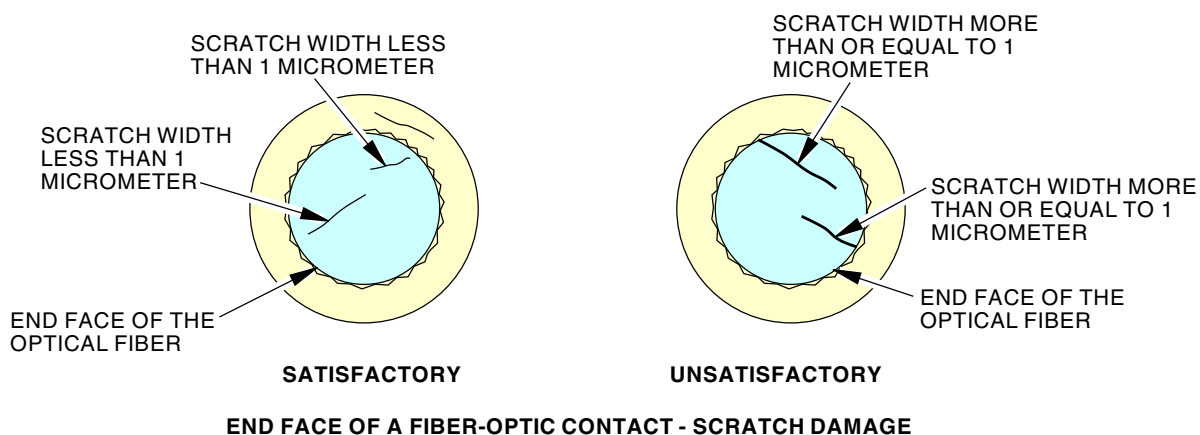
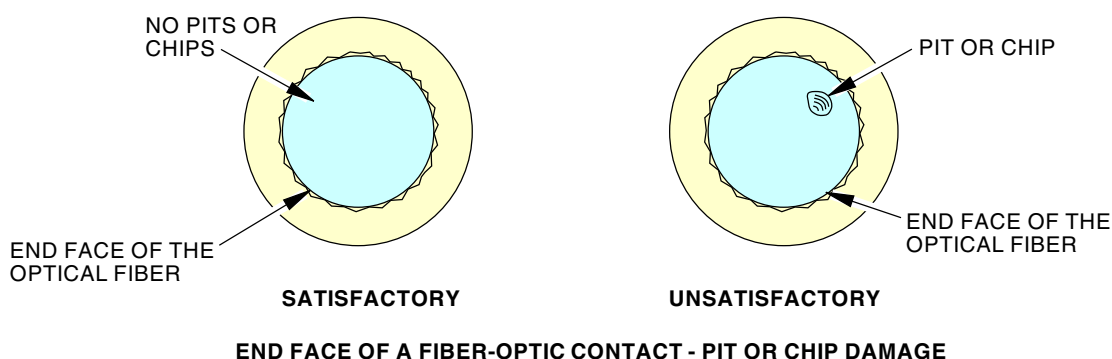
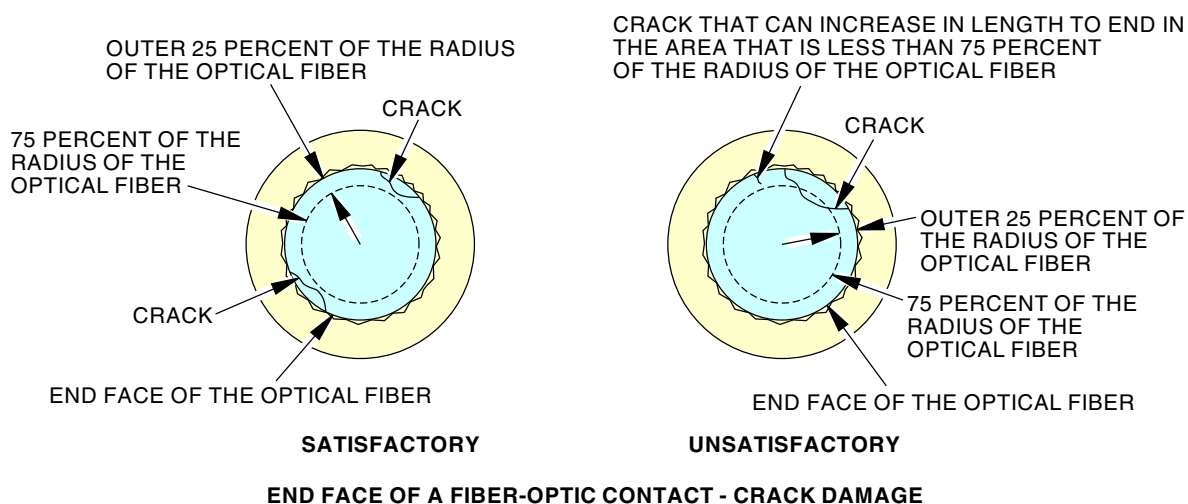
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2123838 S0000457831_V2

Fiber Optic Damage Limits
Figure 204/20-10-35-990-804

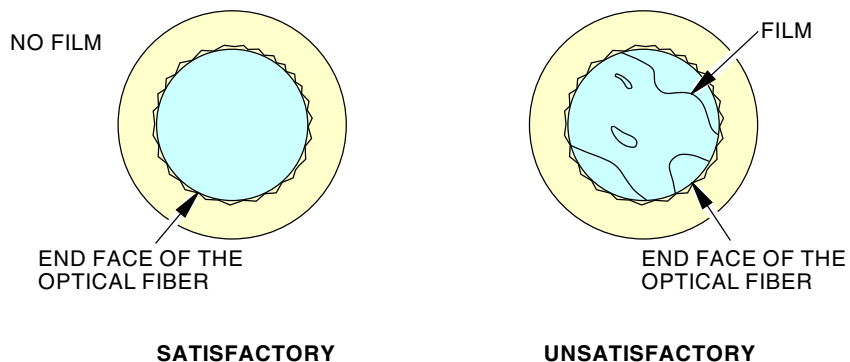
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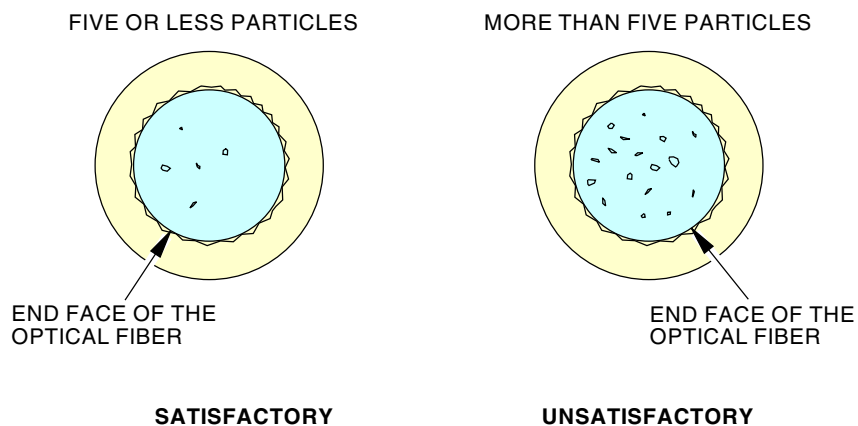
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END FACE OF A FIBER-OPTIC CONTACT - FILM CONTAMINATION



END FACE OF A FIBER-OPTIC CONTACT - PARTICLE CONTAMINATION

2123839 S0000457832_V2

**Fiber Optic Contamination Limits
Figure 205/20-10-35-990-805**

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Hydraulic Caps and Plugs - Maintenance Practices

1. General

- A. This task gives maintenance practices for hydraulic fitting caps and plugs.

TASK 20-10-36-800-801

2. Cap and Plug Hydraulic Fittings

A. General

- (1) This procedure lists the recommended caps and plugs for hydraulic fittings on tube ends and components.
- (2) Caps and plugs are used on the ports and disconnected hydraulic lines to prevent leakage and contamination.

B. Procedure

SUBTASK 20-10-36-860-001



WARNING USE ONLY THE SPECIFIED CAPS OR PLUGS. OTHER CAPS AND PLUGS CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

- (1) Determine the applicable cap or plug (Table 201).

NOTE: Do not use protective metal or plastic caps or plugs for system pressure testing. Use protective caps or plugs before and after test as needed, to prevent system contamination.

Table 201/20-10-36-993-801 Recommended Caps and Plugs

CAPS/PLUGS	TUBE SIZE	FLARELESS/ SHORT FLARELESS	PART NUMBER	MATERIAL	USAGE INFORMATION
PLUG	20, 24	FLARELESS	AS4662	TITANIUM, CRES, ALUMINIUM	600–3000 PSI SYSTEMS
CAP, FITTING ASSEMBLY	20, 24	SHORT FLARELESS	AS4694	TITANIUM, CRES, ALUMINIUM	600–3000 PSI SYSTEMS
PLUG	02 thru 32	FLARELESS	AS21913	CARBON STEEL, CRES, ALUMINIUM, TITANIUM	USE WITH TUBING ONLY
CAP ASSEMBLY	04 thru 24	FLARELESS	BACC14AD ^{*[1]*[2]}	CARBON STEEL, CRES, ALUMINIUM	0–3000 PSI SYSTEMS
PLUG	02 thru 12	FLARELESS	BACP20AU	CARBON STEEL, CRES, ALUMINIUM	USE WITH TUBING ONLY

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Table 201/20-10-36-993-801 Recommended Caps and Plugs (Continued)

CAPS/PLUGS	TUBE SIZE	FLARELESS/ SHORT FLARELESS	PART NUMBER	MATERIAL	USAGE INFORMATION
PLUG	02 thru 32	FLARELESS	AS5169	CARBON STEEL, CRES, ALUMINIUM, TITANIUM	USE IN BOSSES ONLY

*[1] BACC14AD()(NO CODE) (NO CODE) is inactive for design and procurement. Use AS5233V()P as a CLASS V supersession. Carbon steel parts are prone to corrosion.

*[2] BACC14AD()D(NO CODE) is inactive for design and procurement. Use AS5233W() as a CLASS II supersession.

(2) Install the applicable cap or plug on tube ends and components.

———— **END OF TASK** ————

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ELECTRICAL BONDING - INSPECTION/CHECK

1. General

- A. This procedure provides requirements for airplane electrical bonding.
- B. This procedure has one task.
 - (1) An inspection of electrical bonding.

TASK 20-10-37-200-801

2. Electrical Bonding Inspection

A. General

- (1) This task provides information to help an operator determine which bonding meter to select for electrical bonding inspections.
 - (a) The information in this procedure is used to describe the fire zone, flammable zone, flammable leakage zone, and National Electrical Code (NEC) hazardous locations.
 - (b) An operator should also take into consideration their environmental conditions that could impact the zone and location information.
 - (c) Boeing recommends that the intrinsically safe approved bonding meter, COM-1550 be used for all bonding checks. If it is not available, the non-intrinsically safe bonding meter, COM-614 can be used outside of the fire zones, flammable zones, flammable leakage zones, and areas classified as NEC Class I, Division I or II hazardous locations.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-614	Bonding Meters - Non-Intrinsically Safe (For use in outside Class I, Divisions I & II non-hazardous locations. For hazardous locations, use COM-1550). Part #: 247000 Supplier: 00426 Part #: 620LK Supplier: 1CRL2 Part #: M1 Supplier: 3AD17 Part #: T477W Supplier: 01014 Opt Part #: 247001 Supplier: 00426 Opt Part #: M1B Supplier: 3AD17
COM-1550	Bonding Meters - Approved, Intrinsically Safe (Approved for use in Class I, Divisions I & II hazardous (classified) locations. Outside these hazardous locations, COM-614 can be used in lieu of COM-1550). Part #: 620LK Supplier: 1CRL2 Part #: M1 Supplier: 3AD17 Part #: T477W Supplier: 01014 Opt Part #: M1B Supplier: 3AD17

C. Select a Bonding Meter

SUBTASK 20-10-37-580-001

- (1) Inside the zones that follow, Boeing recommends that the intrinsically safe approved bonding meter, COM-1550 be used.
 - (a) Fire Zone

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- 1) In a fire zone, ignition sources are normally present.
- 2) A single failure can cause a flammable mixture to be present.
- 3) Fire Zone locations are as follows (Figure 601).
 - a) Engines
 - b) Tail Cone
- (b) Flammable Zone
 - 1) In a flammable zone, flammable fluid is normally present.
 - 2) An ignition source is not present normally after a single failure.
 - 3) Flammable Zone locations are as follows (Figure 602).
 - a) Wing - Center Fuel Tank
 - b) Wing - Main Tank
 - c) Wing - Surge Tank
 - d) Wing - Dry Bay
- (c) Flammable Leakage Zone
 - 1) Leakage of flammable vapors can occur as a result of the following:
 - a) One failure
 - b) Leakage during normal operation
 - 2) All flames, smoking, sparks, and other ignition sources must not occur.
 - 3) Tools and test equipment that can make a spark must not be used.
 - 4) Flammable Leakage Zone locations are as follows (Figure 603).
 - a) Nose Landing Gear and Main Landing Gear Wheel Wells
 - b) Wing-to-Body Fairings
 - c) Engine Struts and Nacelles
 - d) Wing Leading Edges
 - e) ECS Bay
 - f) Wing Trailing Edges
 - g) Horizontal Stabilizer
 - h) Empennage and Rudder
 - i) Fuselage Aft of the Pressure Bulkhead
- (d) National Electrical Code (NEC) Class I, Division I and II Hazardous Locations (Figure 604).

NOTE: Figure 604 is for the condition with open fuel tanks.

- 1) Class I, Division I Hazardous Locations (or equivalent standard)
 - a) Locations where ignitable concentrations of flammable gases or vapors can exist under standard operational conditions.
 - b) Locations where ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations.
 - c) Locations where ignitable concentrations of flammable gases or vapors can exist because of leakage.

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- d) Locations where equipment problems or incorrect operation of equipment or processes can release ignitable concentrations of flammable gases or vapor, and can also cause failure of electrical equipment at the same time.
- 2) Class I, Division II Hazardous Locations (or equivalent standard)
 - a) Locations where flammable liquids or gases are handled, processed, or used, but where the liquids, vapors, or gases will usually be in closed containers or closed systems. The containers or systems will not allow the release of liquid, gas, or vapor in sufficient quantity or produce an ignitable fuel and air mixture unless the container or system fails or is damaged.
- 3) See Figure 604 for the locations of the NEC Class I, Division I & II Hazardous Locations.

———— **END OF TASK** ————

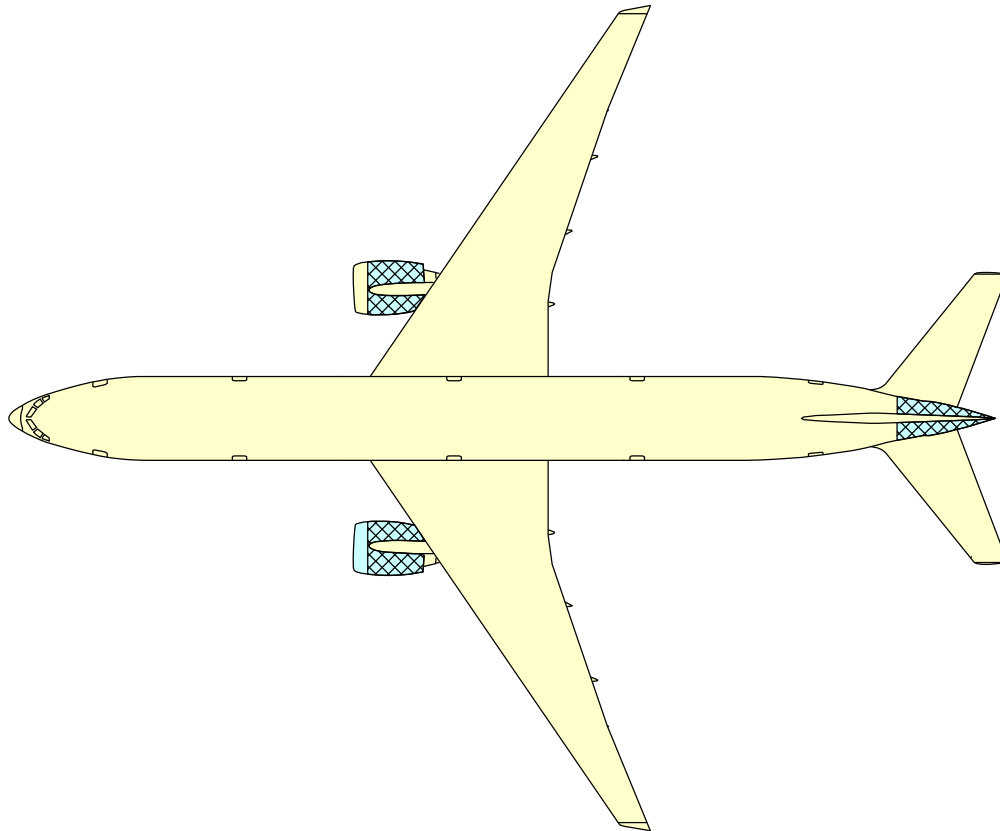
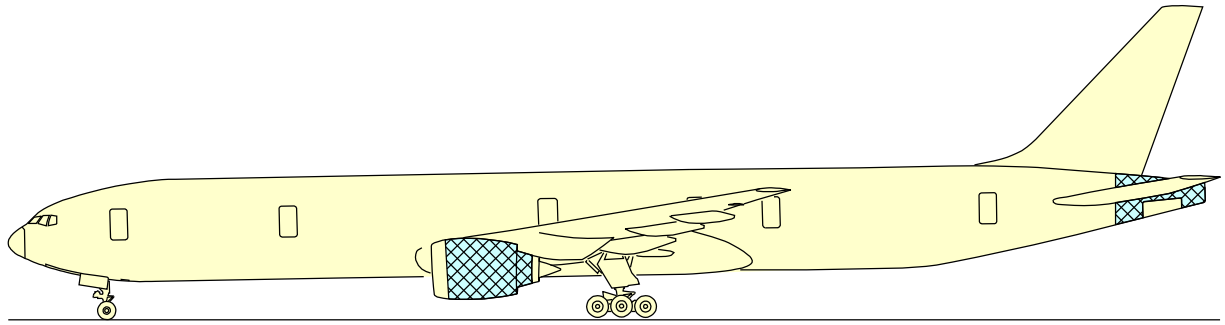
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LEGEND:
 FIRE ZONES

2266081 S0000508386_V2

Fire Zone Locations
Figure 601/20-10-37-990-801

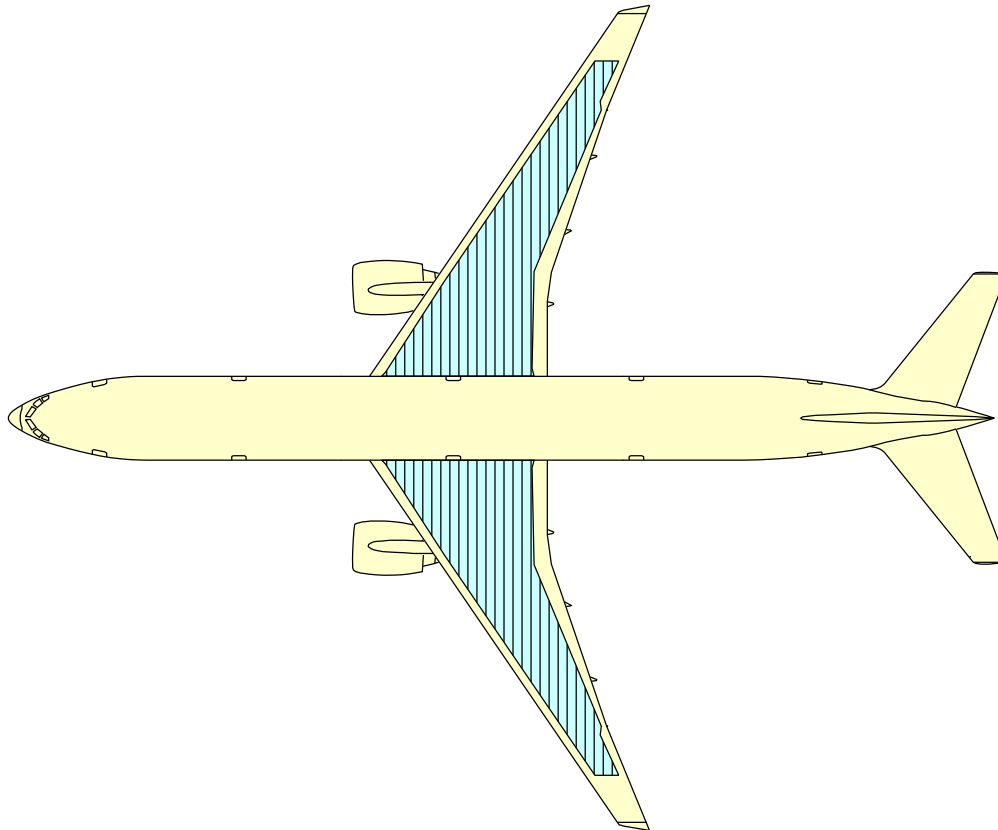
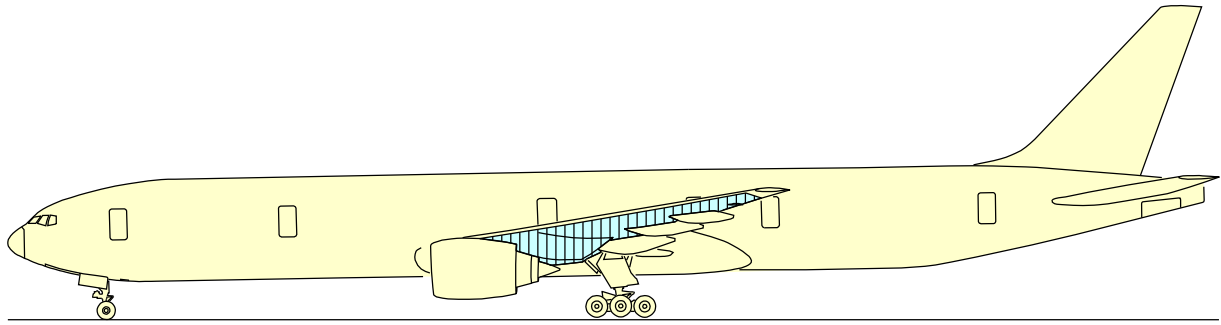
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LEGEND:
 **FLAMMABLE ZONES**

2266075 S0000508387_V2

Flammable Zone Locations
Figure 602/20-10-37-990-802

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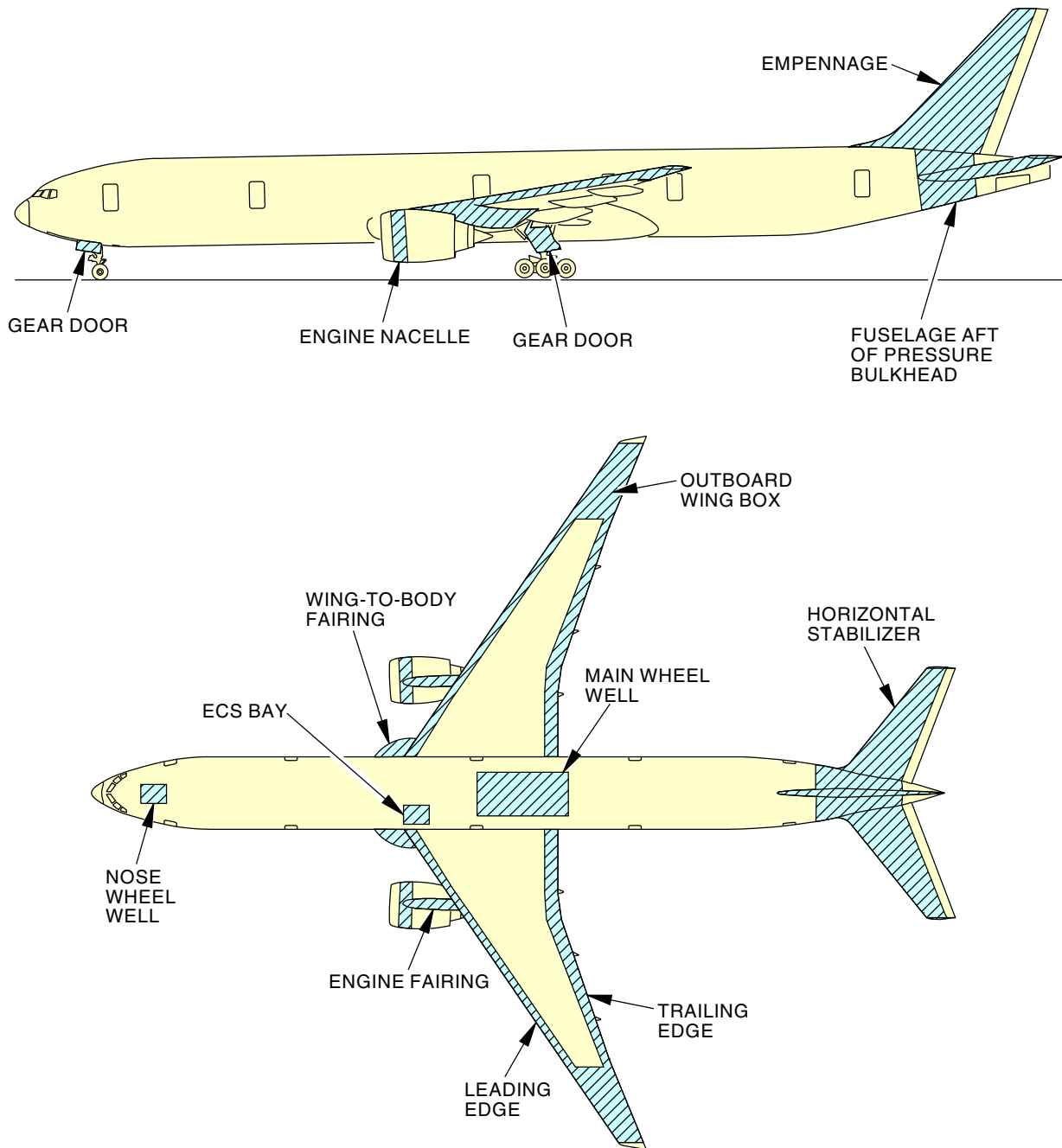
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LEGEND:



FLAMMABLE LEAKAGE ZONES

2266008 S0000508388_V2

Flammable Leakage Zone Locations
Figure 603/20-10-37-990-803

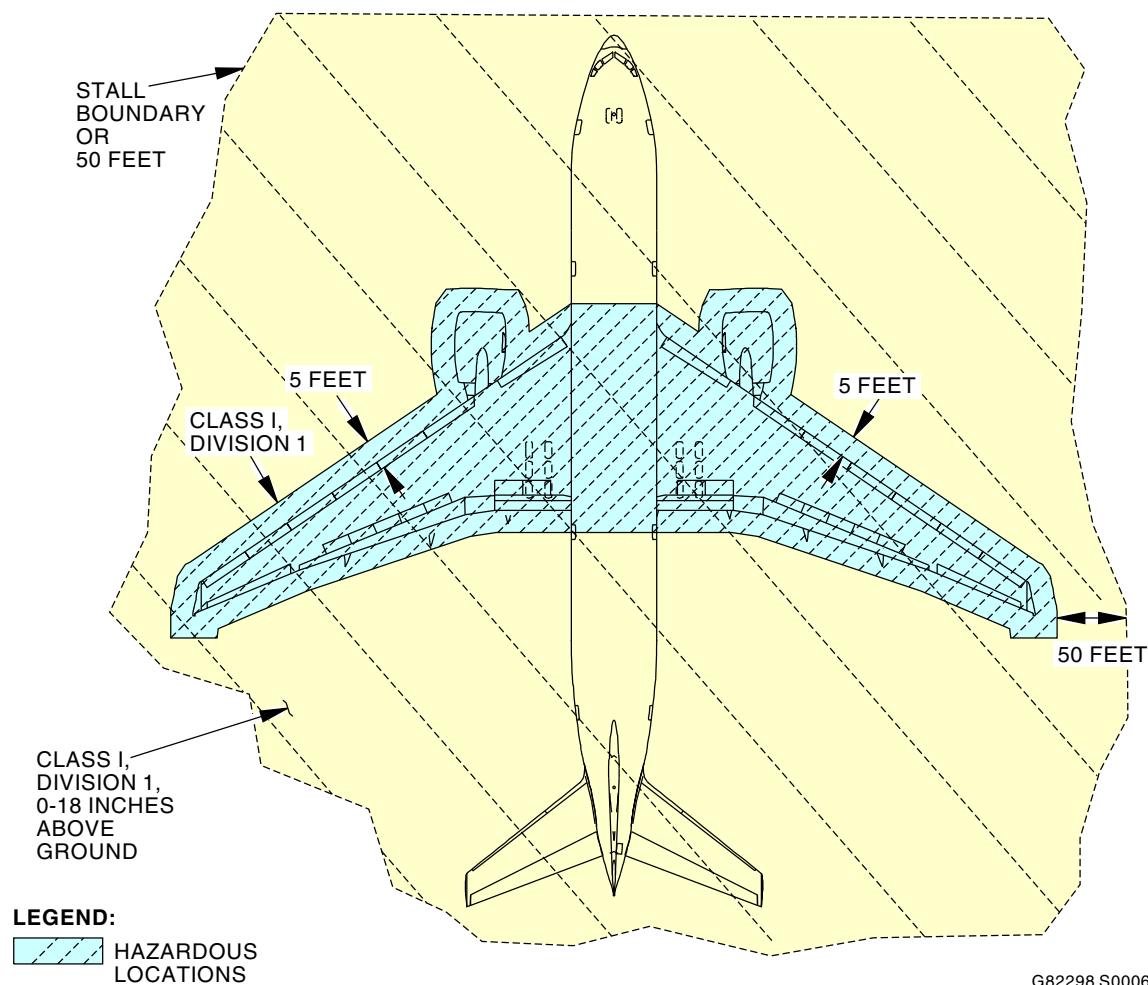
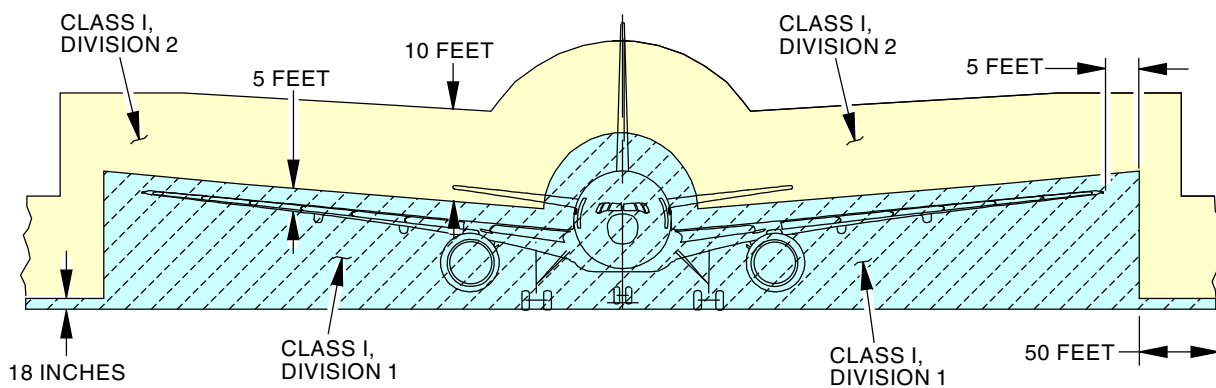
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G82298 S0006414753_V2

Hazardous Locations - Open Fuel Tank(s)
Figure 604/20-10-37-990-804

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POWER QUALITY - MAINTENANCE PRACTICES

1. General

- A. This procedure has this task:
- (1) Power Quality Checks

TASK 20-10-78-760-801

2. Power Quality Checks

Figure 201Figure 202

A. General

- (1) This procedure is for the component power supply and should not be used for generator trouble shooting. Users should refer to EICAS detectability then use the applicable power quality analyzer, COM-15045 task. This procedure helps identify the presence of intermittent, transient and unbalanced power conditions for downstream wiring and components. If not correctly diagnosed, this imbalance may contribute to nuisance faults and tripping of circuit breakers. Unbalanced power also results in high stator winding current leading to overheating and reduced life of 3-phase components.
 - (a) The top causes of these conditions are due to loose connections, degraded relay contacts, and unbalanced component loads.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt.", which stands for Optional.

Reference	Description
COM-15045	Analyzer - Power Quality Part #: FLUKE-437-II Supplier: 89536 Part #: HDPQ XPLOER 400 Supplier: 23207 Part #: PW3198-01/500 PRO Supplier: 1ZJQ1

C. Procedure

SUBTASK 20-10-78-860-001

- (1) Examine the Component Supply Voltage (Power Quality)
 - (a) Start by de-energizing the circuit, if possible. Follow local instructions for Lockout/Tagout (LOTO) and Personal Protective Equipment (PPE).

Refer to Instructions or the Operating Manual of the power quality analyzer, COM-15045, or equivalent for specific instructions on set-up and tests.
 - (b) General Instructions: Connect the analyzer on the component supply side. Connect at a convenient position near to the load equipment terminals.
 - 1) While the analyzer does not disturb the connections, the removal of a panel (or panels) will be necessary to expose individual phase conductors and terminals. Install the current clamps [1] and voltage clips [2] around and on each individual phase.
 - a) For 3-phase loads, the current clamps [1] should be placed around all three phases and neutral. Be sure to connect phase "A" clamp around circuit phase "A", then "B" around "B", etc. Arrow on clamp must point toward the load for proper display.

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- b) The voltage clips [2] should be attached to an exposed connection (i.e. terminal block).



CAUTION

MAKE SURE THAT YOU CONNECT THE GROUND-LEAD BEFORE YOU CONNECT THE CURRENT-CLAMPS WHEN YOU ENERGIZE THE CIRCUIT. IF YOU DO NOT DO THIS, DAMAGE TO EQUIPMENT CAN OCCUR.

- c) Connect all 3 phases, neutral and ground.
- <1> If circuit is energized, connect ground lead first for safety.
- 2) Follow the analyzer instructions for proper analyzer setting.
- (c) Place system under load. Follow the corresponding AMM procedure to operate various high load devices.
- (d) Make sure that proper connection is achieved, do as follows:
- 1) Monitor volts, amps, and hertz to ensure readings are consistent with normal aircraft power.
 - a) For example: Voltage and frequency should be close to the nominal values of 115 V and 400Hz.
 - 2) Monitor phase shift (Phasor) to ensure correct hookup of test leads (Figure 201).
 - a) Example (Figure 202), phase current (thin arrow) and voltage (thick arrow) should be nearly in phase. If 180 degrees apart, make sure current clamps are facing toward the load and are on correct wires.
 - b) In a 3-phase power system, there will be a 120 degree shift between phases.

SUBTASK 20-10-78-700-001

(2) Evaluate Electrical System

- (a) Monitor Volts, Amps, Hertz.
- 1) While operating the Unit Under Test (UUT).
 - a) Examine the voltage indication for imbalance issues.

<1> Voltage on one of the 3 phases should not vary significantly from the others (More than 2% of the average of the 3-phase may require further investigation).

Example: For a 115VAC system, voltage imbalance should be <3.0 Volts between any phase.
 - b) Examine the current indication for imbalance issues.

<1> The current unbalance for the three phases should be <10%.

<2> If individual phases read within 10% of the average current of all three legs, electrical system is balanced. Continue with Power Transition tests.

<3> If unbalanced, >2% voltage and/or >10% amperage, then further investigation is recommended. Go to Fault Analysis.
 - (b) Monitor Power Transition - Continue monitoring as above.
 - 1) While maintaining the same load, switch between individual power sources, the Ground Power Unit (GPU), Auxiliary Power Unit (APU), and ENG GEN (Engine Generator).

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- 2) Make sure of smooth transition and comparable readings between both. Power transfer must occur within 50mS. If >50mS, compare readings between power sources to isolate a defective or slow contactor.

SUBTASK 20-10-78-700-002

(3) Evaluate Mechanical System

(a) Monitor Volts, Amps.

- 1) All phase current should read in balance and inrush & continuous current should measure within normal values.
 - a) Use prior experience along with the manufacturer's Component Maintenance Manual (CMM) instructions on limits to make sure to establish the correct measure threshold, e.g. previous measurements on healthy airplanes.
- 2) If not in balance between phases, perform "Component Analysis" to address electrical imbalance.
- 3) If in balance, but current exceeds operator and/or manufacturer's CMM limits, do as follows:
 - a) Perform a general visual inspection of the UUT for any irregularities or abnormalities.
 - b) Inspect the UUT, refer to applicable Airplane Maintenance Manual (AMM) procedures.
 - <1> Make sure that no corrosion is visible on mounting bolts, stops, rollers, or linkages.

NOTE: Corrosion is evident by powdery white deposits, discoloration, and flaking.

- c) If necessary, lubricate or service the UUT system (gear boxes, torque tubes, bearings, angle gear boxes, etc.) refer to applicable AMM procedures.
- 4) Re-test, make sure that current is now within limits, do as follows:
 - a) If test is now within limits, remove tester and perform return to service tests.
 - b) If test is still out of limits, do as follows:
 - <1> Inspect for any tripped friction indicators if applicable.
 - <2> Disconnect linkages refer to applicable AMM procedures and manually rotate UUT, use the AMM instructions to identify the source of the excessive friction.

SUBTASK 20-10-78-810-001

(4) Fault Analysis

- (a) If a fault exists when using only one of the generating systems (GPU, APU or ENG GEN):
 - 1) Fault may exist
 - a) Internal to the generating source.
 - b) Between the generating source, and the aircraft bus tie contactor terminal connection.
 - 2) See troubleshooting section to isolate faulty component.
- (b) If a fault exists when using multiple sources; GPU and APU, or GPU and ENG GEN, or APU and ENG GEN:
 - 1) Isolate problem between applicable aircraft bus tie contactors, and loads:

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- a) Cycle individual loads one at a time, hydraulic pumps, fuel pumps, etc, until the unbalanced load circuit is identified.
- 2) See troubleshooting section to isolate faulty components.

SUBTASK 20-10-78-700-003

(5) Component Analysis

- (a) Once an individual source circuit (GPU, APU, ENG GEN) or load circuit (i.e. "Boost Pump CTR Tank Left") is identified as the cause of the imbalance:
 - 1) Continue isolating to the specific component (connector, broken conductor strands, degraded relay contact).
 - 2) Use these tools to help further isolate to the root cause:
 - a) Power Quality Analyzer - Measure and move toward the root cause.
 - b) Thermal Imaging - Infrared (IR) camera easily identifies current imbalance, voltage imbalance (drop) via heat signature.
 - 3) Measure voltage and current of the phase wires during UUT movement.
 - a) If individual phases read within 10% of the average current of all three legs, electrical system is balanced. Continue with UUT Mechanical System Tests.
 - b) If a leg is > 10% of the average current of the three legs, compare phase voltages.

If all individual phases read within 2% of the average voltage of all the three legs, then the high unbalanced current is likely due to motor winding fault. Confirm by rotating all 3 phase wires, do as follows:

- <1> Must rotate all phase wires; A to B, B to C, C to A. Moving all three legs will keep the motor rotating in the same direction.
 - <2> Compare current on each line leg before and after the connections are changed.
 - <3> If the high current leg stays with the power line phase (for example, phase A), then this is a power source problem rather than a motor problem. Isolate problem between power generating source and wiring by following step below that reads "If an individual phase reads > than 2% of the average current of all three legs".
 - <4> If high current leg moves with the moved wire (e.g. high amperage on phase A moved to now high amperage on phase B) then this is a motor problem. Schedule motor for replacement at next convenient maintenance opportunity.
- c) If a leg is > 10% of the average current of the three legs, compare phase voltages.

If Individual phase reads > than 2% of the average current of all three legs, then there is a voltage drop. Isolate drop on the lowest leg by:

 - <1> Try another power source and compare readings.
 - <a> For example, if using GPU, try APU.
 - <2> If readings are now within tolerance, problem is isolated to the power source and the common contactor.
 - <3> Isolate by moving the power quality analyzer towards the power generating source.

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- <a> For example, if swapping the GPU did not help, isolate the voltage drop by measuring voltage at the External Power Contactor.
- If voltages are correct on the terminal side of the contactor, but has a low leg on the load side of the contactor, the contactor is degraded. Schedule contactor replacement at next convenient maintenance opportunity.
- <c> If a low leg on the terminal side of the contactor, continue to move the analyzer to the next Line Replaceable Unit (LRU) closer to the source and analyze next LRU or wiring in between.

———— **END OF TASK** ————

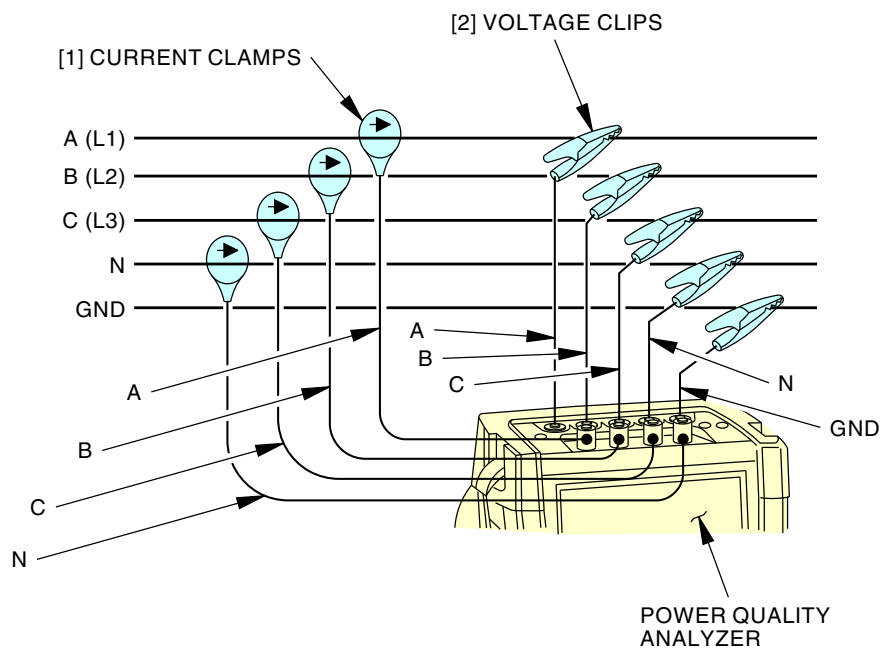
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**CONNECTION OF ANALYZER TO 3-PHASE DISTRIBUTION SYSTEM
(EXAMPLE)**

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Power Quality Check
Figure 201/20-10-78-990-801

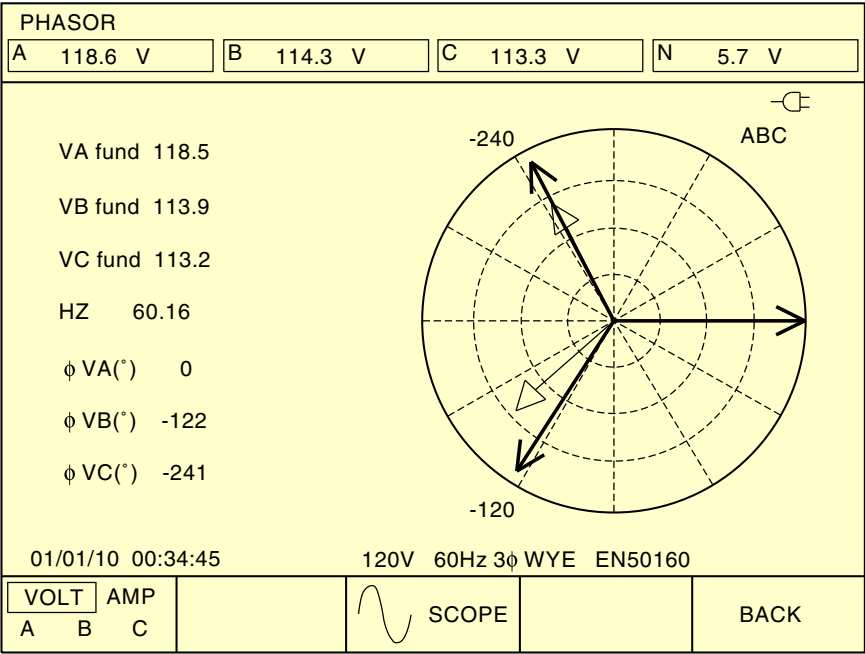
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STANDARD TORQUE VALUES - MAINTENANCE PRACTICES

1. General

A. This procedure has one task:

- (1) Standard Torque Values

TASK 20-11-00-910-801

2. Standard Torque Values

(Figure 201, Figure 202, Figure 203)

A. General

- (1) If the fastener torque value and the nut torque value are different, use the torque range that has the lowest maximum value.
- (2) If Mastinox 6856 K, C50056 is applied to the fastener use the torque value for "dry fasteners". If the installation torque range is specified on the engineering drawing then no substitution is allowed for Mastinox 6856 K, C50056.
- (3) Lubrication
 - (a) If one of the compounds that follow is applied to the fastener, use the torque value for "lubed fastener."
 - 1) BMS3-33 grease, D00633
 - 2) MIL-C-11796 corrosion preventive compound, C00308
 - 3) BMS3-38 corrosion inhibiting material, G50136 or Cor-Ban 27L Compound, G50237
 - 4) MIL-PRF-23827 grease, D00013
 - 5) MIL-PRF-46010 lubricant, D00110
 - 6) Bostik Never Seez Pure Nickel Special Never Seez NSBT, D50237
 - 7) Cetyl Alcohol lubricant, D50197
 - 8) Dry Film Lubricant or Solid Film Lubricant
- (4) Fastener and nut combination rotating member:
 - (a) If the torque is applied to the fastener head, and the joint is fay-sealed or not fay-sealed, then use the torque value in the column labeled "TURN THE FASTENER HEAD AND/OR FAY SEAL."
 - (b) If the torque is applied to the nut, and the joint is fay-sealed, then use the torque value in the column labeled "TURN THE FASTENER HEAD AND/OR FAY SEAL."
 - (c) If torque is applied to the nut, and the joint is not fay-sealed, then use the torque value in the column labeled "TURN THE NUT AND NO FAY SEAL."

B. Consumable Materials

Reference	Description	Specification
C00308	Compound - Corrosion Preventive, Petrolatum Hot Application	MIL-C-11796
C50056	Compound - Corrosion Inhibiting Material, Nondrying Resin Mix	BMS3-27
D00010	Compound - Thread Antiseize, High Temperature	MIL-PRF-907

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Reference	Description	Specification
D00013	Grease - Aircraft And Instrument Grease	MIL-PRF-23827 (NATO G-354) (Supersedes MIL-G-23827)
D00110	Lubricant - Solid Film, Heat Cured, Corrosion Inhibiting	MIL-PRF-46010
D00633	Grease - Aircraft General Purpose	BMS3-33
D50197	Lubricant - Cetyl Alcohol	SAE AS87132 (Supersedes MIL-L-87132)
D50237	Compound - Antiseize, Pure Nickel Special - Never Seez NSBT	BAC5008
G50136	Compound - Corrosion Inhibiting, Non-drying Paste	BMS3-38
G50237	Compound - Corrosion Inhibiting, Non-drying - Cor-Ban 27L	BMS3-38

C. Procedure

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- (1) Refer to the figures and tables that follow for the torque data.
 - (a) Torque Wrench Adapter, Figure 201
 - (b) Nuts and Bolts, Table 201, Table 202, Table 203, Table 204, Table 205, Table 206, Table 207, Table 208, Table 209, Table 210, Table 211, Table 212, Table 213, Table 214.

Table 201/20-11-00-993-802

FASTENER CLASS	220 KSI			
FASTENER PART NUMBER	BACB30MT, BACB30TR, BACB30NH, BACB30US, BACS21EK			
NUT PART NUMBER	BACN10HC, BACN10HR, BACN10JG, BACN10YN, BACN11X			
NOMINAL THREAD SIZE	DRY FASTENERS		LUBED FASTENERS	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL
0.1900-32	82 in-lb (9 N·m) to 88 in-lb (10 N·m)	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	53 in-lb (6 N·m) to 57 in-lb (6 N·m)	58 in-lb (7 N·m) to 62 in-lb (7 N·m)
0.2500-28	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)	78 in-lb (9 N·m) to 82 in-lb (9 N·m)
0.3135-24	204 in-lb (23 N·m) to 216 in-lb (24 N·m)	243 in-lb (27 N·m) to 258 in-lb (29 N·m)	155 in-lb (18 N·m) to 165 in-lb (19 N·m)	175 in-lb (20 N·m) to 185 in-lb (21 N·m)
0.3750-24	388 in-lb (44 N·m) to 412 in-lb (47 N·m)	485 in-lb (55 N·m) to 515 in-lb (58 N·m)	291 in-lb (33 N·m) to 309 in-lb (35 N·m)	320 in-lb (36 N·m) to 340 in-lb (38 N·m)
0.4375-20	655 in-lb (74 N·m) to 695 in-lb (79 N·m)	815 in-lb (92 N·m) to 865 in-lb (98 N·m)	388 in-lb (44 N·m) to 412 in-lb (47 N·m)	427 in-lb (48 N·m)

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FASTENER CLASS	220 KSI			
0.5000-20	1067 in-lb (121 N·m) to 1133 in-lb (128 N·m)	1261 in-lb (142 N·m) to 1339 in-lb (151 N·m)	558 in-lb (63 N·m) to 592 in-lb (67 N·m)	631 in-lb (71 N·m) to 670 in-lb (76 N·m)
0.5625-18	1504 in-lb (170 N·m) to 1597 in-lb (180 N·m)	1746 in-lb (197 N·m) to 1854 in-lb (209 N·m)	873 in-lb (99 N·m) to 927 in-lb (105 N·m)	970 in-lb (110 N·m) to 1030 in-lb (116 N·m)
0.6250-18	2037 in-lb (230 N·m) to 2163 in-lb (244 N·m)	2231 in-lb (252 N·m) to 2369 in-lb (268 N·m)	1455 in-lb (164 N·m) to 1545 in-lb (175 N·m)	1601 in-lb (181 N·m) to 1700 in-lb (192 N·m)
0.7500-16	3686 in-lb (416 N·m) to 3914 in-lb (442 N·m)	4171 in-lb (471 N·m) to 4429 in-lb (500 N·m)	2959 in-lb (334 N·m) to 3142 in-lb (355 N·m)	3201 in-lb (362 N·m) to 3399 in-lb (384 N·m)
0.8750-14	5723 in-lb (647 N·m) to 6077 in-lb (687 N·m)	6499 in-lb (734 N·m) to 6901 in-lb (780 N·m)	4074 in-lb (460 N·m) to 4326 in-lb (489 N·m)	4365 in-lb (493 N·m) to 4635 in-lb (524 N·m)
1.0000-12 OR 1.0000-14	8682 in-lb (981 N·m) to 9219 in-lb (1042 N·m)	10,573 in-lb (1195 N·m) to 11,227 in-lb (1268 N·m)	6402 in-lb (723 N·m) to 6798 in-lb (768 N·m)	6790 in-lb (767 N·m) to 7210 in-lb (815 N·m)
1.1250-12	10,961 in-lb (1238 N·m) to 11,639 in-lb (1315 N·m)	12,610 in-lb (1425 N·m) to 13,390 in-lb (1513 N·m)	8585 in-lb (970 N·m) to 9116 in-lb (1030 N·m)	9118 in-lb (1030 N·m) to 9682 in-lb (1094 N·m)
1.2500-12	16,975 in-lb (1918 N·m) to 18,025 in-lb (2037 N·m)	18,624 in-lb (2104 N·m) to 19,776 in-lb (2234 N·m)	11,155 in-lb (1260 N·m) to 11,845 in-lb (1338 N·m)	11,640 in-lb (1315 N·m) to 12,360 in-lb (1396 N·m)
1.3750-12	21,340 in-lb (2411 N·m) to 22,660 in-lb (2560 N·m)	23,280 in-lb (2630 N·m) to 24,720 in-lb (2793 N·m)	16,005 in-lb (1808 N·m) to 16,995 in-lb (1920 N·m)	16,490 in-lb (1863 N·m) to 17,510 in-lb (1978 N·m)

Table 202/20-11-00-993-803

FASTENER CLASS	220 KSI			
FASTENER PART NUMBER OR STYLE	BACB31G			
NOMINAL THREAD SIZE	DRY FASTENER		LUBED FASTENER	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD OR FAY SEAL
0.1900-32	82 in-lb (9 N·m) to 88 in-lb (10 N·m)	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	53 in-lb (6 N·m) to 57 in-lb (6 N·m)	58 in-lb (7 N·m) to 62 in-lb (7 N·m)
0.2500-28	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)	78 in-lb (9 N·m) to 82 in-lb (9 N·m)
0.3125-24	204 in-lb (23 N·m) to 216 in-lb (24 N·m)	243 in-lb (27 N·m) to 258 in-lb (29 N·m)	155 in-lb (18 N·m) to 165 in-lb (19 N·m)	175 in-lb (20 N·m) to 185 in-lb (21 N·m)

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FASTENER CLASS	220 KSI			
0.3750-24	388 in-lb (44 N·m) to 412 in-lb (47 N·m)	485 in-lb (55 N·m) to 515 in-lb (58 N·m)	291 in-lb (33 N·m) to 309 in-lb (35 N·m)	320 in-lb (36 N·m) to 340 in-lb (38 N·m)
0.4375-20	514 in-lb (58 N·m) to 546 in-lb (62 N·m)	669 in-lb (76 N·m) to 711 in-lb (80 N·m)	340 in-lb (38 N·m) to 361 in-lb (41 N·m)	412 in-lb (47 N·m) to 438 in-lb (49 N·m)
0.5000-20	825 in-lb (93 N·m) to 876 in-lb (99 N·m)	1038 in-lb (117 N·m) to 1102 in-lb (125 N·m)	529 in-lb (60 N·m) to 561 in-lb (63 N·m)	631 in-lb (71 N·m) to 670 in-lb (76 N·m)
0.5625-18	1213 in-lb (137 N·m) to 1288 in-lb (146 N·m)	1426 in-lb (161 N·m) to 1514 in-lb (171 N·m)	786 in-lb (89 N·m) to 834 in-lb (94 N·m)	892 in-lb (101 N·m) to 948 in-lb (107 N·m)
0.6250-18	1601 in-lb (181 N·m) to 1700 in-lb (192 N·m)	1843 in-lb (208 N·m) to 1957 in-lb (221 N·m)	1067 in-lb (121 N·m) to 1133 in-lb (128 N·m)	1164 in-lb (132 N·m) to 1236 in-lb (140 N·m)
0.7500-16	2862 in-lb (323 N·m) to 3039 in-lb (343 N·m)	3395 in-lb (384 N·m) to 3605 in-lb (407 N·m)	1892 in-lb (214 N·m) to 2009 in-lb (227 N·m)	2086 in-lb (236 N·m) to 2215 in-lb (250 N·m)

Table 203/20-11-00-993-804

FASTENER CLASS	160-200 KSI			
FASTENER PART NUMBER	BACB30EM, BACB30FD, BACB30LE, BACB30LM, BACB30LN, BACB30LP, BACB30LR, BACB30LU, BACB30NE, BACB30PN, BACB30UG, BACB30ZF, MS20004-MS20024, NAS1216, NAS6603-NAS6630, NAS6703-NAS6720			
NUT PART NUMBER	AS3485, AS3486, BACN10B, BACN10GW, BACN10JA, BACN10JB, BACN10RM, BACN11W, BACN11Z, BACN10ZC, NAS1804, NAS1805, NAS577			
NOMINAL THREAD SIZE	DRY FASTENERS		LUBED FASTENERS	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL
0.1120-40 or 0.1120-48	8 in-lb (1 N·m)	8 in-lb (1 N·m)	6 in-lb (1 N·m)	6 in-lb (1 N·m)
0.1380-32 or 0.1380-40	15 in-lb (2 N·m)	15 in-lb (2 N·m)	12 in-lb (1 N·m)	12 in-lb (1 N·m)
0.1640-32 or 0.1640-36	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	15 in-lb (2 N·m)	15 in-lb (2 N·m)
0.1900-32	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)
0.2500-28	82 in-lb (9 N·m) to 88 in-lb (10 N·m)	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	63 in-lb (7 N·m) to 67 in-lb (8 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)
0.3125-24	165 in-lb (19 N·m) to 175 in-lb (20 N·m)	194 in-lb (22 N·m) to 206 in-lb (23 N·m)	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)
0.3750-24	310 in-lb (35 N·m) to 330 in-lb (37 N·m)	398 in-lb (45 N·m) to 422 in-lb (48 N·m)	194 in-lb (22 N·m) to 206 in-lb (23 N·m)	243 in-lb (27 N·m) to 258 in-lb (29 N·m)
0.4375-20	514 in-lb (58 N·m) to 546 in-lb (62 N·m)	669 in-lb (76 N·m) to 711 in-lb (80 N·m)	340 in-lb (38 N·m) to 361 in-lb (41 N·m)	412 in-lb (47 N·m) to 438 in-lb (49 N·m)

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FASTENER CLASS	160-200 KSI			
0.5000-20	825 in-lb (93 N·m) to 876 in-lb (99 N·m)	1038 in-lb (117 N·m) to 1102 in-lb (125 N·m)	529 in-lb (60 N·m) to 561 in-lb (63 N·m)	631 in-lb (71 N·m) to 670 in-lb (76 N·m)
0.5625-18	1213 in-lb (137 N·m) to 1288 in-lb (146 N·m)	1426 in-lb (161 N·m) to 1514 in-lb (171 N·m)	786 in-lb (89 N·m) to 834 in-lb (94 N·m)	892 in-lb (101 N·m) to 948 in-lb (107 N·m)
0.6250-18	1601 in-lb (181 N·m) to 1700 in-lb (192 N·m)	1843 in-lb (208 N·m) to 1957 in-lb (221 N·m)	1067 in-lb (121 N·m) to 1133 in-lb (128 N·m)	1164 in-lb (132 N·m) to 1236 in-lb (140 N·m)
0.7500-16	2862 in-lb (323 N·m) to 3039 in-lb (343 N·m)	3395 in-lb (384 N·m) to 3605 in-lb (407 N·m)	1892 in-lb (214 N·m) to 2009 in-lb (227 N·m)	2086 in-lb (236 N·m) to 2215 in-lb (250 N·m)
0.8750-14	4462 in-lb (504 N·m) to 4738 in-lb (535 N·m)	5335 in-lb (603 N·m) to 5665 in-lb (640 N·m)	2910 in-lb (329 N·m) to 3090 in-lb (349 N·m)	3298 in-lb (373 N·m) to 3502 in-lb (396 N·m)
1.0000-12 or 1.0000-14	6790 in-lb (767 N·m) to 7210 in-lb (815 N·m)	8633 in-lb (975 N·m) to 9167 in-lb (1036 N·m)	4414 in-lb (499 N·m) to 4687 in-lb (530 N·m)	5335 in-lb (603 N·m) to 5665 in-lb (640 N·m)
1.1250-12	8536 in-lb (964 N·m) to 9064 in-lb (1024 N·m)	10,379 in-lb (1173 N·m) to 11,021 in-lb (1245 N·m)	5626 in-lb (636 N·m) to 5974 in-lb (675 N·m)	6499 in-lb (734 N·m) to 6901 in-lb (780 N·m)
1.2500-12	12,222 in-lb (1381 N·m) to 12,978 in-lb (1466 N·m)	15,229 in-lb (1721 N·m) to 16,171 in-lb (1827 N·m)	8342 in-lb (943 N·m) to 8858 in-lb (1001 N·m)	9409 in-lb (1063 N·m) to 9991 in-lb (1129 N·m)

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FASTENER CLASS	160-200 KSI			
FASTENER MATERIAL	TITANIUM			
FASTENER PART NUMBER	BACB30MR, BACB30MS, BACB30NM, BACB30NN, BACB30NS, BACB30XJ, BACB30XK, BACB30XL, BACB30XM, BACS21EJ, NAS1189, NAS6803-NAS6820			
NUT PART NUMBER	AS3485, AS3486, BACN10B, BACN10GW, BACN10JA, BACN10JB, BACN10RM, BACN11W, BACN11Z, BACN10ZC, NAS1804, NAS1805, NAS577			
NOMINAL THREAD SIZE	DRY FASTENERS		LUBED FASTENERS	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL
0.1120-40 or 0.1120-48	8 in-lb (1 N·m)	8 in-lb (1 N·m)	6 in-lb (1 N·m)	6 in-lb (1 N·m)
0.1380-32 or 0.1380-40	15 in-lb (2 N·m)	15 in-lb (2 N·m)	12 in-lb (1 N·m)	12 in-lb (1 N·m)
0.1640-32 or 0.1640-36	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	15 in-lb (2 N·m)	15 in-lb (2 N·m)
0.1900-32	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)

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FASTENER CLASS	160-200 KSI			
0.2500-28	82 in-lb (9 N·m) to 88 in-lb (10 N·m)	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	63 in-lb (7 N·m) to 67 in-lb (8 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)
0.3125-24	165 in-lb (19 N·m) to 175 in-lb (20 N·m)	194 in-lb (22 N·m) to 206 in-lb (23 N·m)	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)
0.3750-24	310 in-lb (35 N·m) to 330 in-lb (37 N·m)	398 in-lb (45 N·m) to 422 in-lb (48 N·m)	194 in-lb (22 N·m) to 206 in-lb (23 N·m)	243 in-lb (27 N·m) to 258 in-lb (29 N·m)
0.4375-20	514 in-lb (58 N·m) to 546 in-lb (62 N·m)	669 in-lb (76 N·m) to 711 in-lb (80 N·m)	340 in-lb (38 N·m) to 361 in-lb (41 N·m)	412 in-lb (47 N·m) to 438 in-lb (49 N·m)
0.5000-20	825 in-lb (93 N·m) to 876 in-lb (99 N·m)	1038 in-lb (117 N·m) to 1102 in-lb (125 N·m)	529 in-lb (60 N·m) to 561 in-lb (63 N·m)	631 in-lb (71 N·m) to 670 in-lb (76 N·m)
0.5625-18	1213 in-lb (137 N·m) to 1288 in-lb (146 N·m)	1426 in-lb (161 N·m) to 1514 in-lb (171 N·m)	786 in-lb (89 N·m) to 834 in-lb (94 N·m)	892 in-lb (101 N·m) to 948 in-lb (107 N·m)
0.6250-18	1601 in-lb (181 N·m) to 1700 in-lb (192 N·m)	1843 in-lb (208 N·m) to 1957 in-lb (221 N·m)	1067 in-lb (121 N·m) to 1133 in-lb (128 N·m)	1164 in-lb (132 N·m) to 1236 in-lb (140 N·m)
0.7500-16	1843 in-lb (208 N·m) to 1957 in-lb (221 N·m)	2134 in-lb (241 N·m) to 2266 in-lb (256 N·m)	1892 in-lb (214 N·m) to 2009 in-lb (227 N·m)	2086 in-lb (236 N·m) to 2215 in-lb (250 N·m)

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FASTENER CLASS	95-156 KSI			
FASTENER PART NUMBER OR STYLE	BACB30LH, BACB30LJ, BACB30LK, BACB30LT, BACB30NF, BACB30NJ, BACB30NL, BACB30NR, BACB30NT, BACB30PC, BACB30PF ^[1] , BACB30PU ^[1] , BACB30PW ^[1] , BACB30SW, BACB30TP, BACB30UU, BACB30WP, BACB30XN, BACB30ZC, BACB30ZG, BACS12BE(-)(-), BACS12BE(-)(-), BACS12BE(A)(-), BACS12BE(B)(-), BACS12BF(-)(-), BACS12BF(A)(-), BACS12BF(B)(-), BACS12BG(-)(-), BACS12BG(A)(-), BACS12BG(B)(-), BACS12BP()(no 'C' CODES), BACS12CB, BACS12CK, BACS12ER, BACS12FA, BACS12GM, BACS12GP, BACS12GR, BACS12GU, BACS12GX, BACS12HC, BACS12HJ, BACS12HL, BACS12HM, BACS12HN, BACS12HP, BACS12HU, BACS12HV, BACS12HW, BACS12HY, BACS12JA, BACS12JB, BACS12JD, BACS12JE, BACS12JL, BACS12N, MS21262, MS24678, MS24694-S(), NAS220(-) ^[2] , NAS220C() ^[2] , NAS221(-) ^[2] , NAS221C() ^[2] , NAS428, NAS514, NAS517, NAS563, NAS600-NAS606, NAS6203-NAS6220, NAS623, NAS7600-NAS7616, NAS8200-NAS8206, THREADED ROD (STEEL, CRES, NICKEL ALLOY)			
NOMINAL THREAD SIZE	DRY FASTENER		LUBED FASTENER	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL
0.0860-56 or 0.0860-64	3 in-lb (0 N·m)	3 in-lb (0 N·m)	3 in-lb (0 N·m)	3 in-lb (0 N·m)
0.1120-40 or 0.1120-48	8 in-lb (1 N·m)	8 in-lb (1 N·m)	6 in-lb (1 N·m)	6 in-lb (1 N·m)
0.1380-32 or 0.1380-40	15 in-lb (2 N·m)	15 in-lb (2 N·m)	12 in-lb (1 N·m)	12 in-lb (1 N·m)
0.1640-32 or 0.1640-36	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	15 in-lb (2 N·m)	15 in-lb (2 N·m)

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FASTENER CLASS	95-156 KSI			
0.1900-32	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)
0.2500-28	63 in-lb (7 N·m) to 67 in-lb (8 N·m)	78 in-lb (9 N·m) to 82 in-lb (9 N·m)	63 in-lb (7 N·m) to 67 in-lb (8 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)
0.3125-24	121 in-lb (14 N·m) to 129 in-lb (15 N·m)	146 in-lb (16 N·m) to 155 in-lb (18 N·m)	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)
0.3750-24	194 in-lb (22 N·m) to 206 in-lb (23 N·m)	223 in-lb (25 N·m) to 247 in-lb (28 N·m)	170 in-lb (19 N·m) to 180 in-lb (20 N·m)	194 in-lb (22 N·m) to 206 in-lb (23 N·m)
0.4375-20	291 in-lb (33 N·m) to 309 in-lb (35 N·m)	340 in-lb (38 N·m) to 361 in-lb (41 N·m)	262 in-lb (30 N·m) to 278 in-lb (31 N·m)	291 in-lb (33 N·m) to 309 in-lb (35 N·m)
0.5000-20	616 in-lb (70 N·m) to 654 in-lb (74 N·m)	766 in-lb (87 N·m) to 814 in-lb (92 N·m)	529 in-lb (60 N·m) to 561 in-lb (63 N·m)	631 in-lb (71 N·m) to 670 in-lb (76 N·m)
0.5625-18	946 in-lb (107 N·m) to 1004 in-lb (113 N·m)	1116 in-lb (126 N·m) to 1185 in-lb (134 N·m)	786 in-lb (89 N·m) to 834 in-lb (94 N·m)	892 in-lb (101 N·m) to 948 in-lb (107 N·m)
0.6250-18	1261 in-lb (142 N·m) to 1339 in-lb (151 N·m)	1455 in-lb (164 N·m) to 1545 in-lb (175 N·m)	1067 in-lb (121 N·m) to 1133 in-lb (128 N·m)	1164 in-lb (132 N·m) to 1236 in-lb (140 N·m)
0.7500-16	2571 in-lb (290 N·m) to 2730 in-lb (308 N·m)	2910 in-lb (329 N·m) to 3090 in-lb (349 N·m)	1867 in-lb (211 N·m) to 1983 in-lb (224 N·m)	2086 in-lb (236 N·m) to 2215 in-lb (250 N·m)
0.8750-14	3395 in-lb (384 N·m) to 3605 in-lb (407 N·m)	4365 in-lb (493 N·m) to 4635 in-lb (524 N·m)	2910 in-lb (329 N·m) to 3090 in-lb (349 N·m)	3298 in-lb (373 N·m) to 3502 in-lb (396 N·m)
1.0000-12 or 1.0000-14	5432 in-lb (614 N·m) to 5768 in-lb (652 N·m)	7275 in-lb (822 N·m) to 7725 in-lb (873 N·m)	4414 in-lb (499 N·m) to 4687 in-lb (530 N·m)	5335 in-lb (603 N·m) to 5665 in-lb (640 N·m)
0.1250-12	6790 in-lb (767 N·m) to 7210 in-lb (815 N·m)	8730 in-lb (986 N·m) to 9270 in-lb (1047 N·m)	5626 in-lb (636 N·m) to 5974 in-lb (675 N·m)	6499 in-lb (734 N·m) to 6901 in-lb (780 N·m)
0.2500-12	10,670 in-lb (1206 N·m) to 11,330 in-lb (1280 N·m)	12,610 in-lb (1425 N·m) to 13,390 in-lb (1513 N·m)	8342 in-lb (943 N·m) to 8858 in-lb (1001 N·m)	9409 in-lb (1063 N·m) to 9991 in-lb (1129 N·m)

*[1] Use the thread diameter of the nut to find the applicable torque value. Do not use the nominal fastener diameter.

*[2] No BZ, BZP, or DD material codes are covered for the NAS220-NAS221.

Table 206/20-11-00-993-807

FASTENER CLASS	160 KSI	95 KSI
FASTENER PART NUMBER OR STYLE	BACB31U	BACB31V

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FASTENER CLASS	160 KSI				95 KSI	
NOMINAL THREAD SIZE	DRY FASTENER		LUBED FASTENER		DRY FASTENER	LUBED FASTENER
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT OR FASTENER HEAD	TURN THE NUT OR FASTENER HEAD
	FAY SEAL OR NO FAY SEAL					
0.1900-32	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)
0.2500-28	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)	63 in-lb (7 N·m) to 67 in-lb (8 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)	39 in-lb (4 N·m) to 41 in-lb (5 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)
0.3125-24	204 in-lb (23 N·m) to 216 in-lb (24 N·m)	243 in-lb (27 N·m) to 258 in-lb (29 N·m)	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)	--	--
0.3750-24	388 in-lb (44 N·m) to 412 in-lb (47 N·m)	485 in-lb (55 N·m) to 515 in-lb (58 N·m)	170 in-lb (19 N·m) to 180 in-lb (20 N·m)	243 in-lb (27 N·m) to 258 in-lb (29 N·m)	--	--

Table 207/20-11-00-993-808

NUT CLASS	160 KSI			
NUT PART NUMBER OR STYLE	BACN10JD7-BACN10JD20 ONLY			
NOMINAL THREAD SIZE	DRY FASTENER		LUBED FASTENER	
	TURN THE NUT AND NO FAY SEAL ^{*[1]}	TURN THE FASTENER HEAD AND/OR FAY SEAL ^{*[1]}	TURN THE NUT AND NO FAY SEAL ^{*[1]}	TURN THE FASTENER HEAD AND/OR FAY SEAL ^{*[1]}
0.4375-20	360 in-lb (41 N·m) to 690 in-lb (78 N·m)	620 in-lb (70 N·m) to 760 in-lb (86 N·m)	260 in-lb (29 N·m) to 425 in-lb (48 N·m)	383 in-lb (43 N·m) to 468 in-lb (53 N·m)
0.5000-20	630 in-lb (71 N·m) to 1070 in-lb (121 N·m)	963 in-lb (109 N·m) to 1170 in-lb (132 N·m)	440 in-lb (50 N·m) to 650 in-lb (73 N·m)	585 in-lb (66 N·m) to 715 in-lb (81 N·m)
0.5625-18	1000 in-lb (113 N·m) to 1470 in-lb (166 N·m)	1320 in-lb (149 N·m) to 1610 in-lb (182 N·m)	700 in-lb (79 N·m) to 920 in-lb (104 N·m)	828 in-lb (94 N·m) to 1010 in-lb (114 N·m)
0.6250-18	1400 in-lb (158 N·m) to 1900 in-lb (215 N·m)	1710 in-lb (193 N·m) to 2090 in-lb (236 N·m)	1000 in-lb (113 N·m) to 1200 in-lb (136 N·m)	1080 in-lb (122 N·m) to 1320 in-lb (149 N·m)

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NUT CLASS	160 KSI			
0.7500-16	2400 in-lb (271 N·m) to 3500 in-lb (395 N·m)	3150 in-lb (356 N·m) to 3850 in-lb (435 N·m)	1700 in-lb (192 N·m) to 2150 in-lb (243 N·m)	1930 in-lb (218 N·m) to 2360 in-lb (267 N·m)
0.8750-14	3700 in-lb (418 N·m) to 5500 in-lb (621 N·m)	4950 in-lb (559 N·m) to 6050 in-lb (684 N·m)	2600 in-lb (294 N·m) to 3400 in-lb (384 N·m)	3060 in-lb (346 N·m) to 3740 in-lb (423 N·m)
1.0000-12 or 1.0000-14	5100 in-lb (576 N·m) to 8900 in-lb (1006 N·m)	8010 in-lb (905 N·m) to 9790 in-lb (1106 N·m)	3600 in-lb (407 N·m) to 5500 in-lb (621 N·m)	4950 in-lb (559 N·m) to 6050 in-lb (684 N·m)
1.1250-12	6900 in-lb (780 N·m) to 10,700 in-lb (1209 N·m)	9630 in-lb (1088 N·m) to 11,700 in-lb (1322 N·m)	4900 in-lb (554 N·m) to 6700 in-lb (757 N·m)	6030 in-lb (681 N·m) to 7370 in-lb (833 N·m)
1.2500-12	11,500 in-lb (1299 N·m) to 15,700 in-lb (1774 N·m)	14,100 in-lb (1593 N·m) to 17,200 in-lb (1943 N·m)	7500 in-lb (847 N·m) to 9700 in-lb (1096 N·m)	8730 in-lb (986 N·m) to 10,600 in-lb (1198 N·m)

*[1] Change the fastener grip length or add washers to align the nut slot to the cotter pin hole in the specified torque range.

Table 208/20-11-00-993-809

NUT CLASS	125 KSI	
NUT PART NUMBER OR STYLE	AS3479, AS3481, BACN10DW, BACN10DY, BACN10DZ, BACN10FX, BACN10GH, BACN10JC04-BACN10JC7 ONLY, BACN10JN, BACN10JP, BACN10JQ, BACN10JR, BACN10JT, BACN10JY, BACN10JZ, BACN10KA, BACN10KB, BACN10KE, BACN10KF, BACN10KH, BACN10KJ, BACN10MS, BACN10MX, BACN10NW, BACN10TL, BACN10TM, BACN10VR, BACN10YC, BACN10YD, BACN10YF, BACN10YK, BACN10YR, BACN11P, MS21042, MS21043, NAS1474, NAS679, NAS686, INSERTS IN METAL, TAPPED HOLES	
NOMINAL THREAD SIZE	DRY FASTENERS	LUBED FASTENERS
	FAY SEAL OR NO FAY SEAL	
0.0860-56 or 0.0860-64	3 in-lb (0 N·m)	3 in-lb (0 N·m)
0.1120-40 or 0.1120-48	8 in-lb (1 N·m)	6 in-lb (1 N·m)
0.1380-32 or 0.1380-40	15 in-lb (2 N·m)	12 in-lb (1 N·m)
0.1640-32 or 0.1640-36	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	15 in-lb (2 N·m)
0.1900-32	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)
0.2500-28	78 in-lb (9 N·m) to 82 in-lb (9 N·m)	73 in-lb (8 N·m) to 77 in-lb (9 N·m)
0.3125-24	146 in-lb (16 N·m) to 155 in-lb (18 N·m)	121 in-lb (14 N·m) to 129 in-lb (15 N·m)
0.3750-24	233 in-lb (26 N·m) to 247 in-lb (28 N·m)	194 in-lb (22 N·m) to 206 in-lb (23 N·m)
0.4375-20	340 in-lb (38 N·m) to 361 in-lb (41 N·m)	291 in-lb (33 N·m) to 309 in-lb (35 N·m)
0.5000-20	766 in-lb (87 N·m) to 814 in-lb (92 N·m)	631 in-lb (71 N·m) to 670 in-lb (76 N·m)
0.5625-18	1116 in-lb (126 N·m) to 1185 in-lb (134 N·m)	892 in-lb (101 N·m) to 948 in-lb (107 N·m)

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NUT CLASS	125 KSI	
0.6250-18	1455 in-lb (164 N·m) to 1545 in-lb (175 N·m)	1164 in-lb (132 N·m) to 1236 in-lb (140 N·m)
0.7500-16	2910 in-lb (329 N·m) to 3090 in-lb (349 N·m)	2086 in-lb (236 N·m) to 2215 in-lb (250 N·m)
0.8750-14	4365 in-lb (493 N·m) to 4635 in-lb (524 N·m)	3298 in-lb (373 N·m) to 3502 in-lb (396 N·m)

Table 209/20-11-00-993-810

NUT CLASS	80 KSI		125 KSI			
NUT PART NUMBER	BACN10JD103-BACN10JD120 BACN11N103-BACN11N120 MS14145		BACN10JD3-BACN20JD6 ONLY BACN11N3-BACN11N20 ONLY MS14144			
NOMINAL THREAD SIZE	DRY OR LUBED FASTENERS		DRY FASTENERS		LUBED FASTENERS	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL
0.1900-32	18 in-lb (2 N·m) to 25 in-lb (3 N·m)	18 in-lb (2 N·m) to 25 in-lb (3 N·m)	25 in-lb (3 N·m) to 35 in-lb (4 N·m)	31 in-lb (4 N·m) to 38 in-lb (4 N·m)	25 in-lb (3 N·m) to 35 in-lb (4 N·m)	25 in-lb (3 N·m) to 35 in-lb (4 N·m)
0.2500-28	30 in-lb (3 N·m) to 50 in-lb (6 N·m)	45 in-lb (5 N·m) to 55 in-lb (6 N·m)	50 in-lb (6 N·m) to 80 in-lb (9 N·m)	72 in-lb (8 N·m) to 88 in-lb (10 N·m)	50 in-lb (6 N·m) to 75 in-lb (8 N·m)	68 in-lb (8 N·m) to 83 in-lb (9 N·m)
0.3125-24	60 in-lb (7 N·m) to 90 in-lb (10 N·m)	80 in-lb (9 N·m) to 100 in-lb (11 N·m)	100 in-lb (11 N·m) to 150 in-lb (17 N·m)	135 in-lb (15 N·m) to 165 in-lb (19 N·m)	90 in-lb (10 N·m) to 125 in-lb (14 N·m)	113 in-lb (13 N·m) to 137 in-lb (15 N·m)
.3750-24	95 in-lb (11 N·m) to 160 in-lb (18 N·m)	144 in-lb (16 N·m) to 176 in-lb (20 N·m)	160 in-lb (18 N·m) to 240 in-lb (27 N·m)	216 in-lb (24 N·m) to 264 in-lb (30 N·m)	150 in-lb (17 N·m) to 200 in-lb (23 N·m)	180 in-lb (20 N·m) to 220 in-lb (25 N·m)
0.4375-20	220 in-lb (25 N·m) to 280 in-lb (32 N·m)	252 in-lb (28 N·m) to 308 in-lb (35 N·m)	250 in-lb (28 N·m) to 350 in-lb (40 N·m)	315 in-lb (36 N·m) to 385 in-lb (43 N·m)	240 in-lb (27 N·m) to 300 in-lb (34 N·m)	270 in-lb (31 N·m) to 330 in-lb (37 N·m)
0.5000-20	290 in-lb (33 N·m) to 510 in-lb (58 N·m)	459 in-lb (52 N·m) to 561 in-lb (63 N·m)	480 in-lb (54 N·m) to 790 in-lb (89 N·m)	710 in-lb (80 N·m) to 870 in-lb (98 N·m)	440 in-lb (50 N·m) to 650 in-lb (73 N·m)	585 in-lb (66 N·m) to 715 in-lb (81 N·m)
0.5625-18	480 in-lb (54 N·m) to 850 in-lb (96 N·m)	765 in-lb (86 N·m) to 935 in-lb (106 N·m)	800 in-lb (90 N·m) to 1150 in-lb (130 N·m)	1035 in-lb (117 N·m) to 1265 in-lb (143 N·m)	700 in-lb (79 N·m) to 920 in-lb (104 N·m)	828 in-lb (94 N·m) to 1010 in-lb (114 N·m)

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NUT CLASS	80 KSI		125 KSI			
0.6250-18	660 in-lb (75 N·m) to 980 in-lb (111 N·m)	882 in-lb (100 N·m) to 1080 in-lb (122 N·m)	1100 in-lb (124 N·m) to 1500 in-lb (169 N·m)	1350 in-lb (153 N·m) to 1650 in-lb (186 N·m)	1000 in-lb (113 N·m) to 1200 in-lb (136 N·m)	1080 in-lb (122 N·m) to 1320 in-lb (149 N·m)
0.7500-16	1300 in-lb (147 N·m) to 2000 in-lb (226 N·m)	1800 in-lb (203 N·m) to 2200 in-lb (249 N·m)	2300 in-lb (260 N·m) to 3000 in-lb (339 N·m)	2700 in-lb (305 N·m) to 3300 in-lb (373 N·m)	1700 in-lb (192 N·m) to 2150 in-lb (243 N·m)	1940 in-lb (219 N·m) to 2360 in-lb (267 N·m)
0.8750-14	1500 in-lb (169 N·m) to 3300 in-lb (373 N·m)	2970 in-lb (336 N·m) to 3630 in-lb (410 N·m)	2500 in-lb (282 N·m) to 4500 in-lb (508 N·m)	4050 in-lb (458 N·m) to 4950 in-lb (559 N·m)	2600 in-lb (294 N·m) to 3400 in-lb (384 N·m)	3060 in-lb (346 N·m) to 3740 in-lb (423 N·m)
1.000-12 or 1.000-14	2200 in-lb (249 N·m) to 5300 in-lb (599 N·m)	4770 in-lb (539 N·m) to 5830 in-lb (659 N·m)	3700 in-lb (418 N·m) to 7500 in-lb (847 N·m)	6750 in-lb (763 N·m) to 8250 in-lb (932 N·m)	3600 in-lb (407 N·m) to 5500 in-lb (621 N·m)	4950 in-lb (559 N·m) to 6050 in-lb (684 N·m)
1.1250-12	3000 in-lb (339 N·m) to 6200 in-lb (701 N·m)	5580 in-lb (630 N·m) to 6820 in-lb (771 N·m)	5000 in-lb (565 N·m) to 9000 in-lb (1017 N·m)	8100 in-lb (915 N·m) to 9900 in-lb (1119 N·m)	4900 in-lb (554 N·m) to 6700 in-lb (757 N·m)	6080 in-lb (687 N·m) to 7370 in-lb (833 N·m)
1.2500-12	5400 in-lb (610 N·m) to 8600 in-lb (972 N·m)	7740 in-lb (874 N·m) to 9460 in-lb (1069 N·m)	9000 in-lb (1017 N·m) to 13,000 in-lb (1469 N·m)	11,700 in-lb (1322 N·m) to 14,300 in-lb (1616 N·m)	7500 in-lb (847 N·m) to 9700 in-lb (1096 N·m)	8730 in-lb (986 N·m) to 10,600 in-lb (1198 N·m)

Table 210/20-11-00-993-811

FASTENER CLASS	95 KSI	
FASTENER PART NUMBER	BACB30DP, BACB30EL, BACB30FB, BACB30LL, BACB30NU, BACB30RF, BACB30UR, BACB30UW, BACB30VF, BACB30XD, BACB30YE, BACB30ZE, BACB31A, BACS12HB, BACS12HE, BACS12JC, NAS1992, NAS1993-NAS2000, NAS8704-NAS8716	
NUT PART NUMBER OR STYLE	ALL NON-CASTELLATED NUTS, NUT PLATES, CLIP NUTS, METALLIC STANDOFFS, INSERTS, TAPPED HOLES	ALL CASTELLATED NUTS
NOMINAL THREAD SIZE	DRY AND CETYL ALCOHOL LUBED FASTENERS ^{*[1]*[2]}	
	TURN THE HEAD OR THE NUT - FAY SEAL OR NO FAY SEAL	
0.1640-32 or 0.1640-36	15 in-lb (2 N·m)	10 in-lb (1 N·m) to 18 in-lb (2 N·m)
0.1900-32	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	18 in-lb (2 N·m) to 25 in-lb (3 N·m)
0.2500-28	39 in-lb (4 N·m) to 41 in-lb (5 N·m)	30 in-lb (3 N·m) to 40 in-lb (5 N·m)
0.3125-24	92 in-lb (10 N·m) to 98 in-lb (11 N·m)	90 in-lb (10 N·m) to 100 in-lb (11 N·m)
0.3750-24	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	95 in-lb (11 N·m) to 105 in-lb (12 N·m)

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FASTENER CLASS	95 KSI	
0.4375-20	155 in-lb (18 N·m) to 165 in-lb (19 N·m)	150 in-lb (17 N·m) to 170 in-lb (19 N·m)
0.5000-20	223 in-lb (25 N·m) to 237 in-lb (27 N·m)	229 in-lb (26 N·m) to 245 in-lb (28 N·m)
0.5625-18	301 in-lb (34 N·m) to 319 in-lb (36 N·m)	290 in-lb (33 N·m) to 325 in-lb (37 N·m)
0.6250-18	407 in-lb (46 N·m) to 433 in-lb (49 N·m)	395 in-lb (45 N·m) to 435 in-lb (49 N·m)
0.7500-16	660 in-lb (75 N·m) to 700 in-lb (79 N·m)	645 in-lb (73 N·m) to 720 in-lb (81 N·m)
0.8750-14	1067 in-lb (121 N·m) to 1133 in-lb (128 N·m)	1040 in-lb (118 N·m) to 1150 in-lb (130 N·m)
1.0000-12 or 1.0000-14	1601 in-lb (181 N·m) to 1700 in-lb (192 N·m)	1560 in-lb (176 N·m) to 1730 in-lb (195 N·m)

*[1] This table only gives the torque value for dry fasteners or fasteners that are lubricated with cetyl alcohol. The applicable torque value must be specified in the AMM procedure for fasteners that are installed with other lubricants (including solid film lubricants).

*[2] An 'S' in the part number code may indicate solid film lubricant.

Table 211/20-11-00-993-812

FASTENER CLASS	60-80 KSI		NYLON NUTS	
FASTENER PART NUMBER OR STYLE	BACNS12BP()(all codes that contain 'C')(), BACS12BE()C(), BACS12BF()C(), BACS12BG()C(), MS24693-C(), MS24693-S(), MS24694-C(), MS51957, MS51958		ALL FASTENERS	
NUT PART NUMBER OR STYLE	BACN10JC8-BACN10JC28 ONLY, BACN11BN, MS21245		BACN10YJ08, BACN10YJ3	
NOMINAL THREAD SIZE	DRY OR LUBED FASTENER		DRY OR LUBED FASTENER	
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND FAY SEAL
0.0860-56 or 0.0860-64	3 in-lb (0 N·m)	3 in-lb (0 N·m)	--	--
0.1120-40 or 0.1120-48	6 in-lb (1 N·m)	6 in-lb (1 N·m)	--	--
0.1380-32 or 0.1380-40	12 in-lb (1 N·m)	12 in-lb (1 N·m)	--	--
0.1640-32 or 0.1640-36	15 in-lb (2 N·m)	15 in-lb (2 N·m)	5 in-lb (1 N·m)	6 in-lb (1 N·m)
0.1900-32	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)	7 in-lb (1 N·m)	8 in-lb (1 N·m)
0.2500-28	39 in-lb (4 N·m) to 41 in-lb (5 N·m)	49 in-lb (6 N·m) to 52 in-lb (6 N·m)	--	--
0.3125-24	76 in-lb (9 N·m) to 80 in-lb (9 N·m)	92 in-lb (10 N·m) to 98 in-lb (11 N·m)	--	--

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Table 211/20-11-00-993-812 (Continued)

FASTENER CLASS	60-80 KSI		NYLON NUTS	
0.3750-24	126 in-lb (14 N·m) to 134 in-lb (15 N·m)	155 in-lb (18 N·m) to 165 in-lb (19 N·m)	--	--
0.4375-20	243 in-lb (27 N·m) to 258 in-lb (29 N·m)	272 in-lb (31 N·m) to 288 in-lb (33 N·m)	--	--
0.5000-20	388 in-lb (44 N·m) to 412 in-lb (47 N·m)	495 in-lb (56 N·m) to 525 in-lb (59 N·m)	--	--
0.5625-18	650 in-lb (73 N·m) to 690 in-lb (78 N·m)	825 in-lb (93 N·m) to 876 in-lb (99 N·m)	--	--
0.6250-18	795 in-lb (90 N·m) to 845 in-lb (95 N·m)	951 in-lb (107 N·m) to 1009 in-lb (114 N·m)	--	--
0.7500-16	1601 in-lb (181 N·m) to 1700 in-lb (192 N·m)	1940 in-lb (219 N·m) to 2060 in-lb (233 N·m)	--	--
0.8750-14	2328 in-lb (263 N·m) to 2472 in-lb (279 N·m)	3201 in-lb (362 N·m) to 3399 in-lb (384 N·m)	--	--
1.0000-12 or 1.0000-14	3638 in-lb (411 N·m) to 3863 in-lb (436 N·m)	5141 in-lb (581 N·m) to 5459 in-lb (617 N·m)	--	--
1.1250-12	4462 in-lb (504 N·m) to 4738 in-lb (535 N·m)	6014 in-lb (679 N·m) to 6386 in-lb (722 N·m)	--	--
1.2500-12	6790 in-lb (767 N·m) to 7210 in-lb (815 N·m)	8342 in-lb (943 N·m) to 8858 in-lb (1001 N·m)	--	--
1.3750-12	7760 in-lb (877 N·m) to 8240 in-lb (931 N·m)	8730 in-lb (986 N·m) to 9270 in-lb (1047 N·m)	--	--
1.5000-12	10,670 in-lb (1206 N·m) to 11,330 in-lb (1280 N·m)	11,640 in-lb (1315 N·m) to 12,360 in-lb (1396 N·m)	--	--

Table 212/20-11-00-993-813

FASTENER CLASS		60-80 KSI		95-160 KSI	
STAKE SCREW PART NUMBERS ^{*[1]}		FCM(***)(*)CP(**); FH(***)(*)CP(**); PS(***)(*)CP(**); C(***)(*)CP(**); S(***)(*)CP(**); SFSW(***)(*)CP(**); PS(***)(*)CS(**); S10(***)(*)CP(**); SFSW(***)(*)CS(**); FHC(***)(*)CP(**)		CPS(***)(*)D(**); FCM(***)(*)D(**); FH(***)(*)D(**); PS(***)(*)D(**); S(***)(*)D(**); SFS(***)(*)D(**); SFSW(***)(*)D(**); WHS(***)(*)TPS(**)	
NOMINAL THREAD SIZE	STAKE DASH NUMBER	TORQUE TOOL SETPOINT ^{*[2]}			
		DRY SCREWS	LUBED SCREWS	DRY SCREWS	LUBED SCREWS
0.0860-56 or 0.0860-65	2C	3 in-lb (0 N·m)	3 in-lb (0 N·m)	3 in-lb (0 N·m)	3 in-lb (0 N·m)
0.1120-40 or 0.1120-48	4C	6 in-lb (1 N·m)	5 in-lb (1 N·m)	8 in-lb (1 N·m)	6 in-lb (1 N·m)

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Table 212/20-11-00-993-813 (Continued)

FASTENER CLASS		60-80 KSI		95-160 KSI	
0.1380-32 or 0.1380-40	6C	12 in-lb (1 N·m)	8 in-lb (1 N·m)	15 in-lb (2 N·m)	15 in-lb (2 N·m)
0.1640-32 or 0.1640-36	8C	16 in-lb (2 N·m)	12 in-lb (1 N·m)	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	15 in-lb (2 N·m)
0.1900-32	10C	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	15 in-lb (2 N·m)	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)

*[1] (***) = screw diameter; (*) = length (dash number); (**) = color code (glossiness and color).

*[2] Use the torque values for dry screws unless the AMM procedure specifies additional lubricant.

Table 213/20-11-00-993-814

NUT STYLE	LOCKWIRE HOLES	NO LOCKWIRE HOLES
NUT PART NUMBER	BACN11U(), NAS1423, NAS509	AN315, AN316, BACN11U()N, MS35649, MS35650, MS3591
NOMINAL THREAD SIZE		
0.1900-32	15 in-lb (2 N·m)	19 in-lb (2 N·m) to 21 in-lb (2 N·m)
0.2500-28	19 in-lb (2 N·m) to 21 in-lb (2 N·m)	24 in-lb (3 N·m) to 26 in-lb (3 N·m)
0.3125-24	34 in-lb (4 N·m) to 36 in-lb (4 N·m)	49 in-lb (6 N·m) to 52 in-lb (6 N·m)
0.3750-24	44 in-lb (5 N·m) to 46 in-lb (5 N·m)	63 in-lb (7 N·m) to 67 in-lb (8 N·m)
0.4375-20	63 in-lb (7 N·m) to 67 in-lb (8 N·m)	97 in-lb (11 N·m) to 103 in-lb (12 N·m)
0.5000-20	78 in-lb (9 N·m) to 82 in-lb (9 N·m)	112 in-lb (13 N·m) to 118 in-lb (13 N·m)
0.5625-18	87 in-lb (10 N·m) to 93 in-lb (11 N·m)	131 in-lb (15 N·m) to 139 in-lb (16 N·m)
0.6250-18	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	146 in-lb (16 N·m) to 155 in-lb (18 N·m)
0.7500-16	155 in-lb (18 N·m) to 165 in-lb (19 N·m)	233 in-lb (26 N·m) to 247 in-lb (28 N·m)
0.8750-14	213 in-lb (24 N·m) to 227 in-lb (26 N·m)	320 in-lb (36 N·m) to 340 in-lb (38 N·m)
1.0000-12 or 1.0000-14	272 in-lb (31 N·m) to 288 in-lb (33 N·m)	407 in-lb (46 N·m) to 433 in-lb (49 N·m)
1.1250-12	359 in-lb (41 N·m) to 381 in-lb (43 N·m)	534 in-lb (60 N·m) to 567 in-lb (64 N·m)
0.2500-12	437 in-lb (49 N·m) to 464 in-lb (52 N·m)	655 in-lb (74 N·m) to 695 in-lb (79 N·m)

Table 214/20-11-00-993-815

FASTENER PART NUMBER	ALL COARSE THREAD FASTENERS (DESIGNATED BY UNC OR UNJC)		
NUT PART NUMBER OR STYLE	ALL COARSE THREAD NUTS, INSERTS, AND TAPPED HOLES (DESIGNATED BY UNC OR UNJC)		
NOMINAL THREAD SIZE	DRY FASTENERS ONLY		
	TURN THE NUT AND NO FAY SEAL	TURN THE FASTENER HEAD AND/OR FAY SEAL	MAXIMUM TORQUE ALLOWED TO ALIGN THE COTTER PIN AND THE HOLE
0.1900-24	14 in-lb (2 N·m)	15 in-lb (2 N·m)	20 in-lb (2 N·m)

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Table 214/20-11-00-993-815 (Continued)

FASTENER PART NUMBER	ALL COARSE THREAD FASTENERS (DESIGNATED BY UNC OR UNJC)		
0.2500-20	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	29 in-lb (3 N·m) to 31 in-lb (4 N·m)	45 in-lb (5 N·m)
0.3125-18	49 in-lb (6 N·m) to 52 in-lb (6 N·m)	53 in-lb (6 N·m) to 57 in-lb (6 N·m)	100 in-lb (11 N·m)
0.3750-16	97 in-lb (11 N·m) to 103 in-lb (12 N·m)	107 in-lb (12 N·m) to 113 in-lb (13 N·m)	170 in-lb (19 N·m)
0.4375-14	146 in-lb (16 N·m) to 155 in-lb (18 N·m)	155 in-lb (18 N·m) to 165 in-lb (19 N·m)	280 in-lb (32 N·m)
0.5000-13	262 in-lb (30 N·m) to 278 in-lb (31 N·m)	281 in-lb (32 N·m) to 299 in-lb (34 N·m)	520 in-lb (59 N·m)
0.5625-12	349 in-lb (39 N·m) 371 in-lb (42 N·m)	407 in-lb (46 N·m) to 433 in-lb (49 N·m)	650 in-lb (73 N·m)
0.6250-11	466 in-lb (53 N·m) to 494 in-lb (56 N·m)	524 in-lb (59 N·m) to 556 in-lb (63 N·m)	900 in-lb (102 N·m)
0.7500-10	800 in-lb (90 N·m) to 850 in-lb (96 N·m)	907 in-lb (102 N·m) to 963 in-lb (109 N·m)	1500 in-lb (169 N·m)
0.8750-9	1499 in-lb (169 N·m) to 1591 in-lb (180 N·m)	1746 in-lb (197 N·m) to 1854 in-lb (209 N·m)	2700 in-lb (305 N·m)
1.0000-8	2566 in-lb (290 N·m) to 2724 in-lb (308 N·m)	2910 in-lb (329 N·m) to 3090 in-lb (349 N·m)	4500 in-lb (508 N·m)
1.1250-7	3541 in-lb (400 N·m) to 3760 in-lb (425 N·m)	3880 in-lb (438 N·m) to 4120 in-lb (465 N·m)	7200 in-lb (813 N·m)
0.2500-7	4360 in-lb (493 N·m) to 4630 in-lb (523 N·m)	4850 in-lb (548 N·m) to 5150 in-lb (582 N·m)	10,000 in-lb (1130 N·m)

(c) Self-Locking Nuts, Table 215Table 216.

Table 215/20-11-00-993-817

SIZE	TORQUE	
	MINIMUM BREAKAWAY	MAXIMUM LOCKING
0.1120-40	0.5 in-lb (0.1 N·m)	10.0 in-lb (1.1 N·m)
0.1380-32	1.0 in-lb (0.1 N·m)	20.0 in-lb (2.3 N·m)
0.1640-32	1.5 in-lb (0.2 N·m)	30.0 in-lb (3.4 N·m)
0.1900-32	2.0 in-lb (0.2 N·m)	36.0 in-lb (4.1 N·m)
0.2500-28	3.5 in-lb (0.4 N·m)	60.0 in-lb (6.8 N·m)
0.3125-24	6.5 in-lb (0.7 N·m)	120.0 in-lb (13.6 N·m)
0.3750-24	9.5 in-lb (1.1 N·m)	160.0 in-lb (18.1 N·m)
0.4375-20	14.0 in-lb (1.6 N·m)	200.0 in-lb (22.6 N·m)
0.5000-20	18.0 in-lb (2.0 N·m)	300.0 in-lb (33.9 N·m)
0.5625-18	24.0 in-lb (2.7 N·m)	400.0 in-lb (45.2 N·m)

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Table 215/20-11-00-993-817 (Continued)

SIZE	TORQUE	
0.6250-18	32.0 in-lb (3.6 N·m)	600.0 in-lb (67.8 N·m)
0.7500-16	50.0 in-lb (5.6 N·m)	800.0 in-lb (90.4 N·m)
0.8750-14	70 in-lb (8 N·m)	1200.0 in-lb (135.6 N·m)
1.0000-14	90 in-lb (10 N·m)	1600.0 in-lb (180.8 N·m)
1.0000-12	90.0 in-lb (10.2 N·m)	1600.0 in-lb (180.8 N·m)
1.1250-12	117.0 in-lb (13.2 N·m)	1800.0 in-lb (203.4 N·m)
1.2500-12	143.0 in-lb (16.2 N·m)	2000.0 in-lb (226.0 N·m)
1.3750-12	165.0 in-lb (18.6 N·m)	2200.0 in-lb (248.6 N·m)
1.5000-12	195.0 in-lb (22.0 N·m)	2500.0 in-lb (282.5 N·m)
1.7500-12	245.0 in-lb (27.7 N·m)	2900.0 in-lb (327.7 N·m)
2.0000-12	300.0 in-lb (33.9 N·m)	3400.0 in-lb (384.1 N·m)

Table 216/20-11-00-993-816 Locking Torques for Self-Locking Nuts (Coarse Threads)

SIZE	TORQUE	
	MINIMUM BREAKAWAY	MAXIMUM LOCKING
0.086-56	0.2 in-lb (0.0 N·m)	2.0 in-lb (0.2 N·m)
0.112-40	0.5 in-lb (0.1 N·m)	5.0 in-lb (0.6 N·m)
0.138-32	1.0 in-lb (0.1 N·m)	10 in-lb (1 N·m)
0.164-32	1.5 in-lb (0.2 N·m)	15 in-lb (2 N·m)
0.190-24	2.0 in-lb (0.2 N·m)	18 in-lb (2 N·m)
0.250-20	4.5 in-lb (0.5 N·m)	30 in-lb (3 N·m)
0.312-18	7.5 in-lb (0.8 N·m)	60 in-lb (7 N·m)
0.375-16	12.0 in-lb (1.4 N·m)	80 in-lb (9 N·m)
0.437-14	16.5 in-lb (1.9 N·m)	100 in-lb (11 N·m)
0.500-13	24.0 in-lb (2.7 N·m)	150 in-lb (17 N·m)
0.562-12	30.0 in-lb (3.4 N·m)	200 in-lb (23 N·m)
0.625-11	40.0 in-lb (4.5 N·m)	300 in-lb (34 N·m)
0.750-10	60.0 in-lb (6.8 N·m)	400 in-lb (45 N·m)
0.875-9	82.0 in-lb (9.3 N·m)	600 in-lb (68 N·m)
1.000-8	110.0 in-lb (12.4 N·m)	800 in-lb (90 N·m)
1.125-7	137.0 in-lb (15.5 N·m)	900 in-lb (102 N·m)
1.250-7	165.0 in-lb (18.6 N·m)	1000 in-lb (113 N·m)
1.375-6	200.0 in-lb (22.6 N·m)	1200 in-lb (136 N·m)
1.500-6	230.0 in-lb (26.0 N·m)	1400 in-lb (158 N·m)
1.750-5	300.0 in-lb (33.9 N·m)	1800 in-lb (203 N·m)

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Table 216/20-11-00-993-816 Locking Torques for Self-Locking Nuts (Coarse Threads) (Continued)

SIZE	TORQUE	
	360.0 in-lb (40.7 N·m)	2200 in-lb (249 N·m)
2.000–4.5		
2.250–4.5	430.0 in-lb (48.6 N·m)	2600 in-lb (294 N·m)
2.500–4	500.0 in-lb (56.5 N·m)	3000 in-lb (339 N·m)

(d) Reduced-Head Bolts, Figure 202.

(e) Rigid Tube Coupling Connections, Figure 203, Table 217.

Table 217/20-11-00-993-818

TUBE OD (INCHES)	TORQUE VALUE			
	ALUMINUM ALLOY FITTINGS NAS591-NAS593		STAINLESS STEEL FITTINGS NAS594, NAS596, BACN10HX COUPLING	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1	480 in-lb (54 N·m)	720 in-lb (81 N·m)	480 in-lb (54 N·m)	720 in-lb (81 N·m)
1–1/4	600 in-lb (68 N·m)	900 in-lb (102 N·m)	600 in-lb (68 N·m)	900 in-lb (102 N·m)
1-1/2	600 in-lb (68 N·m)	900 in-lb (102 N·m)	600 in-lb (68 N·m)	900 in-lb (102 N·m)
2	900 in-lb (102 N·m)	1200 in-lb (136 N·m)	900 in-lb (102 N·m)	1200 in-lb (136 N·m)
2-1/2	1500 in-lb (169 N·m)	1800 in-lb (203 N·m)	1800 in-lb (203 N·m)	2100 in-lb (237 N·m)
3	--	--	1800 in-lb (203 N·m)	2100 in-lb (237 N·m)
4	--	--	2400 in-lb (271 N·m)	2700 in-lb (305 N·m)

(f) Pipe Thread Fittings, Table 218.

Table 218/20-11-00-993-819

MATING PIPE FITTING MATERIAL COMBINATIONS	SIZE (INCHES)	TORQUE	
		MINIMUM	MAXIMUM
All Except CRES-to-CRES	1/8	100 in-lb (11 N·m)	175 in-lb (20 N·m)
	1/4	150 in-lb (17 N·m)	300 in-lb (34 N·m)
	3/8	225 in-lb (25 N·m)	450 in-lb (51 N·m)
CRES-to-CRES	1/8	100 in-lb (11 N·m)	150 in-lb (17 N·m)
	1/4	100 in-lb (11 N·m)	275 in-lb (31 N·m)
	3/8	100 in-lb (11 N·m)	400 in-lb (45 N·m)
	1/2	100 in-lb (11 N·m)	500 in-lb (56 N·m)
	3/4	150 in-lb (17 N·m)	600 in-lb (68 N·m)
	1	200 in-lb (23 N·m)	800 in-lb (90 N·m)

(g) Low Pressure and Return Line Fittings, Table 219.

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Table 219/20-11-00-993-820

TUBE OUTER DIAMETER (INCHES)	TUBE SIZE	FLARED AND FLARELESS COMPONENTS TORQUE	
		TUBE MATERIAL/END CONFIGURATION	
		ALUMINUM FLARED TUBE ENDS ALUMINUM TUBE ENDS WITH BACS13BD AND BACS13BX SWAGED SLEEVES FLARELESS TYPE HOSE END FITTINGS WITH ALUMINUM INSERTS TORQUE	FLARED HOSE END FITTINGS WITH ALUMINUM INSERTS
3/16	03	80 in-lb (9 N·m)	35 in-lb (4 N·m)
1/4	04	110 in-lb (12 N·m)	65 in-lb (7 N·m)
5/16	05	140 in-lb (16 N·m)	90 in-lb (10 N·m)
3/8	06	170 in-lb (19 N·m)	130 in-lb (15 N·m)
1/2	08	280 in-lb (32 N·m)	260 in-lb (29 N·m)
5/8	10	360 in-lb (41 N·m)	360 in-lb (41 N·m)
3/4	12	450 in-lb (51 N·m)	500 in-lb (56 N·m)
7/8	14	--	--
1	16	750 in-lb (85 N·m)	700 in-lb (79 N·m)
1-1/4	20	900 in-lb (102 N·m)	900 in-lb (102 N·m)
1-1/2	24	900 in-lb (102 N·m)	900 in-lb (102 N·m)
1-3/4	28	--	--
2	32	--	2000 in-lb (226 N·m)

(h) Flareless Tube Fittings, Table 220, Table 221.

Table 220/20-11-00-993-827

TUBE SIZE		FLARED AND FLARELESS COMPONENTS TORQUE ^{*[1]}						
OUTER DIAMETER (INCHES)	SIZE	TUBE MATERIAL/END CONFIGURATION ^{*[2]*[3]*[4]*[5]*[6]*[7]}						
		*[8]	6061T ALUMINUM AND ANNEALED CRES TUBE WITH BACS13AP SLEEVES					
			*[9]	TORQUE	*[10]	TORQUE	*[11]	TORQUE
1/8	02	-	-	-	-	-	-	-
3/16	03	80 ±4 in-lb (9 ±0 N·m)	0.028	80 ±4 in-lb (9 ±0 N·m)	-	-	-	-
1/4	04	110 ±6 in-lb (12 ±1 N·m)	0.028	110 ±6 in-lb (12 ±1 N·m)	-	-	-	-
5/16	05	140 ±7 in-lb (16 ±1 N·m)	0.028	140 ±7 in-lb (16 ±1 N·m)	-	-	-	-

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Table 220/20-11-00-993-827 (Continued)

TUBE SIZE		FLARED AND FLARELESS COMPONENTS TORQUE*[1]						
3/8	06	170 ±9 in-lb (19 ±1 N·m)	0.028	170 ±9 in-lb (19 ±1 N·m)	0.020	160 ±8 in-lb (18 ±1 N·m)	-	-
1/2	08	280 ±14 in-lb (32 ±2 N·m)	0.028	280 ±14 in-lb (32 ±2 N·m)	--	--	0.035	550 ±28 in-lb (62 ±3 N·m)
5/8	10	360 ±18 in-lb (41 ±2 N·m)	0.028	360 ±18 in-lb (41 ±2 N·m)	0.020	250 ±13 in-lb (28 ±2 N·m)	0.035 0.049	450 ±23 in-lb (51 ±3 N·m)
3/4	12	450 ±23 in-lb (51 ±3 N·m)	0.028	450 ±23 in-lb (51 ±3 N·m)	0.020	325 ±16 in-lb (37 ±2 N·m)	-	-
7/8	14	-	-	-	-	-	-	-
1	16	750 ±38 in-lb (85 ±5 N·m)	0.035	750 ±38 in-lb (85 ±5 N·m)	-	-	-	-
1-1/4	20	900 ±45 in-lb (102 ±5 N·m)	-	-	-	-	-	-
1-1/2	24	900 ±45 in-lb (102 ±5 N·m)	-	-	-	-	-	-
1-3/4	28	-	-	-	-	-	-	-
2	32	-	-	-	-	-	-	-

*[1] Torque +/- 5%

*[2] Use aluminum fitting torque values for aluminum, steel, or titanium fittings installed in aluminum bosses.

*[3] Use aluminum fitting torque values for aluminum jamnuts installed on aluminum, titanium, or steel bulkhead fittings.

*[4] Use steel fitting torque values for steel or titanium fittings installed in steel or titanium bosses.

*[5] Use steel fitting torque values for steel or titanium jamnuts installed on steel or titanium bulkhead fittings.

*[6] The boss or bulkhead fitting size determines the torque value for reducer fittings.

*[7] Tube material specifications: 6061-T6 Aluminum - MIL-T-7081, WW-T-700/6; Annealed CRES - MIL-T-8504, MIL-T-8606, MIL-T-8808; 1/8 Hard CRES - MIL-T-6845; 21-6-9 CRES - BMS7-185; TI-3AL-2.5V - BMS7-234.

*[8] Torque value for aluminum flared tube ends, aluminum tube ends with BACS13BD, and BACS13BX swaged sleeves, and flareless type hose fittings with aluminum inserts.

*[9] Minimum tube wall thickness for aluminum and annealed CRES tubes (inches).

*[10] Special thin wall annealed CRES wall thickness (inches).

*[11] Special heavy wall annealed CRES wall thickness (inches).

Table 221/20-11-00-993-822

TUBE SIZE	FLARED AND FLARELESS COMPONENTS TORQUE[1]
	TUBE MATERIAL/END CONFIGURATION[2][3][4][5][6]

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Table 221/20-11-00-993-822 (Continued)

TUBE SIZE		FLARED AND FLARELESS COMPONENTS TORQUE[1]				
OUTER DIAMETER (INCHES)	SIZE	21-6-9 (BMS7-185) AND OTHER CRES ENDS WITH BACS13BD AND BACS13BX SWAGED SLEEVES 1/8 HARD (MIL-T-6845) AND ANNEALED CRES (MIL-T-8504, MIL-T-8808) FLARED TUBE ENDS HOSE END FITTINGS WITH CRES TUBE INSERTS ALL 3AL-2.5V (BMS7-234) TITANIUM ENDS	1/8 HARD (MIL-T-6845) CRES TUBE ENDS WITH BACS13AP PRESET SLEEVES			
		TORQUE	MINIMUM WALL THICKNESS (INCHES)	TORQUE	SPECIAL THIN-WALL TUBE WALL THICKNESS (INCHES)	TORQUE
1/8	02	--	--	--	--	--
3/16	03	100 ±5 in-lb (11 ±1 N·m)	0.016	100 ±5 in-lb (11 ±1 N·m)	---	--
1/4	04	140 ±7 in-lb (16 ±1 N·m)	0.020	140 ±7 in-lb (16 ±1 N·m)	--	--
5/16	05	190 ±10 in-lb (21 ±2 N·m)	0.020	190 ±10 in-lb (21 ±2 N·m)	--	--
3/8	06	270 ±14 in-lb (31 ±2 N·m)	0.028	270 ±14 in-lb (31 ±2 N·m)	--	--
1/2	08	500 ±25 in-lb (56 ±3 N·m)	0.035	500 ±25 in-lb (56 ±3 N·m)	0.028	375 ±19 in-lb (42 ±3 N·m)
5/8	10	700 ±35 in-lb (79 ±4 N·m)	0.049	700 ±35 in-lb (79 ±4 N·m)	0.035	575 ±29 in-lb (65 ±3 N·m)

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Table 221/20-11-00-993-822 (Continued)

TUBE SIZE		FLARED AND FLARELESS COMPONENTS TORQUE[1]				
3/4	12	900 ±45 in-lb (102 ±5 N·m)	0.049	900 ±45 in-lb (102 ±5 N·m)	0.042	725 ±36 in-lb (82 ±4 N·m)
7/8	14	--	--	--	--	--
1	16	1200 ±60 in-lb (136 ±7 N·m)	--	--	--	--
1-1/4	20	1600 ±80 in-lb (181 ±9 N·m)	--	--	--	--
1-1/2	24	2000 ±100 in-lb (226 ±11 N·m)	--	--	--	--
1-3/4	28	--	--	--	--	--
2	32	2000 ±100 in-lb (226 ±11 N·m)	--	--	--	--

(i) Clamps, V-Band, and Channel-Band, Table 222, Table 223, Table 224, Table 225.

Table 222/20-11-00-993-823

BOEING PART NUMBER	NOTES	DASH NUMBER ()	TORQUE
BACC10AU()	--	250-275	70 +5 / -0 in-lb (8 +1 / -0 N·m)
	--	300-500	100 +5 / -0 in-lb (11 +1 / -0 N·m)
BACC10BR8()	*[1]	100-900	100 +5 / -0 in-lb (11 +1 / -0 N·m)
BACC10CT2-()	*[1]	100-600	100 +5 / -0 in-lb (11 +1 / -0 N·m)
BACC10DP()A	--	150-250	50 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	350-400	50 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	450-600	70 +5 / -0 in-lb (8 +1 / -0 N·m)
BACC10DP()B	--	300	50 +5 / -0 in-lb (6 +1 / -0 N·m)
BACC10DP()AB	--	350-400	50 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	450-600	70 +5 / -0 in-lb (8 +1 / -0 N·m)

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Table 222/20-11-00-993-823 (Continued)

BOEING PART NUMBER	NOTES	DASH NUMBER ()	TORQUE
BACC10DU()AB	--	100-175	50 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	200-275	55 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	300-450	60 +5 / -0 in-lb (7 +1 / -0 N·m)
	--	500-600	65 +5 / -0 in-lb (7 +1 / -0 N·m)
	--	700-1000	75 +5 / -0 in-lb (8 +1 / -0 N·m)
BACC10EY()B	--	150-800	105 +5 / -0 in-lb (12 +1 / -0 N·m)
	--	150-400	75 +5 / -0 in-lb (8 +1 / -0 N·m)
	--	425-800	105 +5 / -0 in-lb (12 +1 / -0 N·m)
BACC10EZ()B	--	125-275	75 +5 / -0 in-lb (8 +1 / -0 N·m)
	--	300	105 in-lb (12 N·m)
BACC10GY()	--	150-175	40 +5 / -0 in-lb (5 +1 / -0 N·m)
	--	200-275	45 +5 / -0 in-lb (5 +1 / -0 N·m)
	--	300-450	50 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	475-600	55 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	650-900	65 +5 / -0 in-lb (7 +1 / -0 N·m)
BACC1HX()	*[2]	100-300	10 +5 / -0 in-lb (1 +1 / -0 N·m)
	*[2]	325-500	15 +5 / -0 in-lb (2 +1 / -0 N·m)
	*[2]	550-800	20 +5 / -0 in-lb (2 +1 / -0 N·m)

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Table 222/20-11-00-993-823 (Continued)

BOEING PART NUMBER	NOTES	DASH NUMBER ()	TORQUE
BACC10KH	--	200-275	45 +5 / -0 in-lb (5 +1 / -0 N·m)
	--	300-475	55 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	500-550	60 +5 / -0 in-lb (7 +1 / -0 N·m)
	--	600-650	65 +5 / -0 in-lb (7 +1 / -0 N·m)
	--	700	70 +5 / -0 in-lb (8 +1 / -0 N·m)
BACC10LE()	--	500-600	55 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	650-900	65 +5 / -0 in-lb (7 +1 / -0 N·m)
BACC10NU()	--	500-600	55 +5 / -0 in-lb (6 +1 / -0 N·m)
	--	650-900	65 +5 / -0 in-lb (7 +1 / -0 N·m)

*[1] Inside of coupling not lubricated.

*[2] Inside of coupling and T-bolt threads not lubricated.

Table 223/20-11-00-993-824

NOMINAL DUCT OUTER DIAMETER (INCHES)	DUCT MATERIAL	TORQUE	
		MINIMUM	MAXIMUM
1.50	5052-0	600 in-lb (68 N·m)	1000 in-lb (113 N·m)
	Stainless Steel	900 in-lb (102 N·m)	1200 in-lb (136 N·m)
1.75	5052-0	900 in-lb (102 N·m)	1200 in-lb (136 N·m)
2.00	5052-0	1300 in-lb (147 N·m)	2500 in-lb (282 N·m)
2.50	5052-0	2000 in-lb (226 N·m)	3000 in-lb (339 N·m)

Table 224/20-11-00-993-825

BOEING PART NUMBER	DASH NUMBER	RECOMMENDED TORQUE
BACC10Q	All	25 ±5 in-lb (3 ±1 N·m)
BACC10GW	All	40 in-lb (5 N·m) maximum*[1]
BACC10HN	All	40 in-lb (5 N·m) maximum*[1]

*[1] The torque value may depend on the duct material and size. See AMM procedure for specific torque value.

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Table 225/20-11-00-993-826

HOSE DUCT OR CAP PART NUMBER SERIES	TORQUE	
	BACC10BN	
	MINIMUM	MAXIMUM
AS1505 Series	13 in-lb (1 N·m)	17 in-lb (2 N·m)
BACC14AU (10.25 to 12.00 inches in diameter)		
BACD40 Series (Except BACD40AF)		
BACD40DF (10.25 to 13.00 inches in diameter)		
MIL-DTL-6000	22 in-lb (2 N·m)	28 in-lb (3 N·m)
MIL-H-7938		
MIL-PRF-7061	13 in-lb (1 N·m)	17 in-lb (2 N·m)
S417N802	22 in-lb (2 N·m)	28 in-lb (3 N·m)
10-20353	13 in-lb (1 N·m)	17 in-lb (2 N·m)

SUBTASK 20-11-00-420-001

- (2) Tighten the bolt, nut, fitting, clamps, or connector (Figure 201, Table 201, Table 202, Table 203, Table 204, Table 205, Table 206, Table 207, Table 208, Table 209, Table 210, Figure 202, Table 211, Table 212, Table 213, Table 214, Table 216, Table 215, Table 217, Table 218, Table 219, Table 220, Table 221, Figure 203, Table 222, Table 223, Table 224, Table 225).
- (a) Lubricate the threads with one of these materials if necessary:
- 1) corrosion preventive compound, C00308
 - 2) grease, D00013, or
 - 3) compound, D00010.
- (b) Tighten the bolts, nuts, fitting, clamps, or connectors to the correct torque.
- (c) Make sure that one male tread (minimum), plus the chamfer of the male tread, extends above the top of the nut.

NOTE: If the male thread does not have a chamfer, the male thread must extend one and one-half treads (minimum) above the top of the nut.

————— END OF TASK —————

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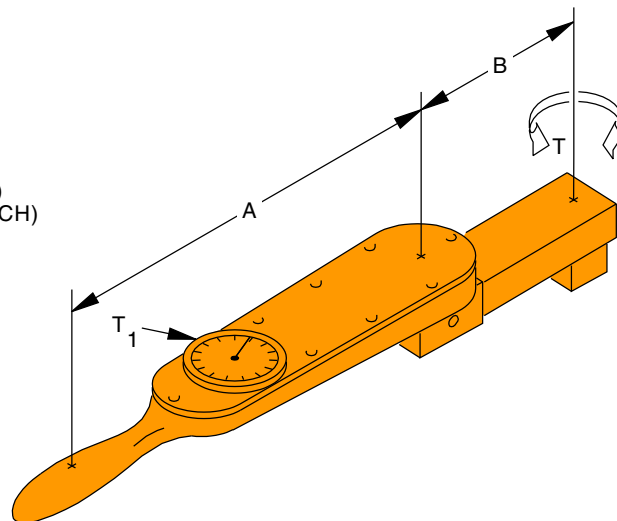
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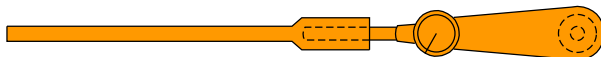
$$T_1 = \frac{TA}{A+B}$$

A = LENGTH OF THE TORQUE WRENCH
B = EFFECTIVE LENGTH OF THE ADAPTER
T = APPROVED TORQUE (SHOWN IN TORQUE TABLE)
T₁ = ADJUSTED TORQUE (SHOWN ON TORQUE WRENCH)

EXAMPLE: A = 12 INCHES
B = 3 INCHES T = 160
POUND-INCHES
 $T_1 = \frac{160 \times 12}{12+3}$
T₁ = 128 POUND-INCHES

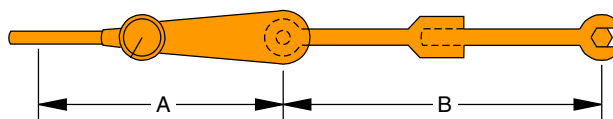


METHOD 1



HANDLE EXTENSION ONLY.
NO CORRECTION NECESSARY.

METHOD 2



ADAPTER WITH THE EXTENSION BETWEEN THE
ADAPTER AND THE WRENCH. BOTH ARE IN LINE
WITH THE WRENCH. INDICATED TORQUE T₁:

$$T_1 = \frac{TA}{A+B}$$

METHOD 3

C99312 S0006402582_V2

Finding Torque Values for a Torque Wrench with an Adapter
Figure 201/20-11-00-990-801 (Sheet 1 of 2)

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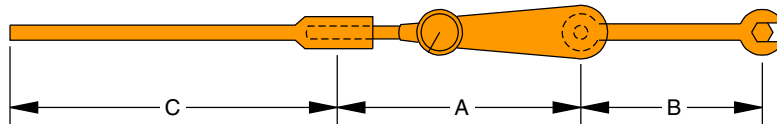
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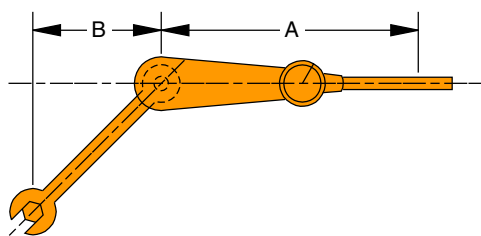
BOTH HANDLE EXTENSION AND ADAPTER,
INDICATED TORQUE T_1 :

$$T_1 = \frac{T(A+C)}{A+B+C}$$

METHOD 4

IF POSSIBLE, METHODS 5 AND 6 SHOULD NOT BE USED. WHEN IT IS NECESSARY TO USE THESE METHODS, THE FOLLOWING CONDITIONS MUST BE APPLICABLE.

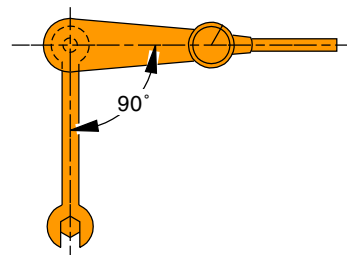
1. THE ADAPTER PLUS ANY EXTENSIONS USED BETWEEN THE WRENCH AND THE ADAPTER MUST NOT BE MORE THAN THE LENGTH OF THE WRENCH.
2. WHEN A FORCE IS APPLIED AT 90 ± 3 DEGREES TO THE HANDLE OF THE WRENCH, IT IS RECOMMENDED THAT A STIRRUP-TYPE HANDLE WITH A POINTER (INDICATING ANGLE OF LOADING) BE USED TO MAKE SURE LOADING IS AT THE CORRECT ANGLE.



ADAPTER AT ANGLE OTHER THAN
 90° . INDICATED TORQUE T_1 :

$$T_1 = \frac{TA}{A+B}$$

METHOD 5



ADAPTER AT RIGHT ANGLE TO THE
WRENCH. NO CORRECTION NECESSARY.

METHOD 6

C99327 S0006402583_V3

Finding Torque Values for a Torque Wrench with an Adapter
Figure 201/20-11-00-990-801 (Sheet 2 of 2)

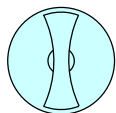
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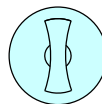
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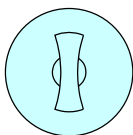
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**BACB30DP (CRES)
BACB30EL (STEEL)
NAS1581 (CRES)**



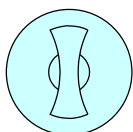
**BACB30FB (STEEL)
BACB30RF (STEEL)
BACB30UW (STEEL)**



BACB30NU (TITANIUM)



BACB30UR (TITANIUM)



BACB30LL (CRES)



**BACB30VF (TITANIUM)
BACB30XD (TITANIUM)**



BACB30ZE (CRES)

D00781 S0006402594_V5

**Reduced-Head Bolts
Figure 202/20-11-00-990-804**

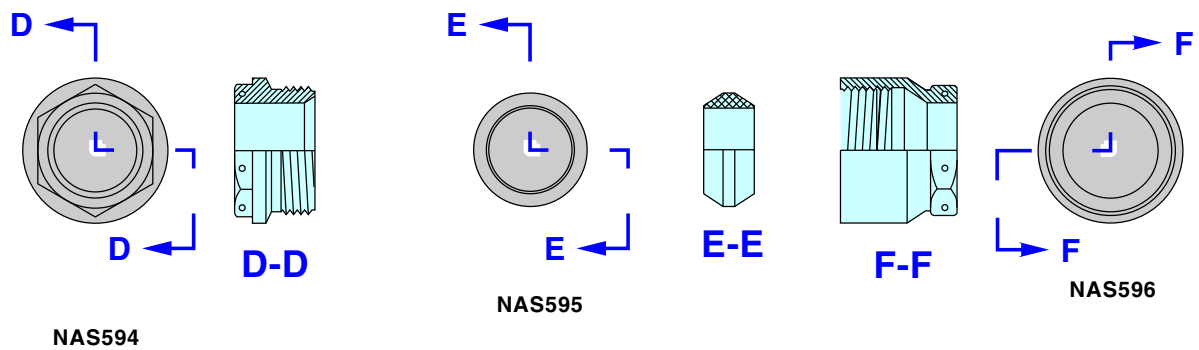
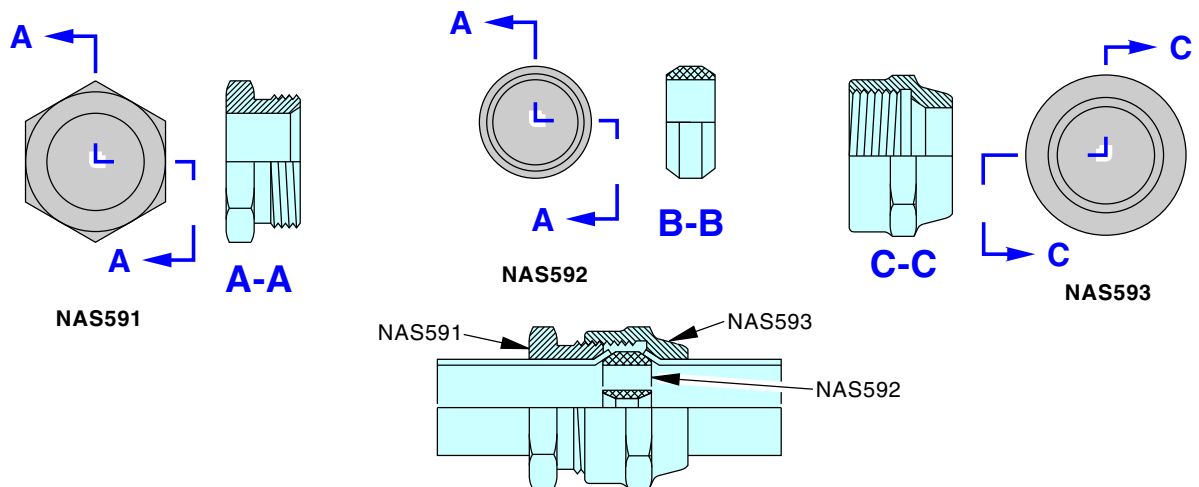
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D03837 S0006402595_V3

**Connection Assemblies for Rigid Tube Couplings
Figure 203/20-11-00-990-805**

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WRENCH ARC METHOD TIGHTENING TECHNIQUES - MAINTENANCE PRACTICES

1. General

- A. This procedure contains one task:
 - (1) The wrench arc method.
- B. This procedure gives the instructions to tighten ball-nose tube fittings.
- C. Torque is the turn force that you apply to the fastener to install a part.

TASK 20-11-10-910-802-001

2. Wrench Arc Method

(Figure 201)

A. General

- (1) The wrench arc method is used to tighten all ball-nose fittings on the engine-mounted components and tubing. The purpose is to obtain a total angle displacement of 30 degrees. The wrench arc method is done by a visual measurement of the angular displacement instead of a torque measurement. There are two methods of the wrench arc method:
 - (a) The turn of the B-nut method (use of an open end wrench, crowfoot or tubing wrench)
 - (b) The line of sight method (use a 15 degree offset open end wrench).

B. Procedure

SUBTASK 20-11-10-420-004-001

- (1) Prepare to tighten the ball-nose fitting:
 - (a) Clean the threads and the mating surfaces of the fitting.
 - (b) Make sure there is no nicks, burrs, and scratches on the fitting threads.

SUBTASK 20-11-10-420-005-001

- (2) Use the turn of the B-nut method to tighten the ball-nose fitting:

NOTE: No lubricant is necessary for the ball-nose fitting.

 - (a) Put the open end wrench, crowfoot or tubing wrench on the B-nut.
 - (b) Turn the B-nut until you feel a sharp increase in the resistance.

NOTE: The sharp increase indicates that the mating surfaces touched.
 - (c) Make sure the ball-nose fitting is correctly installed (not cross-threaded).
 - (d) Make sure there is no looseness between the mating parts of the ball-nose fitting.
 - (e) Set a reference point on the B-nut coupling.

NOTE: The reference point is always between the B-nut flat and the coupling.
 - (f) Tighten the B-nut with an open end wrench through an arc 30 degrees.

NOTE: 1/2 flat turn of the B-nut is 30 degrees of a complete arc.
 - (g) If this is new hardware, loosen the B-nut and then tighten it again to a complete arc of 30 degrees.

SUBTASK 20-11-10-420-006-001

- (3) Use the line of sight method to tighten the ball-nose fitting:

NOTE: No lubricant is necessary for the ball-nose fitting.

 - (a) Put the open end wrench on the B-nut.

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- (b) Turn the B-nut until you feel a sharp increase in the resistance.

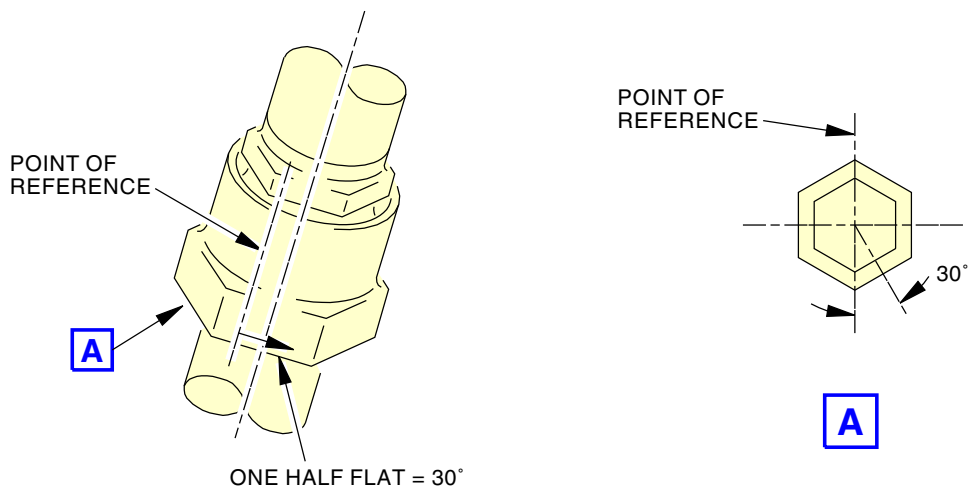
NOTE: The sharp increase indicates that the mating surfaces touched.

- (c) Make sure the ball-nose fitting is correctly installed (not cross-threaded).
(d) Make sure there is no looseness between the mating parts of the ball-nose fitting.
(e) Look at the position of the 15 degree open end wrench handle.
(f) Set a reference point on the B-nut in line with the handle.
NOTE: The reference point is always between the B-nut flats and the wrench handle.
(g) Tighten the B-nut 15 degrees.
(h) Turn the wrench over.
(i) Put the wrench on the same B-nut flats.
(j) Tighten the B-nut an additional 15 degrees which aligns the wrench back to the original start position.

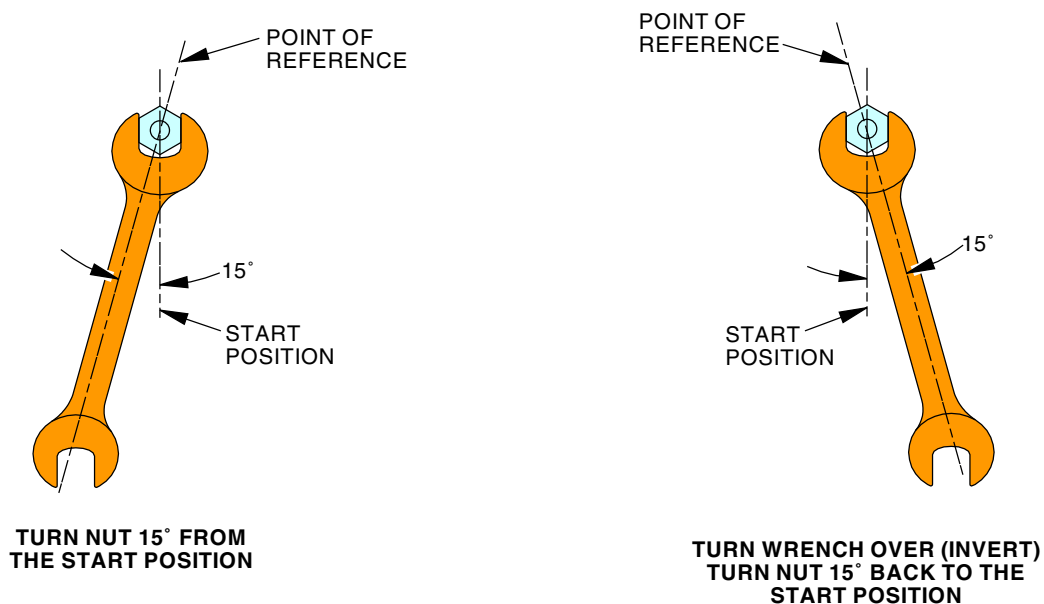
NOTE: If this is new hardware, loosen the new B-nut and then do the above procedure to tighten it again to a complete arc of 30 degrees.

———— **END OF TASK** ————

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TURN OF THE B-NUT METHOD



LINE OF SIGHT METHOD

1120858-01-A
L47122 S0006402605_V2

**Tighten Ball-Nose Fittings with the Wrench Arc Method
Figure 201/20-11-10-990-802-001**

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OFF-AIRPLANE DATA LOADING - MAINTENANCE PRACTICES

1. General

- A. On-board software loadable LRUs can be loaded with software on the airplane using the AMM Software Installation procedures for each software loadable LRU or off the airplane using these off-airplane loading procedures. The AMM on-airplane Software Installation procedure for each software loadable LRU is contained within the respective ATA chapter for the LRU. This procedure provides details for the software loading of an LRU off the airplane.

TASK 20-15-01-410-801

2. Off-Airplane Software Installation

A. General

- (1) Off-airplane data loading equipment may have the capability to support various interfaces: as ARINC 429, ARINC 629, RS232, and PC cards. Off-airplane data loading equipment may be used to load several software loadable LRUs. Reference the airlines off-airplane data loading policy to determine which LRUs can be off-airplane loaded with the following equipment. For off-airplane data loading equipment information contact an off-airplane data loading equipment vendor directly. Equipment information for the shop data loader, COM-1407 follows.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1407	Loader - Data, Shop Part #: QSL7X7 Supplier: 0D4J3 Opt Part #: 615 FDS Supplier: 0D4J3

C. Additional Alternative Equipment

SUBTASK 20-15-01-860-001

- (1) Data Loader - Shop, Pentar Avionics Headquarters, 19820 North Creek Parkway Suite 102, Bothell, WA 98011

D. Procedures

SUBTASK 20-15-01-410-001

- (1) Off-airplane data loading is accomplished on software loadable LRUs that are removed from the airplane or are taken out of stores.

SUBTASK 20-15-01-410-002

- (2) An LRU which is removed from the airplane for the purpose of off-airplane loading must be installed using the AMM Removal and Installation procedures. The R & I procedures will require that you make sure that the correct software is installed in the LRU.

SUBTASK 20-15-01-410-003

- (3) Refer to the appropriate airline's documentation for the correct software part number or numbers for each software loadable LRU prior to performing this software loading procedure.

SUBTASK 20-15-01-410-004

- (4) The procedures for software loading using off-airplane data loading equipment are documented in the respective supplier's off-airplane data loading equipment user's manual.

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SUBTASK 20-15-01-410-005

- (5) Refer to the airline's off-airplane data loading policy for additional off-airplane loading equipment and procedures information.

———— **END OF TASK** ————

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ON-AIRPLANE SOFTWARE INSTALLATION - MAINTENANCE PRACTICES

TASK 20-15-11-400-801

1. On-Airplane Software Installation

A. General

(1) Software Installation Times

- (a) You can use the GSE-Laptop, maintenance device, SPL-5704, as an alternative to the PMAT in this task.

NOTE: The GSE-Laptop and the PMAT are equivalent for all of the PMAT functions that you will use in this task.

- (b) This procedure is for components that use the MAT or PMAT for software installation. For components that use the cabin system control panel (CSCP) for software installation, refer to the software installation procedures for the cabin management system.

- 1) Operational Program Software and Database Verification Test, TASK 23-39-00-700-802 or Operational Program Software and Database Verification Test, TASK 23-39-00-700-804

- (c) Throughout this procedure, component refers to a line replaceable unit (LRU) or a line replaceable module (LRM).

- (d) On the MAT display, software installation is known as Data Load. The component that gets the software is the Destination LRU. The disk drive or hard drive is the Data Source. The piece of software to be installed is the Load Part Number.

- (e) The time that is necessary for software installation includes these variables:

- 1) Time to get the correct software media and Maintenance Manual procedure.
 - 2) Time for hard drive configuration management (if necessary).
 - 3) Time to prepare the airplane and the MAT.
 - 4) Data transfer time.
 - 5) Time to do a software configuration check.
 - 6) Time to put the airplane back to its usual configuration.
 - 7) Time to do airline-specific completion procedures.

(2) Data Transfer Times

- (a) The data transfer time is the time from selection of START on the MAT display until the MAT shows that the data load is complete.

- (b) You can install software from these sources:

- 1) Disks in the PMAT disk drive.
 - 2) The PMAT hard drive (optional).
 - 3) The USB CD/DVD drive.

NOTE: The USB CD/DVD drive requires two USB port connections or AC power to operate with sufficient power. If the USB CD/DVD drive does not have sufficient power, then data transfers and image restores can fail.

- 4) The USB floppy disk drive.
 - 5) The MAT MSD.

- (c) When you install software from disks in the disk drive, the data transfer time depends on:

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- 1) The number of disks.
 - 2) The type and size of software files on each disk.
 - 3) The software that is already installed in the component.
 - 4) The unique internal protocols and processors of the component.
 - 5) Disks inserted in a timely manner.
- (d) When you install software from the hard drive, the data transfer time depends on:
- 1) The type and size of software files on the hard drive.
 - 2) The software that is already installed in the component.
 - 3) The unique internal protocols and processors of the component.
- (e) You can install these types of software:
- 1) Operational Program Software (OPS)
 - 2) Operational Program Configuration (OPC)
 - 3) Database (DB)
 - 4) Airline Modifiable Information (AMI)
- (f) Usual data transfer times from disks in the MAT are:
- 1) OPS: approximately 5 to 16 minutes for each disk (For example, if the OPS has four disks, then the complete data transfer can continue for as long as 64 minutes).
 - 2) OPC: approximately 1 to 3 minutes for each disk.
 - 3) DB: approximately 3 to 15 minutes for each disk.
 - 4) AMI: approximately 3 to 15 minutes for each disk.
- (g) When you install software from disks in the PMAT, the data transfer time can be approximately 10% longer than when you use disks in the MAT.
- (h) When you install software from the MAT hard drive, the data transfer time can be approximately 10% faster than when you use disks in the MAT when the software is on more than one disk. When the software is on one disk, the data transfer times for software installation from the disk and from the hard drive can be approximately the same.
- (i) When you install software from the PMAT hard drive, the data transfer time can be approximately 10% longer than when you use the MAT hard drive.
- (j) Data transfer times for an electronic checklist (ECL) DB, a navigation (nav) DB, an owner requirements table (ORT) DB, or an AMI can be different because the airline can change the software. The given time is for the baseline version of the software.
- (k) The data transfer times given for the MAT hard drive do not include the time to add software to the hard drive (The time that is necessary to add software to the hard drive is approximately the same as the data transfer time given for disks in the MAT).
- (l) Short Load
- 1) Many components can do a short load.
 - 2) During a short load, only pieces of software that are different from what is already in the component are installed during data transfer. This can cause a data transfer time that is much shorter than the time given here. It is possible that some disks will not be used during software installation.
 - 3) You know that the correct software is installed when the MAT shows that the data load is complete and shows the correct software part number.



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- (m) Concurrent Loading of AIMS Software
- 1) To reduce the total time that is necessary to install AIMS software, you can use the MAT and the PMAT at the same time.
 - 2) For example, you can start the installation of AIMS software into one AIMS cabinet from the MAT. During that software installation, you can use the PMAT to do an installation of AIMS software into the other AIMS cabinet.
- (3) This table (Table 201) shows the approximate data transfer times (in minutes) for components that use the MAT for software installation.
- (a) Data transfer times can be different from those given in the table. Data transfers can fail, and failure of the data transfer will increase the total time necessary for software installation. Data transfer times are supplied only as an aid to help you schedule work.
- (b) The times given are for the installation of one piece of software into one component.
- 1) If a component has more than one piece of software, then you must add the time for each piece to find the total data transfer time for the component.
 - 2) If a component has two or more channels, you must multiply the time given in the table by the number of channels to find the total data transfer time for the component.
 - 3) If a system has more than one of a given component, and software is to be installed in each one, you must multiply the time given in the table by the total number of components to find the total data transfer time for the system.
 - a) For example, if a left and a right component are installed on the airplane, you must multiply the time given in the table by two to find the total data transfer time for the two components.
- (c) Times are given for software installation from these data sources:
- 1) Disks in the MAT disk drive.
 - 2) The MAT hard drive.
- (d) The table also shows the AMM reference for software installation in each component.

Table 201/20-15-11-993-801

ATA Chapter and Component	Software	Floppy Drive (min.)	Hard Drive (min.)	CD-ROM Drive (min.)	AMM REFERENCE
21 ECS Misc. Card	ECSMC OPS ECSMC OPC	5 1	2 1	*[1] *[1]	AMM (TASK 21-00-10-400-802)
21 Cabin Temperature Controller	CTC OPS CTS OPC	11 1	11 1	*[1] *[1]	AMM Cabin Temperature Controller (CTC) Software Installation, TASK 21-61-01-400-803
22 Autopilot Flight Director Computer	AFDC OPS AFDC OPC	12 2	11 2	*[1] *[1]	AMM (TASK 22-11-01-400-803)
23 Satellite Data Unit (Honeywell)	SDU ORT MCS6000 SDU SECURE ORT	3 3	3 3	*[1] *[1]	AMM (TASK 23-15-10-400-802)

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Table 201/20-15-11-993-801 (Continued)

ATA Chapter and Component	Software	Floppy Drive (min.)	Hard Drive (min.)	CD-ROM Drive (min.)	AMM REFERENCE
24 ELMS Electronics Unit	ELMS OPC ELMS OPS	20 6	19 6	*[1] *[1]	AMM (TASK 24-09-00-400-809-002)
24 Generator Control Unit	GCU OPS	9	8	*[1]	AMM (TASK 24-22-02-400-802)
24 Backup Converter	BEPS OPS	10	10	*[1]	AMM (TASK 24-25-09-400-802)
24 Bus Power Control Unit	BPCU OPS	8	8	*[1]	AMM (TASK 24-41-05-400-802)
26 Cargo Smoke Detector	CSD OPS	5	4	*[1]	AMM (TASK 26-16-01-400-802)
26 DLODS Control Card	DLODS OPS	4	4	*[1]	AMM (TASK 26-18-05-400-802)
27 Primary Flight Computer	PFC OPS	76 *[2] 20 *[3]	62 *[2] 20 *[3]	*[1] *[1]	AMM (TASK 27-02-01-400-803)
27 Flap/Slat Electronics Unit	FSEU MONITOR OPS FSEU CONTROL OPS	7 6	6 6	*[1] *[1]	AMM (TASK 27-51-01-400-802)
28 Fuel Quantity Processor Unit	FQPU OPS	15	5	*[1]	AMM (TASK 28-41-01-400-802)
29 Hydraulic Interface Module	HYDIM OPS	3	3	*[1]	AMM (TASK 29-11-50-400-802)
30 ACIPS Control Card Module	ACIPS OPS	24	20	*[1]	AMM (TASK 30-11-02-400-802)
31 ARINC Signal 7BS PRE ECO B0360 Gateway	ASG OPS FMCf AMI	5 3	4 3	*[1] *[1]	
ARO 001-014					
31 Printer	PRT OPSA PRT DB	3 5	3 4	*[1] *[1]	AMM (TASK 31-33-01-400-802)
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Batch Loading to the Left and Right AIMS 2.	OPS	*[4]	9 (to the Right AIMS only)	22	AMM (TASK 31-41-21-470-801)

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Table 201/20-15-11-993-801 (Continued)

ATA Chapter and Component	Software	Floppy Drive (min.)	Hard Drive (min.)	CD-ROM Drive (min.)	AMM REFERENCE
31 AIMS CPM/COMM	CPM/COMM OPS	*[4]	2	3	AMM (TASK 31-41-04-420-804)
	NRB OPS	*[4]	1	1	
	NP OPS	*[4]	2	2	
	AIMS OPC	*[1]	2	*[4]	
	FDO/SWAT DB	*[1]	*[1]	*[1]	
	DCMF AMI	2	1	*[1]	
	FDCF AMI	2	1	*[1]	
	AMIs Batch Load	*[1]	2	*[4]	
AIMS CPM/STD	CPM/STD OPS	*[4]	--	*[1]	AMM (TASK 31-41-05-420-801)
	NRB OPS	*[4]	2	2	
	OPC	1	2	*[4]	
	FDO/SWAT DB	*[1]	*[1]	*[1]	
	Navigation Database	7	2	*[1]	
	MarVar DB	5	2	*[4]	
	DUDB (if Installed)	1	1	*[1]	
	Aero-Engine Database	9	3	*[1]	
	AEDB	*[1]	*[1]	*[1]	
	FMCF AMI	1	1	*[4]	
	ACMF AMI	9	2	*[4]	
31 AIMS CPM/GG	CPM/GG OPS	*[4]	3	3	AMM (TASK 31-41-02-420-804)
	NRB OPS	*[4]	2	2	
	OPC	1	2	*[4]	
	FDO/SWAT DB	*[1]	*[1]	*[1]	
	CPM/GG DUDB	2	1	*[1]	
	Checklist Boeing DB	1	1	*[1]	
	Checklist Airline DB	*[1]	1	*[1]	
31 AIMS IOM	IOM OPS	*[4]	1	3	AMM (TASK 31-41-11-420-806)
	IOM NRB OPS	*[4]	2	1	
	AIMS OPC	1	2	*[4]	
	CMCF LDI	13	2	*[1]	
	CMCF AMI	2	1	*[1]	
31 Warning Electronic Unit	WEU OPS	12	11	*[1]	AMM (TASK 31-51-01-400-802)
	WEU OPC	1	1	*[1]	
32 Weight-On-Wheels Card	WOW OPS	24	8	*[1]	AMM (TASK 32-09-02-400-802)
32 Antiskid/Autobrake Control System	ABC OPS	14	14	*[1]	AMM (TASK 32-42-01-470-801)
	Antiskid OPS	8	8	*[1]	
	BSCU OPC	5	5	*[1]	

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Table 201/20-15-11-993-801 (Continued)

ATA Chapter and Component	Software	Floppy Drive (min.)	Hard Drive (min.)	CD-ROM Drive (min.)	AMM REFERENCE
34 Air Data Inertial Reference Unit	ADIRU OPS ADIRU OPC	7 1	6 1	*[1] *[1]	AMM (TASK 34-21-01-420-801)
34 Secondary Attitude Air Data Reference Unit	SAARU OPS SAARU OPC	7 1	5 1	*[1] *[1]	AMM (TASK 34-21-02-420-801)
34 Air Data Module	ADM OPS	2	2	*[1]	AMM (TASK 34-21-03-420-801)
34 TCAS Computer (Collins)	TCAS OPS	10	7	*[1]	AMM (TASK 34-45-01-400-802)
34 Enhanced Ground Proximity Warning Computer (EGPWC)	EGPWC Terrain DB	5 to 45 *[5]	*[1]	*[1]	AMM (PAGEBLOCK 34-46-00/201)
34 Control Display Unit	CDU OPS CDU PPROM	3/30 *[6] 2/30*[6]	2/30 *[6] 1/30*[6]	*[1] *[1]	AMM (TASK 34-61-02-400-801)
36 Air Supply & Cabin Pressure Controller	ASCPC OPS	10	9	*[1]	AMM (TASK 36-11-20-400-803)
45 Maintenance Access Terminal (MAT EDU)	MAT OPS MATA OPS	*[1] *[1]	*[1] *[1]	45 12	AMM (TASK 45-11-05-470-801)
46 Onboard Network System	ONS OS	*[4]	*[1]	*[1]	AMM (TASK 46-13-00-470-801)
49 APU Controller	APUC OPS	7	7	*[1]	AMM (TASK 49-61-00-470-801)
73 Electronic Engine Control (GE90 SERIES ENGINES)	EEC OPS	40	30	*[1]	AMM (TASK 73-21-15-400-802-H01)
73 Engine Data Interface Unit	EDIU OPS	18	17	*[1]	AMM (TASK 73-21-22-400-807-H00)
77 Signal Conditioner Unit (GE90 SERIES ENGINES)	SCU DB	1	1	*[1]	AMM (TASK 77-31-03-400-801-H01)

*[1] The time necessary to install the software that it is on the media is not Available.

*[2] PFC P/N S251W700-101

*[3] PFC P/N S251W700-102 with S/W P/N 2765-PFC-720-00 or 2764-PFC-730-00

*[4] The software is not available on the media.

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*[5] Software installed from PCMCIA card at front panel of component.

*[6] CPU P/N B50A000-00-100.

(4) Software Installation Conditions:

- (a) Table 202 shows a listing of temperature limits based on the equipment location and the type of thermal condition the equipment being installed with software will be exposed to.

Table 202/20-15-11-993-803

Thermal Environment	Equipment Location	Coolant Air Temperature at Equipment Inlet (Degrees Celsius)	Ambient Air Temperature (Degrees Celsius)
High Short Term Operation *[1]	E/E Bay & E5	70/55	70/60
	Flight Deck	70/55	70/65
	Flight Deck Overhead	75/55	75
	Aft Lower Racks (E6, E10, E12, E17)	70/60	70/60
High Continuous Operation	E/E Bay & E5	55	60
	Flight Deck	55	65
	Flight Deck Overhead	55	75
	Aft Lower Racks (E6, E10, E12, E17)	60	60

*[1] High Short Term Operation is defined as equipment operation at the listed temperatures where operational time in temperatures above High Continuous levels is not to exceed 30 minutes.

B. References

Reference	Title
21-00-00 P/B 201	AIR CONDITIONING - GENERAL - MAINTENANCE PRACTICES
21-00-10-400-802	ECS Miscellaneous Cards (ECSMC) Software Installation (P/B 201)
21-61-01-400-803	Cabin Temperature Controller (CTC) Software Installation (P/B 201)
22-11-01-400-803	Autopilot Flight Director Computer Software Installation (P/B 201)
23-15-10-400-802	Satellite Data Unit Software Installation (P/B 201)
23-39-00-700-802	Operational Program Software and Database Verification Test (P/B 201)
23-39-00-700-804	Operational Program Software and Database Verification Test (P/B 201)
24-09-00-400-809-002	Electrical Load Management System - Software Installation (P/B 201)
24-22-02-400-802	GCU Software Installation (P/B 201)
24-25-09-400-802	Backup Generator Converter Software Installation (P/B 201)
24-41-05-400-802	BPCU Software Installation (P/B 201)
26-16-01-400-802	Cargo Smoke Detectors Software Installation (P/B 201)
26-18-05-400-802	DLODS Control Cards Software Installation (P/B 201)

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Reference	Title
27-02-01-400-803	Primary Flight Computer Software Installation (P/B 201)
27-51-01-400-802	Flap/Slat Electronics Unit (FSEU) Software Installation (P/B 201)
28-41-01-400-802	FQPU Software Installation (P/B 201)
29-11-50-400-802	Hydraulic Interface Module Software Installation (P/B 201)
30-11-02-400-802	Airfoil and Cowl Ice Protection System - WAI - Software Installation (P/B 201)
31-33-01-400-802	Flight Compartment Printer Software Installation (P/B 201)
31-41-02-420-804	Core Processor Module/GG Software Installation (P/B 201)
31-41-04-420-804	Core Processor Module/COMM Software Installation (P/B 201)
31-41-05-420-801	Core Processor Module/Standard Software Installation (P/B 201)
31-41-11-420-806	Input/Output Module (IOM) Software Installation (P/B 201)
31-41-21-470-801	AIMS Cabinet Batch Software Installation (P/B 201)
31-51-01-400-802	Warning Electronic Unit Software Installation (P/B 201)
32-09-02-400-802	WOW Software Installation (P/B 201)
32-42-01-470-801	BSCU Software Installation (P/B 201)
34-21-01-420-801	Air Data Inertial Reference Unit (ADIRU) Software Installation (P/B 201)
34-21-02-420-801	Secondary Attitude Air Data Reference Unit (SAARU) Software Installation (P/B 201)
34-21-03-420-801	Air Data Module (ADM) Software Installation (P/B 201)
34-45-01-400-802	TCAS Computer Software Installation (P/B 201)
34-46-00 P/B 201	GROUND PROXIMITY WARNING SYSTEM - MAINTENANCE PRACTICES
34-61-02-400-801	Control Display Unit Software Installation (P/B 201)
36-11-20-400-803	Air Supply Cabin Pressure Controller (ASCPC) Software Installation (P/B 201)
45-10-00-420-801	How to Install Software (P/B 201)
45-10-00-750-803	How to Find the Hardware or Software Configuration of a System (P/B 201)
45-10-00-860-812	How to Add Software to the Hard Drive (P/B 201)
45-10-00-860-813	How to Remove Software from the Hard Drive (P/B 201)
45-10-00-860-814	How to See what Software is on the Hard Drive (P/B 201)
45-11-05-470-801	MAT – Software Installation (P/B 201)
46-13-00-470-801	Onboard Network System LRU Software Installation (P/B 201)
49-61-00-470-801	APU Controller Software Installation (P/B 201)
73-21-15-400-802-H01	EEC (FADEC) Software Installation (on the MAT) (P/B 201)
73-21-22-400-807-H00	Engine Data Interface Unit (EDIU) Software Installation (P/B 201)
77-31-03-400-801-H01	Airborne Vibration Monitoring (AVM) Signal Conditioner Unit Software Installation (P/B 201)

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C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-5704	Device - Maintenance
	Part #: G45004-1 Supplier: 81205
	Part #: G45004-3 Supplier: 81205
	Opt Part #: G45002-20 Supplier: 81205
	Opt Part #: G45002-25 Supplier: 81205
	Opt Part #: G45002-29 Supplier: 81205
	Opt Part #: J45001-1 Supplier: 81205
	Opt Part #: J45003-1 Supplier: 81205

D. Procedure

SUBTASK 20-15-11-860-001

- (1) Refer to the data above and to these related procedures as necessary:
 - (a) When installing software the following conditions must be met:
 - 1) Refer to Table 202 above to ensure that the temperature is appropriate for the type of software installation which is to be performed.
 - 2) During the installation process, if any temperatures are not in compliance, refer to AIR CONDITIONING - GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 21-00-00/201 to supply conditioned air to the aircraft.
 - 3) Wait until the temperature has reached an appropriate level before proceeding with the software installation.
 - (b) To install software in a component, refer to the applicable task in the Table 201.
 - (c) For general software installation instructions, do this task: How to Install Software, TASK 45-10-00-420-801.
 - (d) To add software to the hard drive, do this task: How to Add Software to the Hard Drive, TASK 45-10-00-860-812.
 - (e) To remove software from the hard drive, do this task: How to Remove Software from the Hard Drive, TASK 45-10-00-860-813.
 - (f) To look at the software part numbers on the hard drive, do this task: How to See what Software is on the Hard Drive, TASK 45-10-00-860-814.
 - (g) To find the software part number installed in a component, do this task: How to Find the Hardware or Software Configuration of a System, TASK 45-10-00-750-803.

— END OF TASK —

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CONTROL CABLES - INSPECTION/CHECK

1. General

- A. This procedure contains scheduled maintenance task data.
- B. The procedure has the following tasks:
 - (1) An inspection of the control cable wire rope
 - (2) An inspection of the control cable fittings
 - (3) An inspection of the control cable pulleys
 - (4) An inspection of the control cable travel
- C. These tasks may be performed concurrently at one location of the cable system on the airplane if desired for convenience.
- D. This procedure gives the inspections for control cables in general. If the inspections for specified control cables are different from these inspections, use the inspections for the specified control cables.
- E. Control cables are made of thin wire strands. Each wire in a strand is one unit of hard steel. Thus, if one strand is broken, the control cable is not fully weak.
- F. Control cable type and construction are identified by two numbers. The first number is the number of strands. The second number is the number of wires in a strand. For example, a 7x7 flexible cable has seven strands, each of which has seven wires. The more strands a cable has, the more flexible it is. Thus, use 7x7 and 7x19 cables when cables go through pulleys or when you must bend the wires.
- G. Tests show that flexible cables can have broken wires without an important decrease in strength. A 7x7 cable, for example, can have two broken wires in a one-foot length and continue to hold its specified load.
- H. Wires break most frequently where cables go through fairleads or around pulleys. Examine these areas carefully. Replace worn cables and cables with corrosion.

TASK 20-20-02-200-801

2. Inspection Of The Control Cable Wire Rope

(Figure 601)

NOTE: This procedure is a scheduled maintenance task.

A. References

Reference	Title
12-21-31-600-801	Control Cable Lubrication (P/B 301)

B. Consumable Materials

Reference	Description	Specification
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

C. Prepare for the Procedure

SUBTASK 20-20-02-100-001

- (1) Clean the cables (as necessary) for the inspection as follows:

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- (a) Use a dry cloth to remove the used lubricant and all unwanted material from the surface of the control cable.

NOTE: Do this for the full length of the cable travel through the fair leads, air pressure seals, on pulleys, quadrants, and the drums.

SUBTASK 20-20-02-200-004

- (2) Perform a detailed visual inspection to make sure that the cable does not contact parts other than pulleys, quadrants, cable seals, or grommets installed to control cable routing.

NOTE: The minimum cable clearance from other parts is 0.200 in. (5.080 mm), except 0.100 in. (2.540 mm) within 10 in. (254 mm) of a pulley or quadrant.

NOTE: The control cable system must be displaced full travel in each direction for complete inspection at fairleads, air pressure seals, grommets, quadrants, drums, and over pulleys.

- (a) Look for evidence of contact with other parts.
- (b) Correct the condition if evidence of contact is found.

D. Perform a detailed visual inspection of the cable runs for incorrect routing, kinks in the wire rope, or other damage.

NOTE: The control cable system must be displaced full travel in each direction for complete inspection at fairleads, air pressure seals, grommets, quadrants, drums, and over pulleys.

SUBTASK 20-20-02-200-005

- (1) Replace the cable assembly if:

- (a) The individual wires in a strand appear to blend together (outer wires worn 40 percent or more) (Figure 601).
- (b) A kink is found.
- (c) Corrosion is found.

E. Perform a detailed visual inspection of the cable.

SUBTASK 20-20-02-211-002

- (1) To do a check for the broken wires, rub a cloth along the cable.

NOTE: The cloth will catch on any broken wires.

NOTE: The control cable system must be displaced full travel in each direction for complete inspection at fairleads, air pressure seals, grommets, quadrants, drums, and over pulleys.

SUBTASK 20-20-02-200-006

- (2) Replace the 7X7 cable assembly if:

- (a) There is two or more broken wires in a 12 in. (305 mm) continuous section of cable.
- (b) There is three or more broken wires anywhere in the total cable assembly.

SUBTASK 20-20-02-200-007

- (3) Replace the 7X19 cable assembly if:

- (a) There is four or more broken wires in a 12 in. (305 mm) continuous section of cable.
- (b) There is six or more broken wires anywhere in the total cable assembly.

SUBTASK 20-20-02-211-001

- (4) Perform a detailed visual inspection of the cable for birdcaging.

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- (a) Replace the cable if you find birdcaging in the cable assembly of one or more cable strands.

NOTE: Cable Birdcaging is the disturbance and displacement of individual cable strands which open away from each other and the center core. When this separation strains the cable material more than its elastic limit, instability or birdcaging occurs in the form of a permanent deformation.

SUBTASK 20-20-02-200-014

- (5) Inspect the steel control cable lubrication.



DO NOT APPLY SOLVENTS, GREASE, OR OIL TO STAINLESS STEEL CONTROL CABLES. THESE MATERIALS CAN COLLECT CONTAMINATION THAT CAN CAUSE DAMAGE TO THE INTERNAL SURFACES OF THE CRES CABLE STRANDS. THIS CAN DECREASE THE SERVICE LIFE OF THE CABLE.

- (a) Make sure that there is sufficient lubrication on the control cables (TASK 12-21-31-600-801).
- 1) Do not lubricate the CRES cables.
 - 2) If necessary, wipe the CRES cables with a cotton wiper, G00034.
 - 3) If necessary lubricate the control cables.

————— **END OF TASK** —————

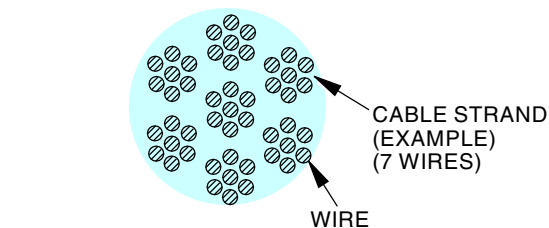
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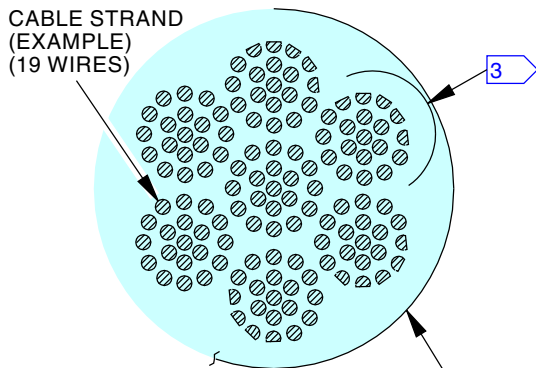
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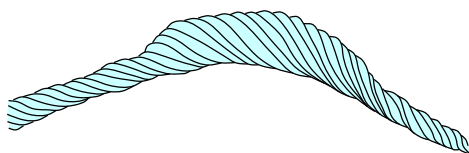


7X7 CABLE

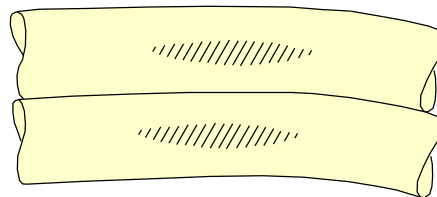


7x19 CABLE

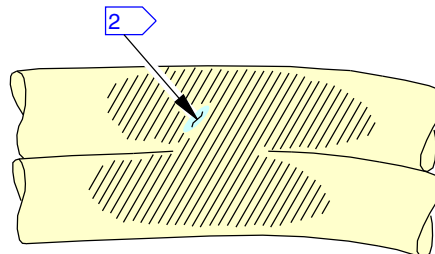
EXAMPLE OF INTERNAL WEAR



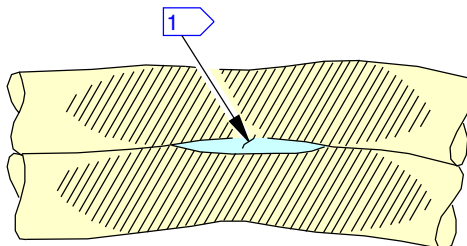
EXAMPLE OF CABLE BIRD-CAGING



**EACH OUTER WIRE WORN LESS THAN 40%
(WORN AREAS NOT BLENDED)**



**EACH OUTER WIRE WORN 40-50%
(WORN AREAS ARE BLENDED)**



EACH WIRE IS WORN MORE THAN 50%

- 1 VISIBLE SPACE BETWEEN WIRES.
- 2 WEAR CONDITION RESULTING IN BLENDED SURFACES BETWEEN WIRES.
- 3 THE OUTER WIRE WEAR AREA ON CABLE STRAND. A VISIBLE SPACE BETWEEN WIRES 1 OR A FULLY BLENDED SURFACE 2.
- 4 CABLE WEAR MAY OCCUR ON ONE SIDE ONLY OR ON FULL CIRCUMFERENCE. CABLE WEAR CAN EXTEND ALONG THE CABLE FOR A DISTANCE EQUAL TO USUAL CABLE TRAVEL.

2259306 S0000506607_V2

**Cable Wear Patterns
Figure 601/20-20-02-990-803**

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TASK 20-20-02-200-802

3. Inspection Of The Control Cable Fittings

A. Procedure

SUBTASK 20-20-02-200-008

- (1) Perform a detailed visual inspection to make sure that the means of locking the joints are intact (wire locking, cotter pins, turnbuckle clips, etc.).
 - (a) Install any missing parts.

SUBTASK 20-20-02-200-009

- (2) Perform a detailed inspection of the swaged portions of swaged end fittings for surface cracks or corrosion.
 - (a) Replace the cable assembly if cracks or corrosion are found.

SUBTASK 20-20-02-200-010

- (3) Perform a detailed visual inspection of the unswaged portion of the end fitting.
 - (a) Replace the cable assembly if a crack is found, if corrosion is present, or if the end fitting is bent more than 2 degrees.

SUBTASK 20-20-02-200-011

- (4) Perform a detailed visual inspection of the turnbuckle.
 - (a) Replace the turnbuckle if a crack is visible or if corrosion is present.

———— **END OF TASK** ————

TASK 20-20-02-200-803

4. Inspection Of The Control Cable Pulley

(Figure 602)

A. Procedure

SUBTASK 20-20-02-200-012

- (1) Perform a detailed visual inspection to make sure that pulleys are free to rotate.
 - (a) Replace pulleys that are not free to rotate.

SUBTASK 20-20-02-200-013

- (2) Perform a detailed visual inspection of the pulleys for conditions shown on Figure 602.
 - (a) Replace pulleys which are not in a normal condition.

———— **END OF TASK** ————

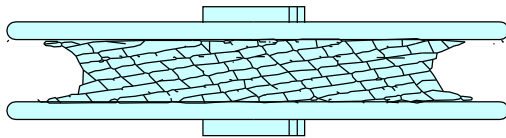
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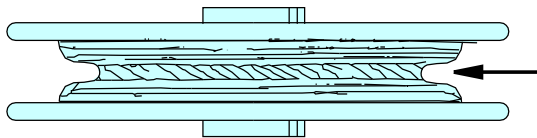
BOEING
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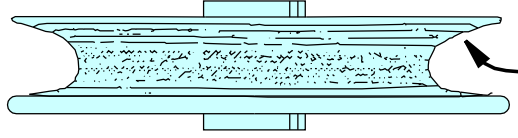
CABLE TENSION TOO HIGH



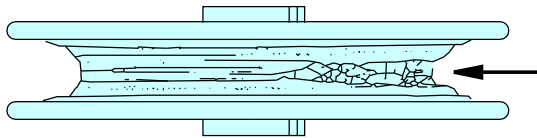
PULLEY NOT ALIGNED CORRECTLY



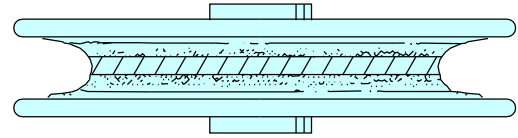
**PULLEY GROOVE WITH
EXCESSIVE WEAR**



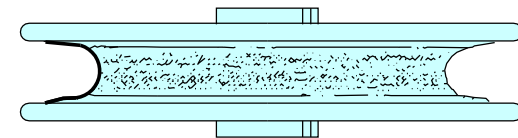
CABLE NOT ALIGNED CORRECTLY



PULLEY WILL NOT TURN



NORMAL CONDITION



NORMAL CONDITION

C94449 S0006402622_V3

**Pulley Wear Patterns
Figure 602/20-20-02-990-804**

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TASK 20-20-02-200-804

5. Inspection Of The Control Cable Travel

A. Procedure

SUBTASK 20-20-02-710-001

- (1) Operate controls through full travel to make sure that they move freely and that too much force is not necessary.

SUBTASK 20-20-02-210-010

- (2) Make sure the cable is free to move through its full travel.

———— **END OF TASK** ————

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PENETRANT INSPECTION - MAINTENANCE PRACTICES

1. Introduction

- A. The data in this subject comes from Boeing process specification BAC5423 and Boeing specification support standard BSS7039. The airline has a copy of the Boeing Process Specification manual.
- B. The Boeing Company will not test penetrant materials for the airlines or act as an intermediary between vendors and airlines, but Boeing will occasionally test new materials as they become available.
- C. Industry standard specifications AMS 2647 and ASTM E1417 are acceptable alternatives to this procedure.

2. General

- A. Penetrant examination uses the property of a liquid to go into a defect that is open at the surface of the part. The liquid is applied to the surface and permitted to soak in. Unwanted liquid is removed from the surface, but some liquid stays in the defect. A developer is applied to pull the liquid out of the defect so it can be seen. Visible penetrants are examined under white light. Fluorescent penetrants are examined under ultraviolet light.
- B. Penetrants are usually used on nonferrous metals, but they can be used on all metals, ceramics, glass and plastics. With some special alloys or plastics, precautions must be used to prevent damage to the part.
- C. A penetrant inspection system is a group of penetrant materials used together to do the inspection. These systems are put into groups by penetrant type, removal method, developer type, and sensitivity level. The details of the systems are shown in Table 1.

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Penetrant Classifications per BSS7039 and QPL AMS 2644

Penetrant Type	Description
1	Fluorescent Dye
2	Visible Dye (color contrast)
Penetrant Method	Description
A	Water Washable
B	Post Emulsifiable, Liphophilic
C	Solvent Removable
D	Post Emulsifiable, Hydrophilic
E	Water Washable, Water Base
Sensitivity Level ^{*[1]}	Description
1/2	Ultra Low (not applicable to flight hardware)
1	Low
2	Medium
3	High
4	Ultra High
Developer Form	Description
a	Dry powder
b	Water soluble
c	Water suspendible
d	Nonaqueous wet Type 1
e	Nonaqueous wet Type 2
f	Special application
g	No developer
Solvent Remover Class	Description
1	Halogenated
2	Non halogenated
3	Special application

*[1] The sensitivity level classifications are for Type 1 penetrant systems only.

- D. The latest revision of the Qualified Product List to AMS 2644 gives a full list of all approved penetrant materials. Other materials can be used if they become approved to be added to that list.

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- E. In each penetrant inspection system, use the materials from only one manufacturer at a time. Do not use materials of one manufacturer with those from a different manufacturer unless tests make you sure the results will be satisfactory.
- F. If the overhaul instructions do not give the sensitivity level for penetrant inspection, use the data in Table 2 as a guide. This gives minimum sensitivity levels. Higher sensitivity levels can be used unless specified by overhaul instructions.

Selection of Penetrant Sensitivity Level

TYPE	QPL-AMS-2644 SENSITIVITY LEVEL	APPLICATION
1	1	Castings, other than precision or titanium, and parts made from such castings.
1	2	All materials and product forms not shown under another sensitivity level.
1	3	Portable Method C inspection of areas of possible damage and local areas of repair on flight hardware.
1	4	As specified by overhaul instructions.
2	N/A	Inspection of parts when overhaul instructions specifically call out Type 2. Inspection of ground handling or support equipment, tools and tooling.

- G. Selection of penetrants for metallic parts
- (1) Unless specified differently, use the sensitivity levels in Table 2.
 - (2) Examine aluminum-lithium alloys with Method B or Method D penetrants only.
 - (3) Method C penetrants can be used to examine local areas.
 - (4) On parts which will contain liquid oxygen, and which cannot be fully cleaned after the examination, use Method E penetrants.
- H. Selection of penetrants for nonmetallic or composite parts
- (1) Make sure that the inspection materials will not damage the surface. The inspection materials must not cause cracks, crazing, pits, etching, or discoloration.
 - (2) Phenolic and equivalent plastics can be safely examined with all Type 1 penetrants.
 - (3) Nonmetallic materials can be examined with Type 1 Method E penetrants.
 - (4) Teflon and equivalent plastics can be examined with Type 1, Method E penetrants. For these penetrants, QPL-25135 approval is not necessary.
 - (5) Developer is not necessary when you penetrant examine plastics. If you use the developer with Method E penetrants, use only dry powder developer.
- I. Do not use visible penetrants before fluorescent penetrants on a surface because mixtures of visible penetrants with fluorescent penetrants will prevent fluorescence, and you will not see the defects. Also, visible penetrants can become hard and when they get into thin cracks, the penetrant cannot be removed with usual cleaning procedures.

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PENETRANT INSPECTION - INSPECTION/CHECK

1. General

- A. This procedure contains the task to perform the NDT (non-destructive testing) penetrant inspection.

TASK 20-20-04-200-801

2. Penetrant Inspection

A. General

- (1) This task contains the procedure to perform a NDT (non-destructive testing) inspection.
- (a) The penetrant inspection is required after the following circumstances:
- heat treatment
 - welding
 - final machining operations
 - other procedures that could cause defects or make them come to the surface

B. References

Reference	Title
20-30-02-910-801	Structure Cleaners and Polishes (P/B 201)

C. Tools/Equipment

Reference	Description
STD-569	Light - Black, Ultraviolet

D. Procedure

SUBTASK 20-20-04-110-001

- (1) To prepare the surface for inspection, do the following steps:
- (a) The parts to be examined must be clean, dry, and free of grease, oil, grinding compounds, rust, scale, acids or alkalis, fluxes, burrs, feather edges, smeared metal, paint (primer, enamel), layout dye, or any other material which could hide defects and result in irrelevant indications or which will interfere with the examination procedure.
- (b) If parts, platings or coatings were removed or chemically etched, the parts must be rinsed and dried before the penetrant examination. Make sure that chemicals do not go into faying surfaces. If you gave holes the protection of masks or plugs before the etch, remove this protection before the penetrant examination.
- (c) Carefully wash with water and dry the parts that were treated with acids or alkalis. Chemicals and moisture that could be caught in the defects must be removed. Chemicals in the defects could react with the penetrant and prevent good indications of defects. Ultrasonic cleaning can help.
- (d) The surface must be fully dry before you apply the penetrant. If you think there is moisture in defects, heat the surfaces to 225°F (107°C) maximum until the moisture is gone or the surface is dry. Let the surface cool to 100°F (38°C) or less before you apply the penetrant.
- (e) Removal of anti-friction bearings and disassembly of parts is recommended before penetrant inspection. If bearings are not removed, or parts are not disassembled, they must be completely masked to prevent contamination by penetrant fluid.

SUBTASK 20-20-04-230-001

- (2) Do the following steps to apply the penetrant:

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- (a) Before you start, make sure the penetrant and part temperature is 40°F (4°C) - 120°F (49°C).
- (b) Under ultraviolet black light, STD-569, apply a layer of penetrant on all of the surfaces to be examined. You can apply the penetrant with a spray, swabs, a flow of liquid, or you can put the part in the penetrant.
- (c) Do not let penetrant collect in holes, recesses, or pockets. Put the part in a rack or turn or move it as necessary to let the penetrant drain equally from all surfaces.
- (d) Let the penetrant soak in for these minimum times (which include drain times):
 - Oil-base, water-washable penetrants – 10 minutes
 - Post-emulsifiable penetrants – 20 minutes
 - Solvent-removable penetrants – 20 minutes
 - Water-base, water-washable penetrants – 10 minutes
 - Visible dye (color contrast) penetrants – refer to the applicable vendor's instructions.
- (e) These penetration times are applicable for penetrant or part temperatures 60°F (16°C) - 120°F (49°C). For penetrant or part temperatures 40°F (4°C) - 60°F (16°C), multiply these times by 2.

SUBTASK 20-20-04-230-002

- (3) To remove the unwanted penetrant, do the following steps:

- (a) After the applicable soak and drain time, remove the penetrant from the surfaces by water spray, emulsifier-water spray, or solvent, as applicable. For fluorescent penetrants, do this under black light of 1000 microwatts per square centimeter minimum at the work surface, and visible light no stronger than 10 foot candles. Remove the penetrant to let a small amount of background fluorescence stay. This will let the remaining penetrant be only in the defects. Be careful not to remove too much penetrant, or you will not be able to find the defects. If the background fluorescence is not there, the penetrant could also be gone from the defects.
- (b) Remove the unwanted penetrant before it dries too much, or it will not be easy to remove it from the surfaces. If the penetrant does get too dry, completely clean the parts and apply the penetrant again per Paragraph 1.B.(1), Paragraph 1.B.(2) above.
- (c) Water washable penetrant
 - 1) Rinse with a water spray, with 50°F (10°C) - 100°F (38°C) water at 40 psi maximum pressure.
- (d) Post emulsifiable penetrant with lipophilic emulsifier

NOTE: EMULSIFICATION TIME STARTS WHEN THE EMULSIFIER OR REMOVER IS APPLIED TO THE PART. THEREFORE, THE PART MUST BE COMPLETELY COVERED AS QUICKLY AS POSSIBLE.

- 1) Spray on the emulsifier or put the part in the emulsifier.
 - 2) Let the part drain for 5 minutes maximum.
 - 3) Rinse with a water spray, with 50°F (10°C) - 100°F (38°C) water at 40 psi maximum pressure.
- (e) Post emulsifiable penetrant with hydrophilic remover. Use one of these procedures:
- NOTE:** EMULSIFICATION TIME STARTS WHEN THE EMULSIFIER OR REMOVER IS APPLIED TO THE PART. THEREFORE, THE PART MUST BE COMPLETELY COVERED AS QUICKLY AS POSSIBLE.

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- 1) Put the part in the remover.
 - a) Rinse the part to remove unwanted penetrant.
 - b) Put the part in the remover for 3 minutes maximum. Shake the part or the remover while the part is in the remover.
 - c) Rinse to remove the penetrant from the surface. Do not rinse an area longer than 30 seconds.
- 2) Spray on the remover
 - a) Rinse with a water spray, with 50°F (10°C) - 100°F (38°C) water at 40 psi maximum pressure.
 - b) Use a metered spray and a remover solution no stronger than 1 percent (0.25 percent is recommended) to remove the remaining penetrant.
 - c) Rinse with a water spray, with 50°F (10°C) - 100°F (38°C) water at 40 psi maximum pressure.
- (f) If parts are on an automatic line, do not let the line stop with emulsifier on the part surface. If the emulsification time is longer than the limit, clean and dry the parts and start over again. Parts on an automatic line can be rinsed without black light if the procedure is controlled to be sure the rinse is sufficient to remove the penetrant.
- (g) If a water rinse could cause corrosion because the water could make puddles or be slow to dry, use this procedure:
 - 1) Wipe the area with a clean, dry, lint-free cloth. Turn the cloth to use a clean surface for each wipe. Wipe until most of the penetrant is removed.
 - 2) Wipe the area with a clean, lint-free cloth lightly moist with a cleaner approved in Structure Cleaners and Polishes, TASK 20-30-02-910-801. Turn the cloth to use a clean surface for each wipe. Wipe until the penetrant is removed.
 - 3) When the penetrant is removed, immediately apply a very thin layer of non-aqueous wet developer.

SUBTASK 20-20-04-230-003

- (4) To dry the part, do the following steps:
 - (a) Part surfaces must be fully dry before you apply dry developer or developer which is not waterbased. Water based developers must be applied while the surface is wet, and then the surfaces must be fully dried.
 - (b) Dry parts with warm air up to 160°F (71°C). The recommended temperature is 120°F (49°C). If a drier is not available, let the parts dry in air or use a fan. Do not dry parts longer than 30 minutes. Too high a temperature or too long a time will decrease the sensitivity of the penetrant.
 - (c) For plastic parts, dry the surfaces with clean, lint-free cheesecloth or equivalent wipers or with a good flow of air up to 100°F (38°C).

SUBTASK 20-20-04-230-004

- (5) To apply the developer, do the steps that follow:
 - (a) Developer must be used for all parts unless the overhaul instructions are different.

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- (b) Development time for wet developers is measured from the time the developer is completely dry to the time you examine the surface. For dry developers, development time is measured from the time you apply the developer to the time you examine the surface. For all developers, use a minimum of 10 minutes development time. More development time could be necessary for some types of defects or to help you find out how important the indications are.
- (c) Dry Developers
 - 1) Sift, dust, or spray the developer on the parts or put the parts in the developer to make sure you apply the developer to all surfaces.
 - 2) Do not shake or spray too much, or the developer could rub off some of the penetrant that shows indication of defects.
- (d) Wet Developers – Aqueous (water) Suspendible and Aqueous (water) Soluble
 - 1) Immediately after you remove the unwanted penetrant, spray the developer on the surfaces or put the parts in the developer. Do not apply this developer with a brush. Make sure you apply the developer as a continuous, fully-mixed suspension or solution that wets all of the surfaces to be examined.
 - 2) Do not let the developer collect in puddles. Use low air pressure or suction, or move the parts, to remove unwanted developer.
 - 3) Immediately after you apply the developer to all of the surfaces, dry the surface with warm air per Paragraph 1.B.(4).
- (e) Wet developers – Nonaqueous (not water-based)
 - 1) Shake the developer container to fully mix it before you apply it.
 - 2) For best results and best sensitivity, a thin smooth layer of the developer is necessary. To get a thin layer, spray the developer with a very fine nozzle and constant movement of the spray. Two or three thin coats are better than one thick coat.

SUBTASK 20-20-04-230-005

- (6) To do the inspection of the parts, do the following steps:
 - (a) Examine the parts in a booth with the correct white or black light.
 - (b) Before you examine with fluorescent penetrants under black light and each time your eyes are open to visible light, let your eyes adjust to the darkness for at least 3 minutes. Special scales are available from penetrant manufacturers to help you know if your eyes are sufficiently adapted to the darkness.
 - (c) When you examine with fluorescent penetrants, do not use corrective lenses or spectacles which are photochrome, photogray, or equivalently sensitive to light. Under black light, when there is no white light, this type of eyewear can decrease visual sensitivity.
 - (d) Do not look directly at the source of the black light, or your eyeballs will fluoresce and temporarily decrease visual sensitivity. Correctly filtered black light is not dangerous to the eyes, but if the filter is defective, it could let dangerous short-wave ultraviolet light through from the bulb. Replace defective or cracked filters immediately.
 - (e) Examine the surfaces as carefully as your eyes will permit. This is the practical limit of penetrant inspection. If this is not sufficiently satisfactory, the overhaul instructions will give other inspection procedures to make sure the part is serviceable.

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- (f) Reject parts that have surface defects which are more than permitted limits. If the limits are not specified, reject parts that have shrinkage cracks or porosity, cold shuts, fatigue cracks, forming cracks, grinding and heat-treat cracks, seams, laps, and bursts.
- (g) If permitted by the overhaul instructions, repair the defects and penetrant examine the part again to see if it became serviceable.

SUBTASK 20-20-04-160-001

- (7) To clean the parts after the penetrant inspection:
 - (a) Clean the accepted parts in 4 hours or less after you applied the developer.
 - (b) Penetrant material remaining on the part could cause corrosion or can be a problem for subsequent machining and inspection. Remove the remaining developer as follows:
 - 1) Dry powder developer – Blow with an air hose. If necessary, alkaline or solvent clean.
 - 2) Wet developer – Use a brush or wipe with a dry cloth. Rinse or spray with water. If necessary, alkaline or solvent clean.
 - (c) After you clean the parts, examine them under black or white light, as applicable, to make sure all of the penetrant and developer is gone.

———— **END OF TASK** ————

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SPECIFICATIONS AND MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure contains one task:
- (1) Specifications and Materials

TASK 20-30-00-800-801

2. Specifications and Materials

A. General

- (1) Specifications and materials sections contain lists of consumable materials that can be necessary during regular maintenance of the airplane. In many cases for engine-related consumable materials, the engine manufacturer's consumable product reference number has been provided.
- (2) Whenever possible, consumable materials will be referenced in the Maintenance Manual by a material specification.
- (3) In the event a material is shown with no material specification, the material will be a specific vendor product or it will be commercially available (as shown by "Coml").
- (4) For specific vendor information on a product, you should refer to the U-File. Or, you should refer to the qualified products list of the applicable material specification.
- (5) The data on the products and their sources is based on the latest Boeing specifications and available vendor data. If any of the consumable materials listed are not available from the sources or if the source is not in operation, please contact Boeing. You can reach Boeing through your local Boeing Field Service Representative or you can also e-mail requests directly into the Boeing Communications (Boecom) system at this address: ame-boecom@boeing.com. Please provide this data: airline name, your name, phone number, e-mail address, bulk code identification, and a description of the change requested.

B. References

Reference	Title
20-30-01-910-801	Structure Adhesives, Cements, and Sealants (P/B 201)
20-30-02-910-801	Structure Cleaners and Polishes (P/B 201)
20-30-03-910-801	Structure Finishing Materials (P/B 201)
20-30-04-910-801	Structure Lubricants (P/B 201)
20-30-05-910-801	Structure Welding Materials (P/B 201)
20-30-06-910-801	Structure Stripper Materials (P/B 201)
20-30-07-910-801	Structure Miscellaneous Materials (P/B 201)
70-30-11-910-801-H01	Engine Adhesives, Cements, and Sealants (P/B 201)
70-30-12-910-801-H01	Engine Cleaners and Polishes (P/B 201)
70-30-13-921-801-H01	Engine Finishing Materials (P/B 201)
70-30-14-910-801-H01	Engine Lubricants (P/B 201)
70-30-17-910-801-H01	Engine Miscellaneous Materials (P/B 201)

C. Procedure

SUBTASK 20-30-00-800-002

- (1) Use these tasks for information on airframe consumable materials:
 - (a) Adhesives, Cements, and Sealers (TASK 20-30-01-910-801)
 - (b) Cleaners and Polishes (TASK 20-30-02-910-801)

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- (c) Finishing Materials (TASK 20-30-03-910-801)
- (d) Lubricants (TASK 20-30-04-910-801)
- (e) Welding Materials (TASK 20-30-05-910-801)
- (f) Stripping Materials (TASK 20-30-06-910-801)
- (g) Miscellaneous Materials (TASK 20-30-07-910-801)

SUBTASK 20-30-00-800-001

- (2) Use these tasks for information on engine consumable materials:
- (a) Adhesives, Cements, and Sealers (Engine Adhesives, Cements, and Sealants, TASK 70-30-11-910-801-H01)
 - (b) Cleaners and Polishes (Engine Cleaners and Polishes, TASK 70-30-12-910-801-H01)
 - (c) Finishing Materials (Engine Finishing Materials, TASK 70-30-13-921-801-H01)
 - (d) Lubricants (Engine Lubricants, TASK 70-30-14-910-801-H01)
 - (e) Miscellaneous Materials (TASK 70-30-17-910-801-H01)

———— **END OF TASK** ————

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AIRPLANE STRUCTURE ADHESIVES, CEMENTS, AND SEALANTS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists adhesives, cements, and sealants for airplane structure maintenance. There are no procedural steps in this procedure.

TASK 20-30-01-910-801

2. Structure Adhesives, Cements, and Sealants

A. Procedure

SUBTASK 20-30-01-800-001

- (1) The list of adhesives, cements, and sealers has been moved to the introduction section of the AMM.

Table 201/20-30-01-993-807

Permitted Substitutes for Initial Specified Sealant						
Permitted Alternate Sealants						
Initial Specified Sealants	BMS 5-45	BMS 5-63	BMS 5-95	BMS 5-142*[1]	PR-1826*[1]*[2]*[3]*[6]	PR-1828*[1]*[3]*[6]
BMS 5-26	See Table 202	No	No	No	Yes	No
BMS 5-45	--	No	No	No	Yes	No
BMS 5-63	No	--	No	No	No	No
BMS 5-95	Yes*[4]*[5]	No	--	Yes	Yes	Yes
BMS 5-142	Yes	No	Yes	--	Yes	Yes

*[1] This alternative is not permitted for mating surface seal, faying surface seal, pre-pack sealing, wet fastener and wet bushing/bearing installation procedures. BMS 5-142 is an acceptable alternative to BMS 5-45 between the inlet cowl and the fan case flange.

*[2] This sealant has a primer that must also be used.

*[3] This sealant is only for fillet sealing and aerodynamic smoothing.

*[4] Both of the mating surfaces must be primed (or primed and enameled) to use this substitute for faying surface sealing.

*[5] Substitution is not allowed for faying surface sealing of fuselage skin lap splices or door skin lap splices (a skin lap splice is a joint where one skin overlaps another skin and the two skins are fastened together at this overlap area). Substitution is not allowed for faying surface sealing common to any unprimed fuselage skin or door skin surface. Substitution is not allowed for faying surface sealing common to unprimed nacelle or pylon/strut box structure. Substitution is not allowed for wet fastener installation common to nacelle or pylon/strut box structure. Substitution is not allowed for landing gear components. Substitution is not applicable to usage per any of the BAC 5117-XX specifications. Substitution is not applicable to Class E sealant.

*[6] This sealant cannot be used on or near acrylic windows or other acrylic components.

Table 202/20-30-01-993-803 BMS 5-26 Superseded by BMS 5-45

BMS 5-26, Types, Classes, Grade	Superseded by BMS 5-45, Classes, Grade
Type I, Class A-1/2, Grade 1	Class A-2, Grade 1 or Grade 2
Type I, Class A-2, Grade 1	Class A-2, Grade 1 or Grade 2
Type I, Class B-1/2	Class B-1/2

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Table 202/20-30-01-993-803 BMS 5-26 Superseded by BMS 5-45 (Continued)

BMS 5-26, Types, Classes, Grade	Superseded by BMS 5-45, Classes, Grade
Type I, Class B-2	Class B-2
Type II, Class A-2, Grade 1	Class A-2, Grade 1
Type II, Class A-2, Grade 2	Class A-2, Grade 2
Type II, Class B-2	Class B-2
Type II, Class C-24	Class C-24
Type II, Class C-48	Class C-48
Type II, Class C-168	Class C-168

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANERS AND POLISHES - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of cleaners and polishes for airplane structure maintenance. There are no procedural steps in this procedure.

TASK 20-30-02-910-801

2. Structure Cleaners and Polishes

A. Procedure

SUBTASK 20-30-02-800-001

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

———— **END OF TASK** ————

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AIRPLANE STRUCTURE FINISHING MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists finishing materials for airplane structure maintenance. There are no procedural steps in this procedure.

TASK 20-30-03-910-801

2. Structure Finishing Materials

A. Procedure

SUBTASK 20-30-03-800-001

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

———— **END OF TASK** ————

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AIRPLANE STRUCTURE LUBRICANTS - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of lubricants for airplane structure maintenance. There are no procedural steps in this procedure.

TASK 20-30-04-910-801

2. Structure Lubricants

A. Procedure

SUBTASK 20-30-04-800-001

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

———— **END OF TASK** ————

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AIRPLANE STRUCTURE WELDING MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists the consumable materials which are necessary for airplane structure welding and soldering. There are no procedural steps in this procedure.

TASK 20-30-05-910-801

2. Structure Welding Materials

A. Procedure

SUBTASK 20-30-05-800-001

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

———— **END OF TASK** ————

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AIRPLANE STRUCTURE STRIPPER MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists the consumable materials which are necessary for airplane structure stripping of organic and inorganic coatings. There are no procedural steps in this procedure.

TASK 20-30-06-910-801

2. Structure Stripper Materials

A. Procedure

SUBTASK 20-30-06-800-001

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

———— **END OF TASK** ————

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AIRPLANE STRUCTURE MISCELLANEOUS MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists miscellaneous consumable materials for airplane structure maintenance. There are no procedural steps in this procedure.

TASK 20-30-07-910-801

2. Structure Miscellaneous Materials

A. Procedure

SUBTASK 20-30-07-800-001

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 80) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for general cleaning of metals as listed in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-80-910-801

2. General Cleaning of Metal (Series 80)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01000, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-80-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-80-993-801 General Cleaning of Metal (Series 80)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Aqua Solvent SP-20		
Ardrox 5529		
Barsol A-2926		
BIOACT 108		BMS11-14 Type 1
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
CEE-BEE A-954		
Citra Safe	B50226	
Citra Safe, deodorized	B50225	
Citra Safe, Ultra-deodorized		
Degreasing Solvent (Mineral Spirits)	B00074	MIL-PRF-680 Type I, II or III
DesoClean 45	B00647	
Diestone DLS		
Diestone HFP		
DS-108	B50230	
EP-921	B50229	

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Table 201/20-30-80-993-801 General Cleaning of Metal (Series 80) (Continued)

Material Name	Material Bulk Code	Other Specifications
Ethyl 3-Ethoxy propionate (EEP)	B50228	
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Isopropyl alcohol:Toluene 1:1		
Lenium FHD		
Limonene Cleaner	B00634	BMS11-10 Types 1, 2 and 3
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl isobutyl ketone (MIBK)	B00151	ASTM D1153
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MOK, or MOK*		
MPK:MEK 70:30 percent		
Naphtha, aliphatic	B00083	TT-N-95, Type II or ASTM D 3735, Type III
Novec 7100	B50002	
Novec 71DE	B50003	
Novec 72FL Engineered Fluid		
NS Clean 100		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Re-Entry Prepsolv		
Shopmaster RTU		
SkyKleen 1000	B50085	
Teruclean PGE-01		
Toluene	B00094	A-A-59107
Vertrel MCA	B50005	
Vertrel XF	B50004	
Wedco 3500		

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 81) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for general cleaning of solvent sensitive organic coatings as listed in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-81-910-801

2. General Cleaning of Solvent Sensitive Organic Coatings (Series 81)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01001, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-81-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-81-993-801 General Cleaning of Solvent Sensitive Organic Coatings (Series 81)

Material Name	Material Bulk Code	Other Specifications
BIOACT 108		BMS11-14 Type 1
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
CEE-BEE A-954		
Degreasing Solvent (Mineral Spirits)	B00074	MIL-PRF-680 Type I, II or III
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Lenium FHD		
Naphtha, aliphatic	B00083	TT-N-95, Type II or ASTM D 3735, Type III
Novec 7100	B50002	
Novec 71DE	B50003	
Novec 72FL Engineered Fluid		
Shopmaster RTU		
Vertrel MCA	B50005	
Vertrel XF	B50004	

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 82) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for general cleaning of solvent resistant organic coatings as listed in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-82-910-801

2. General Cleaning of Solvent Resistant Organic Coatings (Series 82)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01002, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk code. Refer to the U-File for this applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-82-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-82-993-801 General Cleaning of Solvent Resistant Organic Coatings (Series 82)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Aqua Solvent SP-20		
Ardrox 5529		
BIOACT 108		BMS11-14 Type 1
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
CEE-BEE A-954		
Citra Safe	B50226	
Citra Safe, deodorized	B50225	
Citra Safe, Ultra-deodorized		
Degreasing Solvent (Mineral Spirits)	B00074	MIL-PRF-680 Type I, II or III
DesoClean 45	B00647	
Diestone DLS		
Diestone HFP		
DS-108	B50230	
EP-921	B50229	
Ethyl 3-Ethoxy propionate (EEP)	B50228	

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Table 201/20-30-82-993-801 General Cleaning of Solvent Resistant Organic Coatings (Series 82)
(Continued)

Material Name	Material Bulk Code	Other Specifications
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Lenium FHD		
Limonene Cleaner	B00634	BMS11-10 Types 1, 2 and 3
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl isobutyl ketone (MIBK)	B00151	ASTM D1153
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MOK, or MOK*		
MPK:MEK 70:30 percent		
Naphtha, aliphatic	B00083	TT-N-95, Type II or ASTM D 3735, Type III
Novec 7100	B50002	
Novec 71DE	B50003	
Novec 72FL Engineered Fluid		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Re-Entry Prepsolv		
Shopmaster RTU		
SkyKleen 1000	B50085	
Teruclean PGE-01		
Toluene	B00094	A-A-59107
Vertrel MCA	B50005	
Vertrel XF	B50004	
Wedco 3500		

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 83) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for general cleaning of composites as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-83-910-801

2. General Cleaning of Composites (Series 83)

A. **General**

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk code of B01003, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. **Procedure**

SUBTASK 20-30-83-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-83-993-801 General Cleaning of Composites (Series 83)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Ardrox 5529		
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Citra Safe	B50226	
Citra Safe, deodorized	B50225	
Citra Safe, Ultra-deodorized		
Diestone DLS		
Diestone HFP		
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Limonene Cleaner	B00634	BMS11-10 Types 1, 2 and 3
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I

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Table 201/20-30-83-993-801 General Cleaning of Composites (Series 83) (Continued)

Material Name	Material Bulk Code	Other Specifications
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Naphtha, aliphatic	B00083	TT-N-95, Type II or ASTM D 3735, Type III
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Re-Entry Prepsolv		
SkyKleen 1000	B50085	

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 84) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for cleaning of metal before painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-84-910-801

2. Final Cleaning of Metal Prior to Painting (Series 84)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01004, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-84-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-84-993-801 Final Cleaning of Metal Prior to Painting (Series 84)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Citra Safe	B50226	
Citra Safe, deodorized	B50225	
Citra Safe, Ultra-deodorized		
DesoClean 45	B00647	
Diestone DLS		
Diestone HFP		
DS-108	B50230	
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Limonene Cleaner	B00634	BMS11-10 Types 1, 2 and 3
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I

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Table 201/20-30-84-993-801 Final Cleaning of Metal Prior to Painting (Series 84) (Continued)

Material Name	Material Bulk Code	Other Specifications
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Re-Entry Prepsolv		
SkyKleen 1000	B50085	
Toluene	B00094	A-A-59107

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 85) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of solvent sensitive organic coatings before painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-85-910-801

2. Final Cleaning of Solvent Sensitive Organic Coatings Prior to Painting (Series 85)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01005, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-85-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-85-993-801 Final Cleaning of Solvent Sensitive Organic Coatings Prior to Painting (Series 85)

Material Name	Material Bulk Code	Other Specifications
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Diestone DLS		
Diestone HFP		
DS-108	B50230	
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Toluene	B00094	A-A-59107

— END OF TASK —

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 86) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of solvent resistant organic coating before painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-86-910-801

2. Final Cleaning of Solvent Resistant Coatings Prior to Painting (Series 86)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01006, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-86-110-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-86-993-802 Final Cleaning of Solvent Resistant Organic Coatings Prior to Painting (Series 86)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Citra Safe	B50226	
Citra Safe, deodorized	B50225	
Citra Safe, Ultra-deodorized		
DesoClean 45	B00647	
Diestone DLS		
Diestone HFP		
DS-108	B50230	
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Limonene Cleaner	B00634	BMS11-10 Types 1, 2 and 3
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		

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**Table 201/20-30-86-993-802 Final Cleaning of Solvent Resistant Organic Coatings Prior to Painting
(Series 86) (Continued)**

Material Name	Material Bulk Code	Other Specifications
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Re-Entry Prepsolv		
SkyKleen 1000	B50085	
Toluene	B00094	A-A-59107

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 87) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of composites before painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-87-910-801

2. Final Cleaning of Composites Prior to Painting (Series 87)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01007, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-87-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-87-993-801 Final Cleaning of Composites Prior to Painting (Series 87)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Bonderite C-SO 4460-BK Aero		
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Citra Safe	B50226	
Citra Safe, deodorized	B50225	
Citra Safe, Ultra-deodorized		
Diestone DLS		
Diestone HFP		
FCC-55 or Naptha:MPK 1:1	B01026	
FD Cleaner		
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
Limonene Cleaner	B00634	BMS11-10 Types 1, 2 and 3
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		

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Table 201/20-30-87-993-801 Final Cleaning of Composites Prior to Painting (Series 87) (Continued)

Material Name	Material Bulk Code	Other Specifications
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
Re-Entry Prepsolv		
SkyKleen 1000	B50085	

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 88) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of metal before non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-88-910-801

2. Final Cleaning of Metal Prior to Non-structural Bonding (Series 88)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01008, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-88-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-88-993-801 Final Cleaning of Metal Prior to Non-structural Bonding (Series 88)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Diestone DLS		
Diestone HFP		
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FCC-55 or Naptha:MPK 1:1	B01026	
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
SkyKleen 1000	B50085	

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 89) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of solvent sensitive organic coatings before non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-89-910-801

2. Final Cleaning of Solvent Sensitive Organic Coatings Prior to Non-structural Bonding (Series 89)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01009, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-89-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-89-993-801 Final Cleaning of Solvent Sensitive Organic Coatings Prior to Non-structural Bonding (Series 89)

Material Name	Material Bulk Code	Other Specifications
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 90) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of solvent resistant organic coatings before non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-90-910-801

2. Final Cleaning of Solvent Resistant Organic Coatings Prior to Non-structural Bonding (Series 90)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01010, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-90-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-90-993-801 Final Cleaning of Solvent Resistant Organic Coatings Prior to Non-structural Bonding (Series 90)

Material Name	Material Bulk Code	Other Specifications
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Diestone DLS		
Diestone HFP		
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FCC-55 or Naptha:MPK 1:1	B01026	
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
SkyKleen 1000	B50085	

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 91) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of composites before non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-91-910-801

2. Final Cleaning of Composites Prior to Non-structural Bonding (Series 91)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk code of B01011, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk code. Refer to the U-File for the applicable vendors. Mixture ratios are given by volume with a tolerance of plus or minus 2%.

B. Procedure

SUBTASK 20-30-91-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-91-993-801 Final Cleaning of Composites Prior to Non-structural Bonding (Series 91)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	ASTM D 329
Bonderite C-SO 6709 Aero		
CDG-110 or Naptha:IPA 1:1		
CDG-211 or Naptha:IPA:DNA 2:1:1		
Diestone DLS		
Diestone HFP		
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II
FCC-55 or Naptha:MPK 1:1	B01026	
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9 Grades 1 and 2
MIBK:MEK 3:2		
MPK:MEK 70:30 percent		
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I
SkyKleen 1000	B50085	

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 92) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning before general sealing as given in BAC5000. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-92-910-801

2. Final Cleaning Prior to General Sealing (Series 92)

A. General

- (1) This selection of solvents uses BAC5000 as a guide and may be used on all surfaces except unpainted composite laminated surfaces. This list of solvents has the Series Bulk Code of B01012, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-92-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-92-993-801 Final Cleaning Prior to General Sealing (Series 92)

Material Name	Material Bulk Code	Other Specifications
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9
Naphtha, aliphatic (for acrylic surfaces only)	B00083	TT-N-95, Type II or ASTM D 3735, Type III
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 93) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning before fuel tank sealing as given in BAC5504. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-93-910-801

2. Final Cleaning Prior to Fuel Tank Sealing (Series 93)

A. General

- (1) This selection of solvents uses BAC5504 as a guide. This list of solvents has the Series Bulk Code of B01013, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-93-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-93-993-801 Final Cleaning Prior to Fuel Tank Sealing (Series 93)

Material Name	Material Bulk Code	Other Specifications
FD Cleaner		
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D 740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 94) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning before application of rain erosion resistant coating as given in BAC5880. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-94-910-801

2. Final Cleaning Prior to Application of Rain Erosion Resistant Coating (Series 94)

A. General

- (1) This selection of solvents uses BAC5880 as a guide. This list of solvents has the Series Bulk Code of B01014, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-94-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-94-993-801 Final Cleaning Prior to Application of Rain Erosion Resistant Coating (Series 94)

Material Name	Material Bulk Code	Other Specifications
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Toluene (for 8200 ASTROCOAT Primer surfaces only)	B00094	A-A-59107
Xylene (for 8200 ASTROCOAT Primer surfaces only)		

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 95) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning before aerodynamic smoothing and fairing as given in BAC5030. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-95-910-801

2. Final Cleaning Prior to Aerodynamic Smoothing and Fairing (Series 95)

A. General

- (1) This selection of solvents uses BAC5030 as a guide. This list of solvents has the Series Bulk Code of B01015, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-95-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-95-993-801 Final Cleaning Prior to Aerodynamic Smoothing and Fairing (Series 95)

Material Name	Material Bulk Code	Other Specifications
FCC-55		
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9
Naphtha, aliphatic (for acrylic surfaces only)	B00083	TT-N-95, Type II or ASTM D 3735, Type III
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 96) - MAINTENANCE PRACTICES

1. General

- A. This subject contains a list of solvents for final cleaning of oxygen components exposed to oxygen as given in BAC5402. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-96-910-801

2. Final Cleaning of Oxygen Components Exposed to Oxygen (Series 96)

A. General

- (1) This selection of solvents uses BAC5402 as a guide. This list of solvents has the Series Bulk code of B01016, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown.

Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-96-800-001

- (1) In Table 201, find the applicable solvent.

Table 201/20-30-96-993-801 Final Cleaning of Oxygen Components Exposed to Oxygen (Series 96)

Material Name	Material Bulk Code	Other Specifications
1,1,1 – Trichloroethane	B50135	ASTM D 4126
Freon TF (trichlorotrifluoroethane)	B00143	
Genesolve D (trichlorotrifluoroethane)		
HFE 7100	B50002	
HFE 71DE	B50003	
Isopropyl Alcohol	B00130	TT-I-735 Grade A or B, ASTM D 770
Tetrachloroethylene	B00093	ASTM D4376 and ASTM D4081
Trichloroethylene	B00081	ASTM D 4080
Vertrel MCA	B50005	
Vertrel XF	B50004	

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 97) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning before structural bonding as given in BAC5514. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-97-910-801

2. Final Cleaning Prior to Structural Bonding (Series 97)

A. General

- (1) This selection of solvents uses BAC5514 as a guide. This list of solvents has the Series Bulk Code of B01017, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-97-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-97-993-801 Final Cleaning Prior to Structural Bonding (Series 97)

Material Name	Material Bulk Code	Other Specifications
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I
Methyl propyl ketone (MPK)	B00666	BMS11-9
MIBK:MEK 3:2		

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 98) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for general cleaning of specific polymerics as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-98-910-801

2. Cleaning of Specific Polymerics (Series 98)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01018, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
- (2) The solvents in this list may be used for:
- (a) The general cleaning of:
- 1) Polyester (Vibrin, Mylar, Dacron)
 - 2) Polytetrafluoroethylene (Teflon)
 - 3) Polyvinyl fluoride (Tedlar).
- (b) OR, the final cleaning of the following prior to painting:
- 1) Polyester (Vibrin, Mylar, Dacron)
 - 2) Polytetrafluorethylene (Teflon)
 - 3) Polyvinyl fluoride (Tedlar).
- (c) OR, the final cleaning of the following prior to non-structural bonding:
- 1) Polyester (Vibrin, Mylar, Dacron)
 - 2) Polytetrafluorethylene (Teflon)
 - 3) Polyvinyl fluoride (Tedlar).

B. Procedure

SUBTASK 20-30-98-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-98-993-801 Cleaning of Specific Polymerics (Series 98)

Material Name	Material Bulk Code	Other Specifications	tedlar	mylar	teflon
BIOACT 108			x		
Bonderite C-SO 6709 Aero			x	x	
CDG-110			x	x	
CDG-211			x	x	
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II	x	x	x
Ethyl-3-Ethoxy propionate (EEP)			x	x	x

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Table 201/20-30-98-993-801 Cleaning of Specific Polymerics (Series 98) (Continued)

Material Name	Material Bulk Code	Other Specifications	tedlar	mylar	teflon
FCC-55	B01026		x	x	
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770	x	x	x
MEK:sec-Butyl alcohol 42:58 percent			x	x	
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I	x	x	x
Methyl isobutyl ketone (MIBK)	B00151	ASTM D 1153	x	x	x
Methyl propyl ketone (MPK)	B00666		x	x	x
MOK or MOK*			x	x	x
Naphtha, aliphatic	B00083	TT-N-95, Type II or ASTM D 3735, Type III	x	x	x
Novec 7100	B50002		x		x
Novec 71DE	B50003		x		x
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or AA- 59281, Type I	x	x	x
Shopmaster RTU (General cleaning only - not for final cleaning)			x		
SkyKleen 1000	B50085		x	x	x
Vertrel MCA			x		x

————— END OF TASK —————

TASK 20-30-98-910-802

3. Cleaning of Phenolics or Nylon (Series 98-1)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This procedure contains a list of solvents for general cleaning of phenolics or nylon as given in BAC5750. This list of solvents has the Series Bulk Code of B01051, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-98-800-002

- (1) When your procedure refers to this subject (Table 202), use a solvent from this list.

Table 202/20-30-98-993-802 Cleaning of Phenolics or Nylon (Series 98-1)

Material Name	Material Bulk Code	Other Specifications	Phenolics	Polyamide
Bonderite C-SO 6709 Aero				x
CDG-110				x
CDG-211				x

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Table 202/20-30-98-993-802 Cleaning of Phenolics or Nylon (Series 98-1) (Continued)

Material Name	Material Bulk Code	Other Specifications	Phenolics	Polyamide
Ethyl alcohol, denatured	B00068	AMS 3002, ASTM E 1145 Type II	x	x
Ethyl-3-Ethoxy propionate (EEP)			x	
FCC-55	B01026			x
Isopropyl alcohol (IPA)	B00130	TT-I-735 Grade A or B, ASTM D 770	x	x
MEK:sec-Butyl alcohol 42:58 percent				x
Methyl ethyl ketone (MEK)	B00148	ASTM D740 Type I	x	x
Methyl Isobutyl Ketone (MIBK)	B00151	ASTM D 1153	x	x
Methyl propyl ketone (MPK)	B00666		x	x
MOK or MOK*			x	
Naphtha, aliphatic	B00083	TT-N-95, Type II or ASTM D 3735, Type III	x	x
Novec 7100	B50002			x
Novec 71DE	B50003			x
Pre-sealing Cleaning Solvent	B00184	BMS11-7 or A-A-59281, Type I	x	
Shopmaster RTU				x
SkyKleen 1000	B50085		x	
Toluene	B00094	A-A-59107		x
Vertrel MCA	B50005			x

———— **END OF TASK** ————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 99) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning of composites prior to structural bonding as given in BAC5578. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-99-910-801

2. Final Cleaning of Composites Prior to Structural Bonding (Series 99)

A. General

- (1) This selection of solvents uses BAC5578, D6-83908, and D6-83909 as a guide. This list of solvents has the Series Bulk Code of B01019, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

SUBTASK 20-30-99-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-99-993-801 Final Cleaning of Composites Prior to Structural Bonding (Series 99)

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane		ASTM D 4126
Acetone	B00062	ASTM D 329
BMS11-7 (Non-Metallic core only)	B00184	
Isopropyl Alcohol (IPA) (Non-Metallic core only)	B00130	TT-I-735 Grade A or B, ASTM D 770
MEK: Toluene 1:1		ASTM D 740 TT-T-548
Methyl Ethyl Ketone (MEK)	B00148	ASTM D740 Type I
Methyl Propyl Ketone (MPK)	B00666	BMS11-9
Naphtha (Non-Metallic core only)	B00083	TT-N-95

————— END OF TASK —————

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AIRPLANE GROUNDING - MAINTENANCE PRACTICES

1. General

A. This procedure contains these tasks:

- (1) Static Grounding
- (2) Electrical Bonding
- (3) Measurement of Airplane Electrical Resistance to Ground

B. If operators choose not to do these recommended tasks, they should develop alternate procedures which adequately protect personnel and equipment. Local fire codes and customs may require alternative or additional procedures to those shown here.

TASK 20-41-00-910-801

2. Static Grounding

(Figure 201)

A. General

- (1) Static grounding is not necessary if the airplane is parked for turnaround flight and no maintenance is to be done.
- (2) During normal pressure refueling of the airplane:
 - (a) An electrical bond is necessary between the airplane and the refueling vehicle.
NOTE: Static grounding is not necessary when performing pressure refueling or pressure defueling of the airplane.
- (3) Provide an electrical ground to the airplane when you do maintenance tasks with these items:
 - (a) power tools
 - (b) electrical power sources
 - (c) lights
 - (d) powered instruments
 - (e) flammable conditions (such as painting and solvent application).
- (4) When static grounding is necessary, you must connect the airplane to an identified and approved static ground point.



WARNING

THE EXTERNAL POWER PLUG MUST HAVE AN EARTH-GROUND. THE EARTH-GROUND MUST OPERATE CORRECTLY WHEN YOU USE THE EXTERNAL POWER PLUG TO STATICALLY GROUND THE AIRPLANE. IF YOU DO NOT STATICALLY GROUND THE AIRPLANE CORRECTLY, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (a) If an approved static ground point is not available, the external power plug gives an alternative connection to static ground. The external power plug must have an earth-ground that is operating correctly.
- (5) Where a grid system is used, any number of individual grounds will provide a common ground, since all grounds are interconnected. If an area does not have a grid system, use a single approved and identified ground as the common ground for all grounding cables.

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ALL WORK AROUND THE AIRPLANE MUST STOP WHEN LIGHTNING OCCURS AT A DISTANCE OF 6 MILES OR LESS. ALL PERSONNEL MUST GO IN A BUILDING OR THE AIRPLANE. LIGHTNING CAN KILL PERSONNEL OR CAUSE INJURY.



DO NOT WEAR HEADSET OR HANDLE ANY UMBILICAL CONNECTIONS TO AIRPLANE DURING ATMOSPHERIC ELECTRICAL DISTURBANCES. LIGHTNING STRIKE CAN CAUSE SEVERE INJURY.

- (6) During electrical storms, stop ground servicing operations, external to the airplane.
- (7) The airplane is normally electrostatically grounded through conductive tires (TASK 20-41-00-760-802). However, static grounding is necessary for:
 - (a) Airplanes having inadequate conductivity to ground through the tires.
 - (b) Airplanes parked on a surface where the parking site conductivity is inadequate to carry away electrical charge.

NOTE: The operator should assure the adequacy of airplane and parking area conductivity and may need to establish local procedures in areas where inadequate parking site conductivity is seasonal or permanent. Parking site conductivity may be inadequate on dry snow, dry sand or in areas of low moisture.

B. Location Zones

Zone	Area
711	Nose Landing Gear
731	Left Main Landing Gear
741	Right Main Landing Gear

C. Grounding procedure:

SUBTASK 20-41-00-840-001

- (1) Make sure the airplane is not parked over painted surfaces.

SUBTASK 20-41-00-480-001



ALL WORK AROUND THE AIRPLANE MUST STOP WHEN LIGHTNING OCCURS AT A DISTANCE OF 6 MILES OR LESS. ALL PERSONNEL MUST GO IN A BUILDING OR THE AIRPLANE. LIGHTNING CAN KILL PERSONNEL OR CAUSE INJURY.



DO NOT CONNECT A HEADSET AND DO NOT TOUCH CONNECTIONS TO THE AIRPLANE DURING ATMOSPHERIC ELECTRICAL ACTIVITY OR IN STRONG ELECTROMAGNETIC FIELDS. LIGHTNING STRIKE AND HIGH DISCHARGE CURRENTS CAN CAUSE SEVERE INJURY.



ALWAYS ATTACH THE GROUNDING CABLE TO THE GROUND CONNECTION FIRST. NEVER ATTACH THE CABLE TO THE AIRPLANE AND THEN TO THE GROUND CONNECTION.

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(WARNING PRECEDES)



ATTACH GROUNDING CABLES ONLY TO SPECIFIED POINTS ON THE AIRPLANE. INCORRECTLY ATTACHED GROUNDING CABLES CAN CAUSE SCRATCHES WHICH CAN CAUSE CORROSION AND CRACKS ON STRESSED PARTS. GROUND WIRES ATTACHED TO DOORS OR FAIRINGS MADE FROM COMPOSITE MATERIALS DO NOT PROVIDE A GROUND.

- (2) Attach grounding cable to a ground and to the airplane in the following sequence:
 - (a) Connect the grounding cable to an approved, identified static ground point.

NOTE: These points may be located in the parking surface or in another fixed location.
 - (b) Connect the grounding cable to approved grounding attach point on the airplane.

NOTE: These points are shown in Figure 201.

NOTE: Jack pads at jack points A and B (body integral jack pads) are the preferred alternate places for grounding when the grounding cable cannot be attached to the landing gear.
- 1) Attach the grounding cable to the jack pad in this condition:
 - a) When the landing gear is removed from the aircraft.
 - b) The procedure of landing gear retraction and extension checks.

NOTE: The jack pad must be completely installed and the grounding stud on it must be unpainted and free from oil.

SUBTASK 20-41-00-020-001

- (3) Before the airplane is moved, remove the ground cables from the approved grounding attach point on the airplane.

————— END OF TASK —————

TASK 20-41-00-760-801

3. Electrical Bonding

A. General

- (1) During pressure refueling of the airplane:
 - (a) An electrical bond between the airplane and the refueling vehicle is necessary.
- (2) Static grounding of the airplane during over wing refueling is necessary.



DO NOT WEAR HEADSET OR HANDLE ANY UMBILICAL CONNECTIONS TO AIRPLANE DURING ATMOSPHERIC ELECTRICAL DISTURBANCES. LIGHTNING STRIKE CAN CAUSE SEVERE INJURY.

- (3) During electrical storms, stop ground servicing operations, external to the airplane.

B. Procedure:

SUBTASK 20-41-00-840-002

- (1) Make sure the airplane is not parked over painted surfaces.

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SUBTASK 20-41-00-420-001



DO NOT CONNECT A HEADSET AND DO NOT TOUCH CONNECTIONS TO THE AIRPLANE DURING ATMOSPHERIC ELECTRICAL ACTIVITY OR IN STRONG ELECTROMAGNETIC FIELDS. LIGHTNING STRIKE AND HIGH DISCHARGE CURRENTS CAN CAUSE SEVERE INJURY.



ATTACH BONDING CABLES ONLY TO SPECIFIED POINTS ON THE AIRPLANE. INCORRECTLY ATTACHED BONDING CABLES CAN CAUSE SCRATCHES WHICH CAN CAUSE CORROSION AND CRACKS ON STRESSED PARTS. BOND WIRES ATTACHED TO DOORS OR FAIRINGS MADE FROM COMPOSITE MATERIALS DO NOT PROVIDE A BOND.

- (2) Connect a bonding cable to a known bonding or grounding point on the airplane.
- (a) Attach the grounding cable to the jack pad in this condition:
- 1) When the landing gear is removed from the aircraft.
 - 2) The procedure of landing gear retraction and extension checks.
- NOTE: The jack pad must be completely installed and the grounding stud on it must be unpainted and free from oil.

SUBTASK 20-41-00-480-002

- (3) Connect the other end of the bonding cable to a known bonding or grounding point on the support equipment in use.

SUBTASK 20-41-00-020-002

- (4) Before the airplane is moved, remove the ground cables in the opposite sequence that you attached them.

————— END OF TASK —————

TASK 20-41-00-760-802

4. Measurement of Airplane Electrical Resistance to Ground

A. References

Reference	Title
24-22-00-860-801	Supply Primary External Power (P/B 201)
24-22-00-860-806	Remove Electrical Power (P/B 201)
24-41-03-200-803	External Power Receptacle Neutral Pin to Nose Gear Grounding Stud Continuity Check (P/B 601)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-6457	Meter - Insulation (Range: 1-1,000 VDC or equivalent, select meter per test requirements) Part #: 1863-9700 Supplier: 62015 Part #: 1864-9700 Supplier: 62015 Part #: 1865PLUS Supplier: 62015 Part #: 1865PLUSCE Supplier: 62015 Opt Part #: 1865-00-CE Supplier: 62015

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C. Prepare for the Measurement

SUBTASK 20-41-00-840-003

- (1) Make sure the airplane is not parked over painted surfaces.

SUBTASK 20-41-00-700-001

- (2) Do this task: External Power Receptacle Neutral Pin to Nose Gear Grounding Stud Continuity Check, TASK 24-41-03-200-803.

SUBTASK 20-41-00-860-001

- (3) Do this task: Remove Electrical Power, TASK 24-22-00-860-806.

D. Airplane Electrical Resistance to Ground Measurement

SUBTASK 20-41-00-480-003



THE MEGOHMMETER HAS A HIGH DC VOLTAGE OUTPUT. MAKE SURE THE TEST LEADS HAVE THE CORRECT INSULATION AND ARE CORRECTLY ATTACHED. THIS WILL PREVENT INJURY TO PERSONS AND DAMAGE TO THE EQUIPMENT.



DO NOT USE A MEGOHMMETER NEAR A FUEL TANK VENT. IT CAN CAUSE AN EXPLOSION OR FIRE. FIRE AND EXPLOSIONS CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

- (1) Connect a insulation meter, COM-6457 to a known bonding/grounding point on one of the landing gear.

SUBTASK 20-41-00-480-004

- (2) Connect the other end of the insulation meter, COM-6457 to an approved identified ground point on the ramp.

SUBTASK 20-41-00-420-002

- (3) Set the insulation meter, COM-6457 to the 50 Vdc range.

SUBTASK 20-41-00-970-001

- (4) Measure the resistance to ground and record the resistance in the maintenance log.

NOTE: The resistance should be less than 1.0 megohms. If the resistance is more than 1.0 megohms this may be the result of a bad grounding location. Also, if the resistance is more than 1.0 megohms, there may be a very high surface resistance on the airplane.

- (a) If the resistance is more than 1.0 megohms, tell the flight crews of subsequent flights in this airplane the conductivity to ground is not sufficient through the tires to electrostatically ground this airplane on a parking surface.

NOTE: Static ground procedures may apply.

SUBTASK 20-41-00-970-003

- (5) Repeat the measurement at other parking site locations where successful measurements have been made.

NOTE: This will make sure the airplane has sufficient conductivity.

SUBTASK 20-41-00-210-002

- (6) Make sure the airplane is not parked over painted surfaces.
 - (a) Make sure the tires have sufficient conductivity.

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E. Put the Airplane Back to Its Usual Condition

SUBTASK 20-41-00-020-004

- (1) Disconnect the end of the insulation meter, COM-6457, or equivalent, from the ground point on the ramp.

SUBTASK 20-41-00-020-003

- (2) Disconnect the insulation meter, COM-6457, or equivalent, from the bonding/ground point on one of the landing gear.

SUBTASK 20-41-00-860-002

- (3) Do this task: Supply Primary External Power, TASK 24-22-00-860-801.

———— **END OF TASK** ————

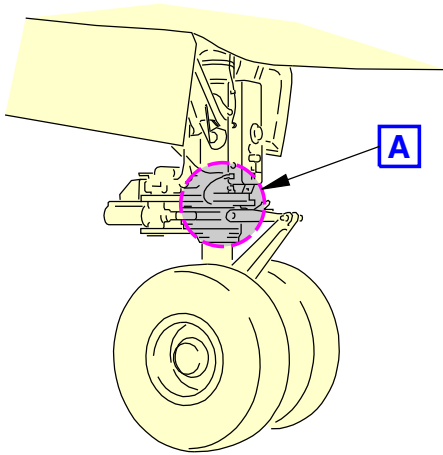
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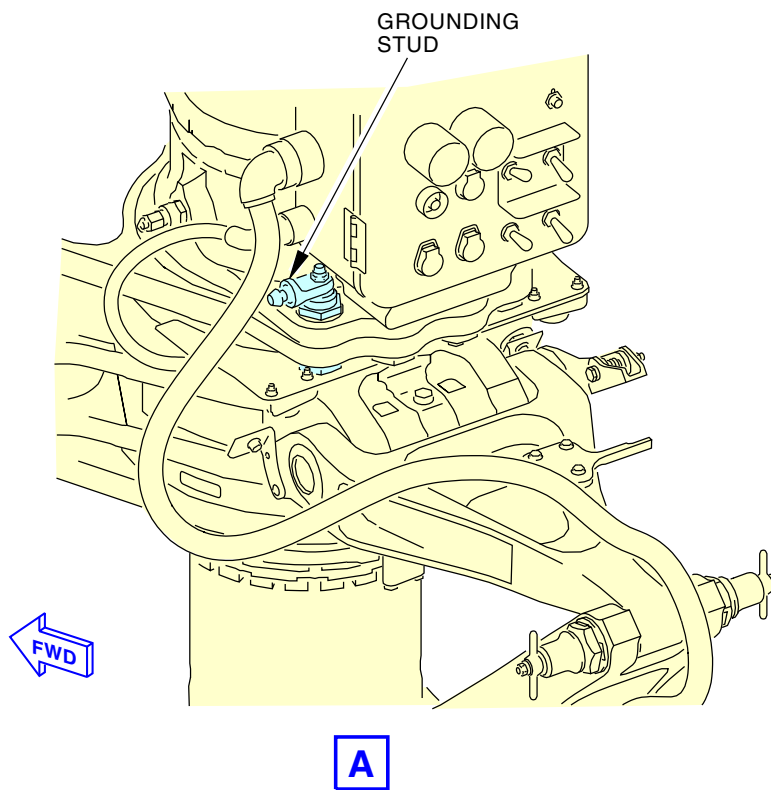
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NOSE LANDING GEAR



C98471 S0006402743_V2

Static Ground - Maintenance Practices
Figure 201/20-41-00-990-801 (Sheet 1 of 2)

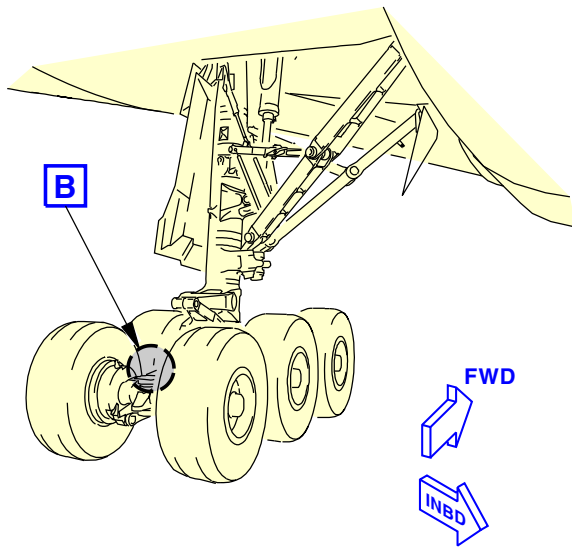
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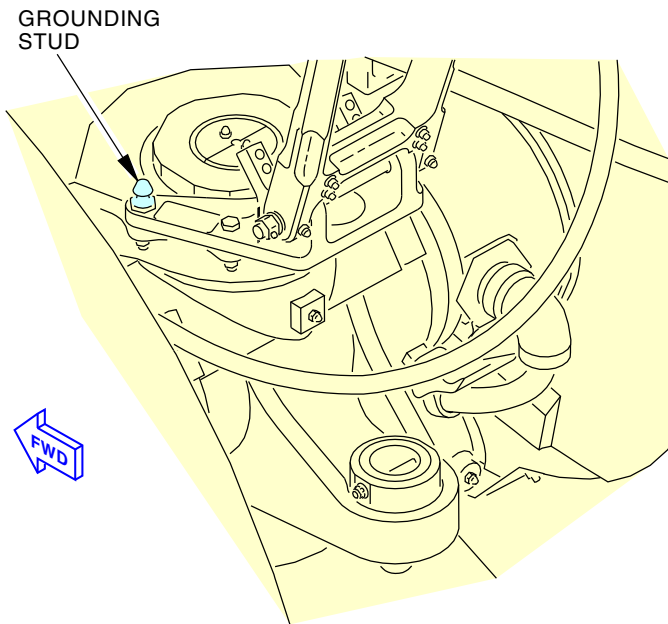
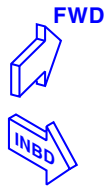
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MAIN LANDING GEAR



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Static Ground - Maintenance Practices
Figure 201/20-41-00-990-801 (Sheet 2 of 2)

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ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES - MAINTENANCE PRACTICES

1. General

- A. This procedure has these tasks:
- (1) The ESDS handling for printed circuit board removal.
 - (2) The ESDS handling for printed circuit board installation.
 - (3) The ESDS handling for removal of metal encased units.
 - (4) The ESDS handling for installation of metal encased units.
 - (5) The installation of conductive dust caps and connector covers.
 - (6) The removal of conductive dust caps and connector covers.
- B. Many electronic line replaceable units (LRUs) contain micro-circuits and other sensitive devices which can be damaged internally by electrostatic discharges. These LRUs are identified as ESDS. The placards installed on the ESDS LRUs show that you must be careful. The persons who remove, install, and move the ESDS LRUs must know about static electricity and how to protect ESDS LRUs from static discharges.
- C. Electrostatic charges can be caused by these: human bodies, hair, clothing, floors, equipment racks, and equipment units. An electrostatic discharge is electrostatic energy transmitted between substances of different electrical potentials. Electrostatic discharges from nylon clothing or human hair onto polyethylene or steel can damage ESDS components. Damage to the internal components of an ESDS LRU can cause failure with one static discharge. System properties can change with time because of many static discharges.
- D. The function of this procedure is to show the maintenance persons how to handle the ESDS LRUs. This procedure contains the precautions that are necessary to safely touch the units that are identified by the ESDS placard. Three types of decals are used to identify the units with ESDS sensitive circuits. The military and commercial symbols are used on some units, while the international (JEDEC) symbol is used on most ESDS placards (Figure 201, Figure 202, Figure 203, Figure 204). The ESDS printed circuit boards that are LRU's are identified with a "STATIC SENSITIVE" placard (Figure 201, Figure 202, Figure 203, Figure 204).
- E. The placards on the outer area of the cardfiles show the cards that contain electrostatic sensitive devices.

TASK 20-41-01-000-801

2. ESDS Handling for Printed Circuit Board Removal

(Figure 201, Figure 202, Figure 203, Figure 204)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203

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(Continued)

Reference	Description
COM-1566	Bags - Conductive, Static Shielding Part #: 13020 Supplier: 63070 Part #: 13670 Supplier: 62576 Part #: SCS 2121211 Supplier: 6Y703 Opt Part #: 2120R Supplier: 55203
COM-1567	Container - Conductive, Antistatic Part #: PCC-700-ADE Supplier: 62049 Opt Part #: 2217-12 Supplier: 9A807
COM-1793	Multimeter - Digital/Analog (or equivalent meter meets task requirements) Part #: 117 Supplier: 89536 Part #: 260-8XPI Supplier: 55026 Part #: 287 Supplier: 89536 Part #: 289 Supplier: 89536 Part #: 87V Supplier: 89536 Part #: FLUKE 27 II Supplier: 89536 Part #: FLUKE-77-4 Supplier: 89536 Opt Part #: 187 Supplier: 89536 Opt Part #: 189 Supplier: 89536 Opt Part #: 260 Supplier: 55026 Opt Part #: 27 Supplier: 89536 Opt Part #: 77 SERIES III Supplier: 89536 Opt Part #: 87 Supplier: 89536 Opt Part #: FLUKE 27 Supplier: 89536 Opt Part #: MODEL 27 Supplier: 89536

B. Handling Procedure

SUBTASK 20-41-01-860-009

- (1) Make sure you remove electrical power from the printed circuit board.

SUBTASK 20-41-01-750-001



USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

- (2) Do these steps to do a resistance test of the static control wrist strap, COM-1565:
 - (a) Use a digital/analog multimeter, COM-1793, to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.



THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS PRINTED CIRCUIT BOARDS.

- (b) Put the static control wrist strap, COM-1565, on the wrist of the person that will remove the printed circuit board.
- (c) Use a digital/analog multimeter, COM-1793, to make sure the resistance is less than 10 megohms.

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SUBTASK 20-41-01-480-001

- (3) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-41-01-020-002

- (4) Remove the printed circuit board with the applicable removal task.

SUBTASK 20-41-01-860-001

- (5) Put the printed circuit board in a static shielding bag, COM-1566, or antistatic conductive container, COM-1567, with an ESDS placard.

SUBTASK 20-41-01-860-002



CAUTION

DO NOT USE STAPLES OR ADHESIVE TAPES TO CLOSE THE BAG OR CONTAINER. FAILURE TO CLOSE CORRECTLY CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT BOARD.

- (6) Use 100% cotton twine to close the antistatic conductive container, COM-1567.

NOTE: The static shielding bag, COM-1566, or antistatic conductive container, COM-1567, must be put in a rigid container to make sure it stays in a satisfactory condition.

SUBTASK 20-41-01-860-003

- (7) Do not remove the static control wrist strap, COM-1565, until you close the applicable access door.

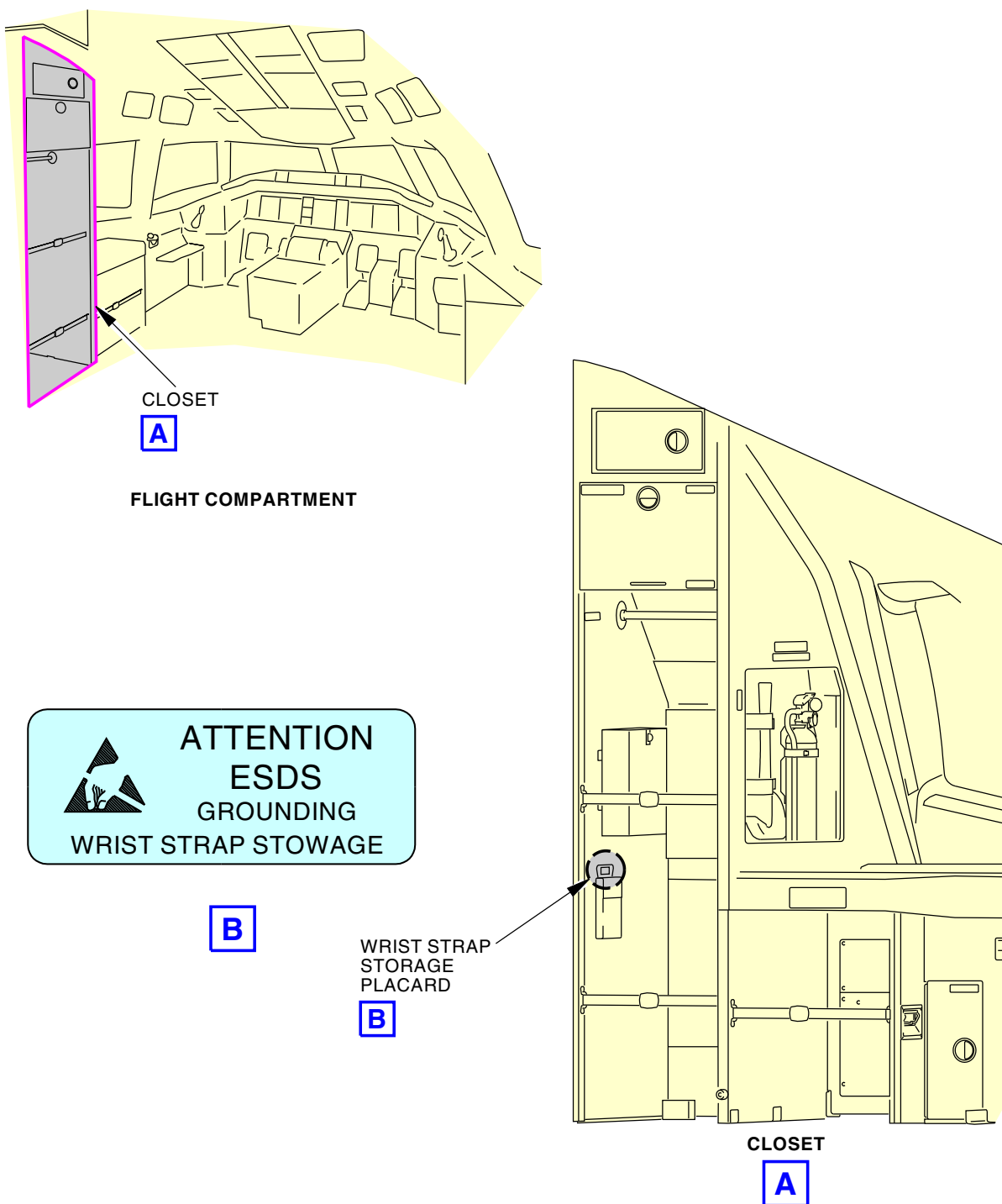
————— **END OF TASK** —————

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ESDS Devices Placards
Figure 201/20-41-01-990-801

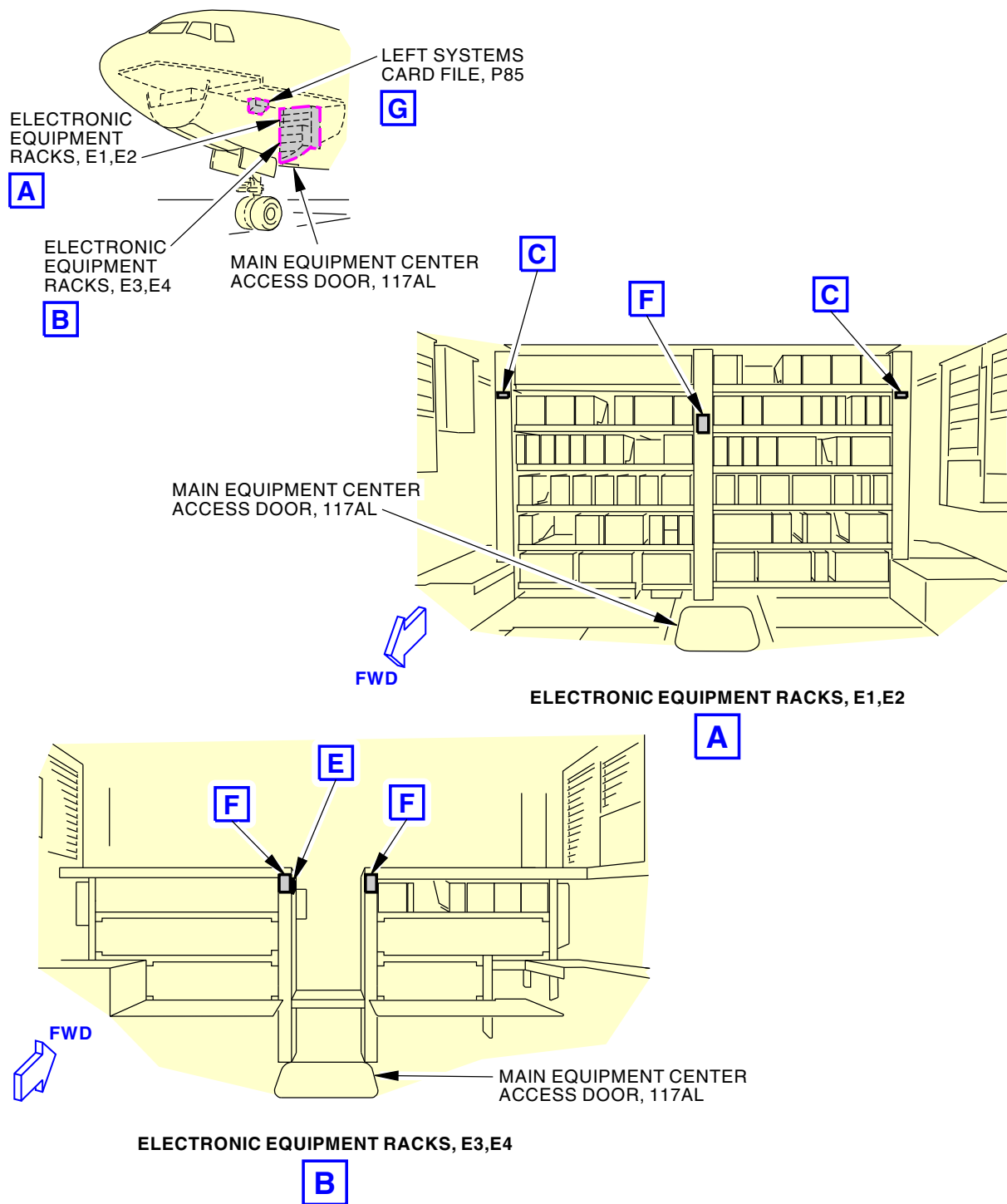
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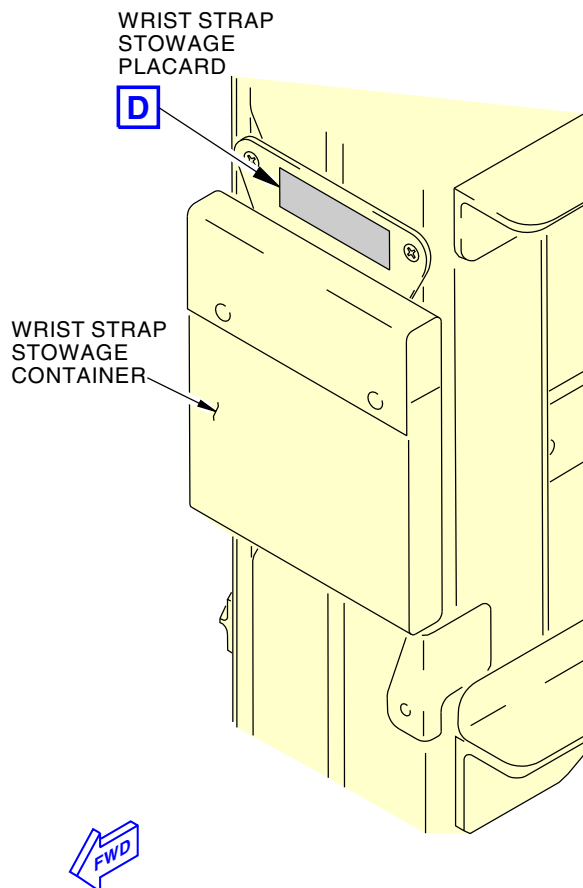
**ESDS Devices Placards
Figure 202/20-41-01-990-805 (Sheet 1 of 3)**

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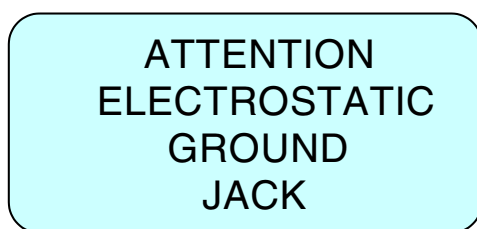
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E

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ESDS Devices Placards
Figure 202/20-41-01-990-805 (Sheet 2 of 3)

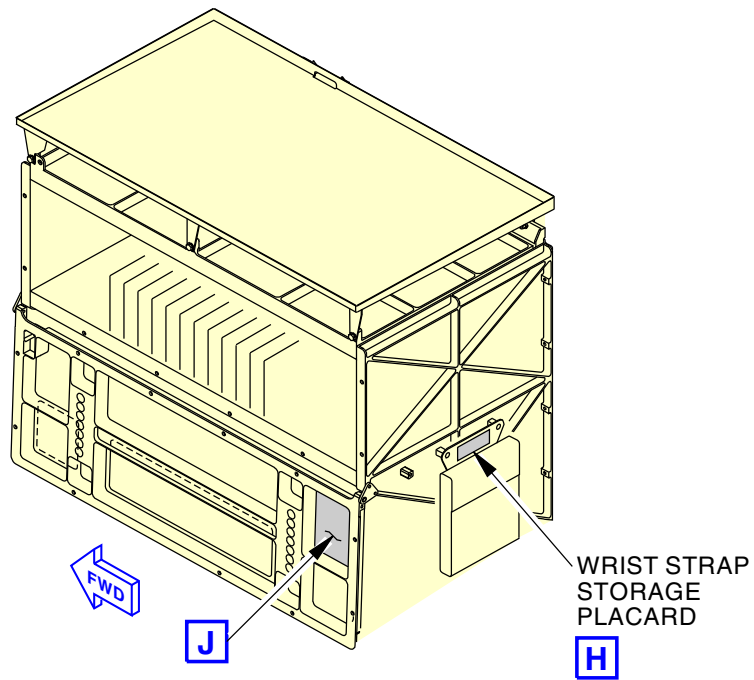
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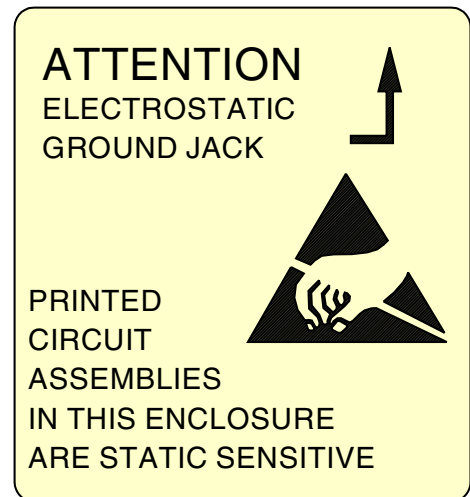


LEFT SYSTEMS CARD FILE, P85
(RIGHT SYSTEMS CARD FILE, P84, IS OPPOSITE)

G



H



J

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ESDS Devices Placards
Figure 202/20-41-01-990-805 (Sheet 3 of 3)

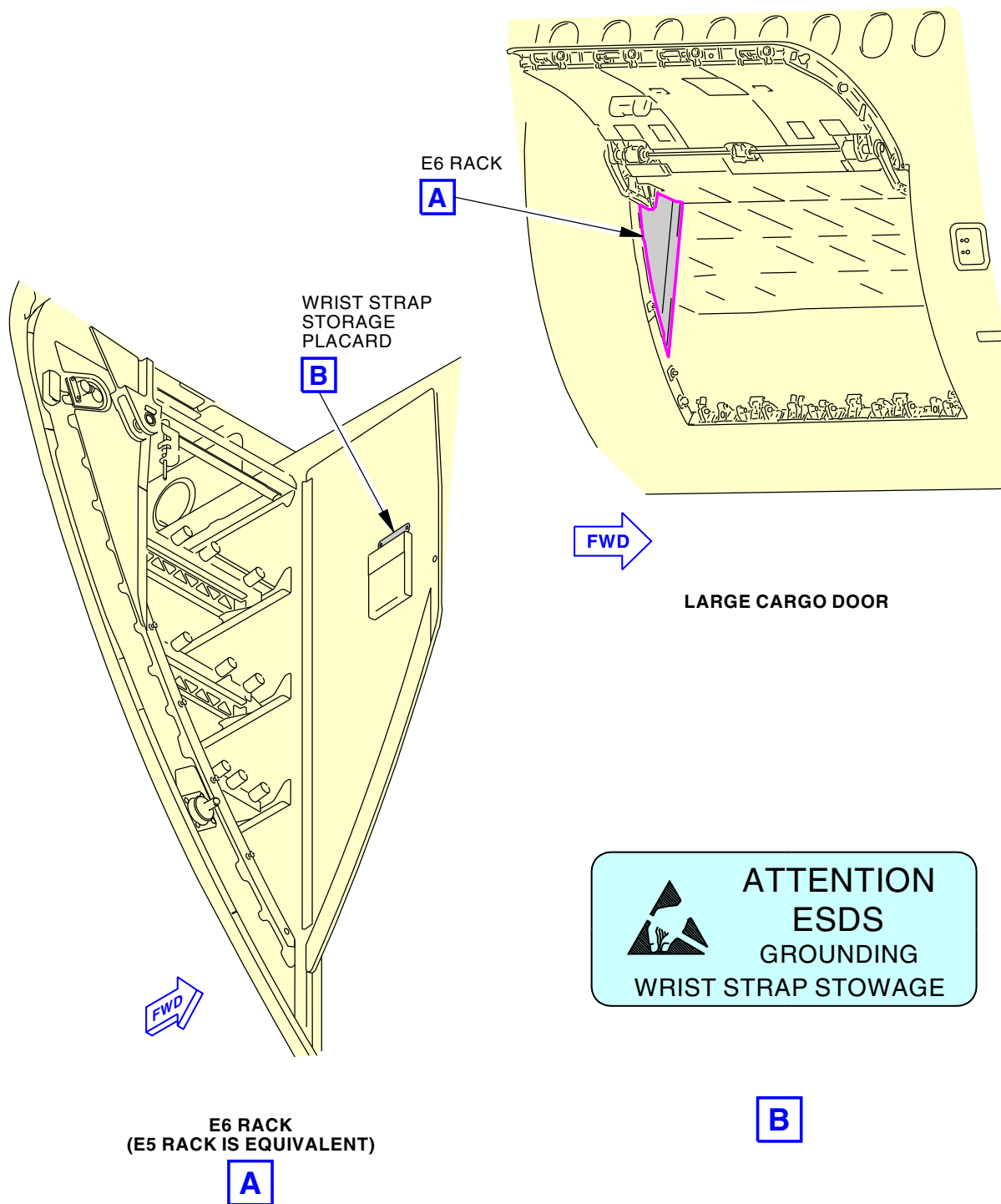
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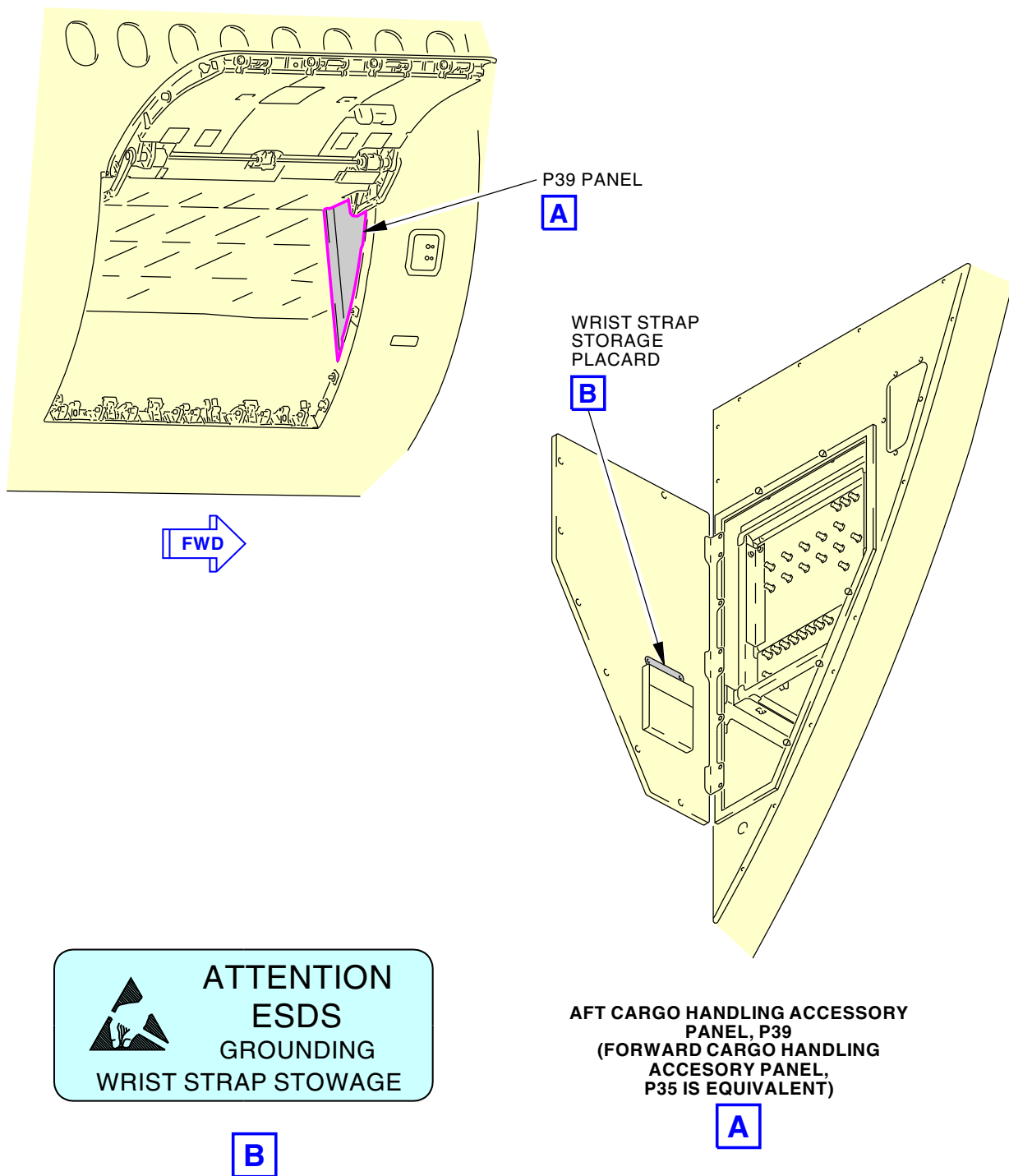
ESDS Devices Placards
Figure 203/20-41-01-990-806 (Sheet 1 of 2)

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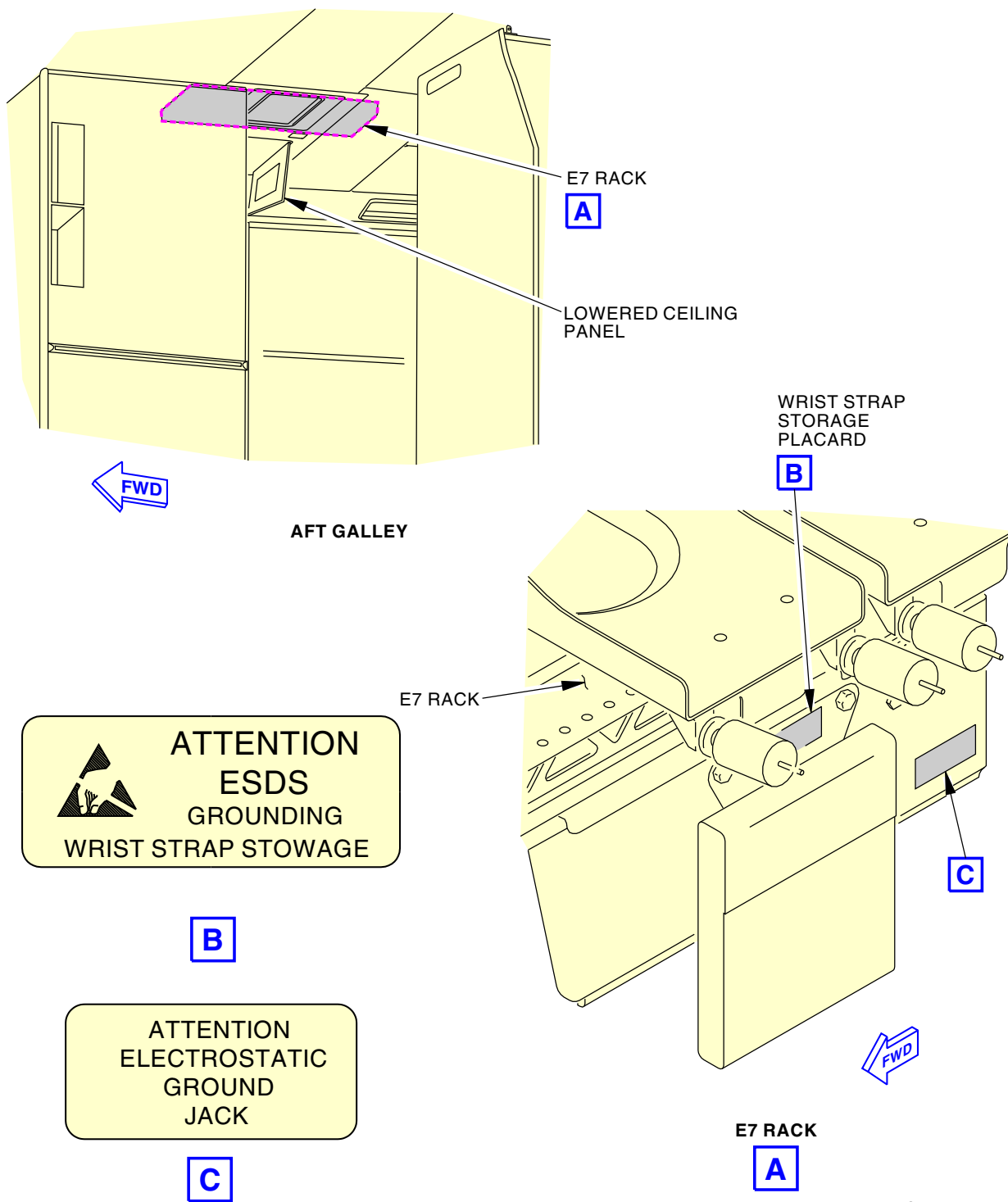
**ESDS Devices Placards
Figure 203/20-41-01-990-806 (Sheet 2 of 2)**

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**ESDS Devices Placards
Figure 204/20-41-01-990-802**

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TASK 20-41-01-400-801

3. ESDS Handling for Printed Circuit Board Installation

(Figure 201, Figure 202, Figure 203, Figure 204)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203
COM-1566	Bags - Conductive, Static Shielding Part #: 13020 Supplier: 63070 Part #: 13670 Supplier: 62576 Part #: SCS 2121211 Supplier: 6Y703 Opt Part #: 2120R Supplier: 55203
COM-1567	Container - Conductive, Antistatic Part #: PCC-700-ADE Supplier: 62049 Opt Part #: 2217-12 Supplier: 9A807
COM-1793	Multimeter - Digital/Analog (or equivalent meter meets task requirements) Part #: 117 Supplier: 89536 Part #: 260-8XPI Supplier: 55026 Part #: 287 Supplier: 89536 Part #: 289 Supplier: 89536 Part #: 87V Supplier: 89536 Part #: FLUKE 27 II Supplier: 89536 Part #: FLUKE-77-4 Supplier: 89536 Opt Part #: 187 Supplier: 89536 Opt Part #: 189 Supplier: 89536 Opt Part #: 260 Supplier: 55026 Opt Part #: 27 Supplier: 89536 Opt Part #: 77 SERIES III Supplier: 89536 Opt Part #: 87 Supplier: 89536 Opt Part #: FLUKE 27 Supplier: 89536 Opt Part #: MODEL 27 Supplier: 89536

B. Handling Procedure

SUBTASK 20-41-01-860-004

- (1) Make sure electrical power is removed from the printed circuit board.

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SUBTASK 20-41-01-750-002



WARNING

USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

- (2) Do these steps to do a resistance test of the static control wrist strap, COM-1565:
 - (a) Use a digital/analog multimeter, COM-1793, to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.



CAUTION

THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS PRINTED CIRCUIT BOARDS.

- (b) Put the static control wrist strap, COM-1565, on the wrist of the person that will install the printed circuit board.
- (c) Use a digital/analog multimeter, COM-1793, to make sure the resistance is less than 10 megohms.

SUBTASK 20-41-01-480-002

- (3) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-41-01-860-005

- (4) Remove the ESDS printed circuit board from the static shielding bag, COM-1566, or antistatic conductive container, COM-1567.

SUBTASK 20-41-01-860-006

- (5) Install the printed circuit board with the applicable installation procedure.

SUBTASK 20-41-01-860-007

- (6) Do not remove the static control wrist strap, COM-1565, until you close the applicable access door.

————— END OF TASK —————

TASK 20-41-01-000-803

4. ESDS Handling for Metal Encased Unit Removal

(Figure 201, Figure 202, Figure 203, Figure 204)

A. General

- (1) This task provides instructions to touch an ESDS metal encased unit during removal.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203
COM-1567	Container - Conductive, Antistatic Part #: PCC-700-ADE Supplier: 62049 Opt Part #: 2217-12 Supplier: 9A807
COM-1793	Multimeter - Digital/Analog (or equivalent meter meets task requirements) Part #: 117 Supplier: 89536 Part #: 260-8XPI Supplier: 55026 Part #: 287 Supplier: 89536 Part #: 289 Supplier: 89536 Part #: 87V Supplier: 89536 Part #: FLUKE 27 II Supplier: 89536 Part #: FLUKE-77-4 Supplier: 89536 Opt Part #: 187 Supplier: 89536 Opt Part #: 189 Supplier: 89536 Opt Part #: 260 Supplier: 55026 Opt Part #: 27 Supplier: 89536 Opt Part #: 77 SERIES III Supplier: 89536 Opt Part #: 87 Supplier: 89536 Opt Part #: FLUKE 27 Supplier: 89536 Opt Part #: MODEL 27 Supplier: 89536

C. ESDS Metal Encased Units Removal

SUBTASK 20-41-01-860-010

- (1) Make sure you remove electrical power from the metal encased unit.

SUBTASK 20-41-01-750-003



USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

- (2) Do these steps to do a resistance test of the static control wrist strap, COM-1565:
 - (a) Use a digital/analog multimeter, COM-1793 to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.



THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS METAL ENCASED UNIT.

- (b) Put the static control wrist strap, COM-1565, on the wrist of the person that will remove the metal encased unit.
- (c) Use a digital/analog multimeter, COM-1793 to make sure the resistance is less than 10 megohms.

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SUBTASK 20-41-01-480-003

- (3) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-41-01-860-011

- (4) Remove the ESDS unit with the applicable removal task.

SUBTASK 20-41-01-420-002

- (5) Do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-41-01-000-802.

SUBTASK 20-41-01-860-012

- (6) Put the ESDS unit in the antistatic conductive container, COM-1567.

SUBTASK 20-41-01-860-013



DO NOT USE STAPLES OR ADHESIVE TAPES TO CLOSE THE CONTAINER. FAILURE TO CLOSE CORRECTLY CAN CAUSE DAMAGE TO THE ESDS METAL ENCASED UNIT.

- (7) Use 100% cotton twine to close the antistatic conductive container, COM-1567.

SUBTASK 20-41-01-860-014

- (8) Remove the static control wrist strap, COM-1565.

————— **END OF TASK** —————

TASK 20-41-01-400-803

5. **ESDS Handling for Metal Encased Unit Installation**

(Figure 201, Figure 202, Figure 203, Figure 204)

A. General

- (1) This task provides instructions to touch an ESDS metal encased unit during installation.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203
COM-1567	Container - Conductive, Antistatic Part #: PCC-700-ADE Supplier: 62049 Opt Part #: 2217-12 Supplier: 9A807

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(Continued)

Reference	Description
COM-1793	Multimeter - Digital/Analog (or equivalent meter meets task requirements) Part #: 117 Supplier: 89536 Part #: 260-8XPI Supplier: 55026 Part #: 287 Supplier: 89536 Part #: 289 Supplier: 89536 Part #: 87V Supplier: 89536 Part #: FLUKE 27 II Supplier: 89536 Part #: FLUKE-77-4 Supplier: 89536 Opt Part #: 187 Supplier: 89536 Opt Part #: 189 Supplier: 89536 Opt Part #: 260 Supplier: 55026 Opt Part #: 27 Supplier: 89536 Opt Part #: 77 SERIES III Supplier: 89536 Opt Part #: 87 Supplier: 89536 Opt Part #: FLUKE 27 Supplier: 89536 Opt Part #: MODEL 27 Supplier: 89536

C. ESDS Metal Encased Unit Installation

SUBTASK 20-41-01-860-015

- (1) Make sure electrical power is removed from the metal encased unit.

SUBTASK 20-41-01-750-004



USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

- (2) Do these steps to do a resistance test of the static control wrist strap, COM-1565:
 - (a) Use a digital/analog multimeter, COM-1793 to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.



THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS METAL ENCASED UNIT.

- (b) Put the static control wrist strap, COM-1565, on the wrist of the person that will install the metal encased unit.
 - (c) Use a digital/analog multimeter, COM-1793, to make sure the resistance is less than 10 megohms.

SUBTASK 20-41-01-480-004

- (3) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-41-01-860-016

- (4) Remove the ESDS unit from the antistatic conductive container, COM-1567.

SUBTASK 20-41-01-430-002

- (5) Do this task: Conductive Dust Cap and Connector Cover Removal, TASK 20-41-01-400-802.

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SUBTASK 20-41-01-860-017

- (6) Install the ESDS unit with the applicable installation task.

SUBTASK 20-41-01-860-018

- (7) Remove the static control wrist strap, COM-1565.

————— END OF TASK —————

TASK 20-41-01-400-802

6. Conductive Dust Cap and Connector Cover Removal

(Figure 201, Figure 202, Figure 203, Figure 204)

A. Conductive Dust Cap and Connector Cover Removal

SUBTASK 20-41-01-200-001

- (1) Examine the cap seals on all fiber optic connectors.
 - (a) If the dust cap seal is broken, refer to SWPM 20-12-11.

SUBTASK 20-41-01-430-001



DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE UNIT. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE UNIT.

- (2) Remove all of the conductive dust caps and the connector covers from the unit to be installed.

SUBTASK 20-41-01-420-001



DO NOT LOOK INTO FIBER OPTIC CONNECTORS UNLESS THE CABLE IS DISCONNECTED AT BOTH ENDS OR THE POWER IS REMOVED FROM THE LRU. THE LIGHT TRANSMITTED OVER THE FIBER OPTIC LAN IS INVISIBLE AND CAN BE INTENSE ENOUGH TO CAUSE DAMAGE TO YOUR EYES.

- (3) Install the ESDS unit with the applicable installation task.

————— END OF TASK —————

TASK 20-41-01-000-802

7. Conductive Dust Cap and Connector Cover Installation

(Figure 201, Figure 202, Figure 203, Figure 204)

A. General



DO NOT LOOK INTO FIBER OPTIC CONNECTIONS UNLESS THE CABLE IS DISCONNECTED AT BOTH ENDS OR POWER IS REMOVED FROM THE LRU. THE LIGHT TRANSMITTED OVER THE FIBER OPTIC LAN IS INVISIBLE AND CAN BE INTENSE ENOUGH TO CAUSE DAMAGE TO YOUR EYES.

- (1) Conductive dust caps and connector covers must be installed on the connectors of ESDS units and fiber optic connections when the units are removed.
- (2) Use ITT Cannon dust caps and connector covers as applicable (stamped "CONDUCTIVE") (Table 201).

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Table 201/20-41-01-993-803

ITT CANON		
PART NUMBER	MARKING ON CAP	CONNECTOR
025-1155-001	BKAD1-A&B-R	BKAD1-A-R BKAD1-B-R
025-1156-001 025-1157-001	BKAD1-C-R BKAD2&3-A&B-R	BKAD2-A-R BKAD2-B-R BKAD3-A-R BKAD3-B-R
025-1158-001	BKAD2&3-C-R	BKAD2-C-R BKAD3-C-R

(3) Use Souriau dust caps and connectors as applicable (Table 202).

Table 202/20-41-01-993-804

SOURIAU		
PART NUMBER	TYPE CONNECTOR	SHELL SIZE
8660-1404	Power	1
8660-1405	Signal	1
8660-1406	Power	2 & 3
8660-1407	Signal	2 & 3

B. Conductive Dust Cap and Connector Cover Installation

SUBTASK 20-41-01-020-001

 CAUTION	DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE UNIT. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE UNIT.

(1) Remove the ESDS unit as shown in the applicable removal procedure.

NOTE: Make sure a static sensitive placard is installed adjacent to the electrical connector(s).

SUBTASK 20-41-01-030-001

(2) Install conductive dust covers on the connectors with a static sensitive placard and standard dust covers on fiber optic connections and on the connectors that do not have the placard.

NOTE: The conductive dust caps and the connector covers are black in color. The conductive dust caps and the connector covers from the installed unit can be used on the removed unit.

NOTE: Use masking tape to seal the dust caps to the fiber optic connectors.

SUBTASK 20-41-01-860-008

(3) Move the unit, as shown in the applicable procedure, with the conductive dust caps and connector covers installed.

————— **END OF TASK** —————

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ELECTROSTATIC DISCHARGE SENSITIVE DEVICES - INSPECTION/CHECK

1. General

- A. This procedure has this task:
(1) A check of ESDS wrist straps

TASK 20-41-01-200-801

2. ESDS Wrist Strap Check

(Figure 601)

A. **Tools/Equipment**

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control Part #: 09070 Supplier: 62576 Part #: 14810 Supplier: 62576 Part #: 2214 Supplier: 55203 Opt Part #: 2211 Supplier: 55203 Opt Part #: 2212 Supplier: 55203 Opt Part #: 2213 Supplier: 55203

B. **ESDS Wrist Strap Check**

NOTE: Refer to (Figure 601) for ESDS wrist strap locations.

SUBTASK 20-41-01-210-001

- (1) Do a check for one each static control wrist strap, COM-1565 or static control wrist strap, COM-1565 in the pouch at the locations shown in the table.
(a) If the wrist strap is not in the pouch, install one static control wrist strap, COM-1565 wrist strap in the pouch.

Table 601/20-41-01-993-805

	LOCATION	ESDS WRIST STRAP
Crew Closet	Flight Deck	1 each
P84	E/E Equip Compartment	1 each
P85	E/E Equip Compartment	1 each
E1 Rack	E/E Equip Compartment	1 each
E2 Rack	E/E Equip Compartment	1 each
E5 Rack	Forward Cargo Door (FWD)	1 each
E6 Rack	Aft Cargo Door (FWD)	1 each
E7 Rack	Overhead Pass Compt (DR 4R)	1 each
E16 Rack	Forward Cargo Door (AFT)	1 each
E17 Rack	Aft Cargo Door (AFT)	1 each

————— **END OF TASK** —————

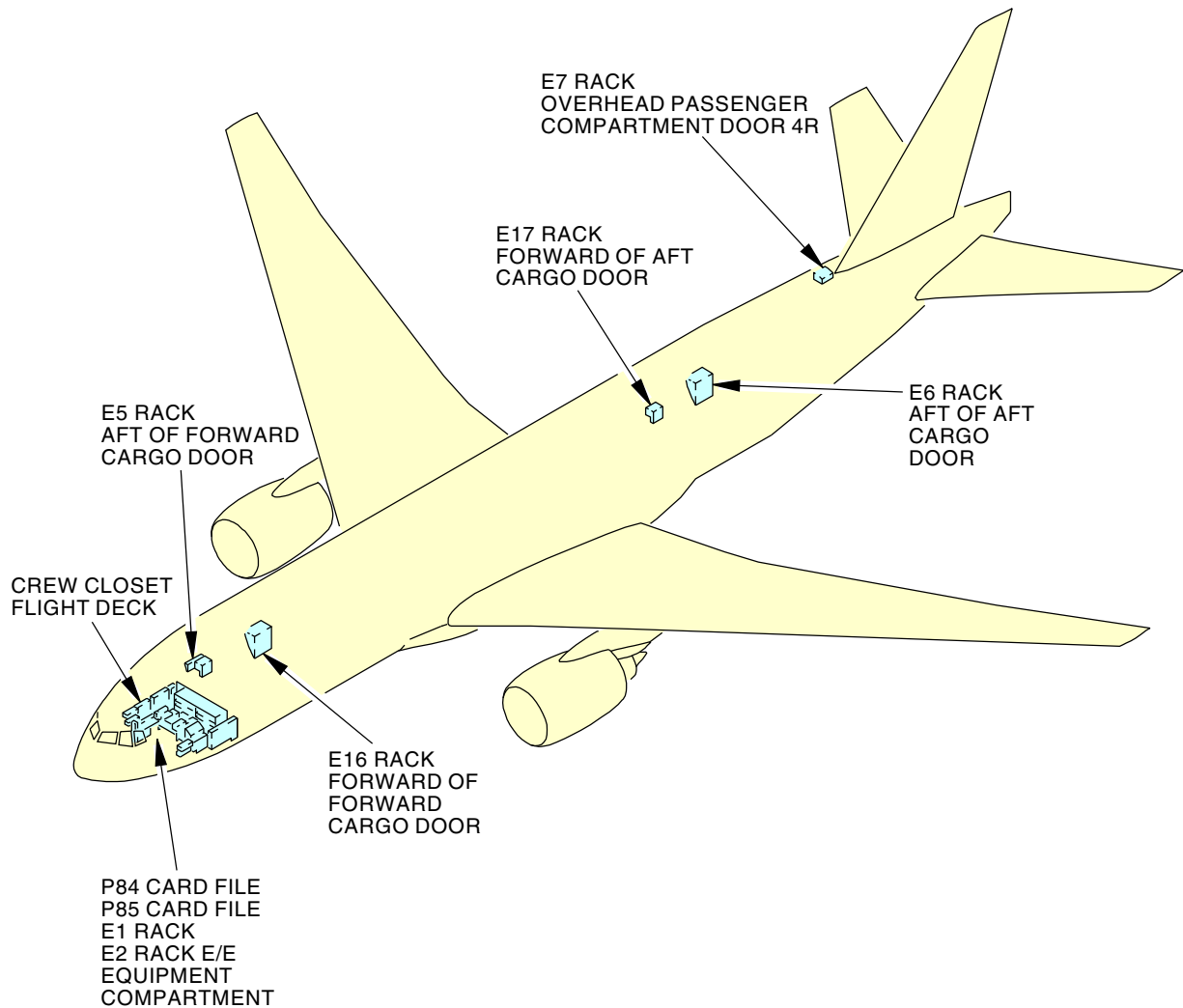
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**ESDS Wrist Strap Locations
Figure 601/20-41-01-990-807**

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CIRCUIT BREAKER RESET - MAINTENANCE PRACTICES

1. General

- A. This procedure has one task:
- (1) Circuit Breaker Reset.

TASK 20-60-01-860-801

2. Circuit Breaker Reset

A. General

- (1) This procedure is for on-the-ground maintenance.
 - (a) Circuit breakers open when there is an electrical overload in the airplane system. A circuit breaker that opens because of an electrical overload is known as a "tripped" circuit breaker.
 - (b) You must use the Fault Isolation Manual (FIM) for troubleshooting open fuel pump circuit breakers.
 - 1) You can not use this procedure to reset a tripped fuel pump circuit breaker.
- NOTE: Reset of the fuel pump circuit breakers is a Critical Design Configuration Control Limitation (CDCCL) item.
- (c) If there are currently specific instructions for the reset of a tripped circuit breaker in maintenance and troubleshooting procedures, follow those instructions.
 - (d) A defective circuit breaker can cause the circuit breaker to open. Make sure that the circuit breaker is serviceable.
 - (e) Use your judgement and airline policy to reset a tripped circuit breaker.
 - (f) Monitor the airplane to see if a tripped circuit breaker occurs again on subsequent flights.
 - (g) Do not reset a tripped circuit breaker until you know the cause for the tripped circuit breaker and that the circuit breaker can be safely reset. Fires have occurred in which the tripped circuit breakers were reset without an examination of the cause.
 - (h) Use this procedure to reset a tripped circuit breaker:
 - 1) If you know that the circuit breaker is serviceable.
 - 2) If this procedure is in agreement with your airline policy.
 - 3) If you cannot determine the cause for the tripped circuit breaker.
 - 4) If you cannot determine whether it is safe to reset the circuit breaker.

B. Location Zones

Zone	Area
100	Lower Half of Fuselage
200	Upper Half of Fuselage

C. Procedure

SUBTASK 20-60-01-860-001

- (1) Attach a DO-NOT-CLOSE tag to the tripped circuit breaker.

SUBTASK 20-60-01-860-002

- (2) Install a circuit breaker lock on the tripped circuit breaker.

SUBTASK 20-60-01-860-003

- (3) If the tripped circuit breaker is one of three circuit breakers protecting a 3-phase circuit:

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- (a) Open the other two circuit breakers.
- (b) Attach DO-NOT-CLOSE tags.
- (c) Install circuit breaker locks.

SUBTASK 20-60-01-860-004

- (4) Look in the aircraft logbook to find if there is recorded data about a "tripped" circuit breaker, such as:
 - (a) The condition existing when the circuit breaker trip occurred.
 - (b) The conditions existing when the circuit breaker was reset.
 - (c) The results of resetting the circuit breaker.

SUBTASK 20-60-01-860-005

- (5) Do a visual check for damage to electrical wiring and system components related to the tripped circuit breaker. If necessary, refer to the Wiring Diagram Manual (WDM). Look for these types of damage:
 - (a) Electrical shorting
 - (b) Electrical arcing
 - (c) Corrosion on the contacts of the electrical wiring and system components
 - (d) Abrasion of the electrical wiring and system components
 - (e) Cracks on the insulation of the electrical wiring
 - (f) Split wires

NOTE: A split wire is when you can see the conductor through the crack in the insulation of the electrical wiring.

 - (g) Broken wires
 - (h) Discoloration of the insulation of the electrical wiring
 - (i) Fluid or dust contamination of electrical wiring and system components

NOTE: Contamination can be a fuel source during electrical arcing.

 - (j) Metal shavings

NOTE: Metal shavings can cause electrical shorting.

SUBTASK 20-60-01-860-006

- (6) Make sure that there are no loose terminal connections.
- NOTE: Loose terminal connections can be a source of electrical arcing.

SUBTASK 20-60-01-860-007

- (7) If you find damage to the electrical wiring, refer to the Standard Wiring Practices Manual (SWPM) and repair the electrical wiring.

SUBTASK 20-60-01-860-008

- (8) If you find damage to a system component, refer to the applicable Aircraft Maintenance Manual (AMM) procedure and replace the component.

SUBTASK 20-60-01-860-009

- (9) Remove contamination and metal shavings if necessary.

SUBTASK 20-60-01-860-010

- (10) Remove the DO-NOT-CLOSE tag(s).

SUBTASK 20-60-01-860-011

- (11) Remove the circuit breaker lock(s).

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SUBTASK 20-60-01-860-012



BEFORE YOU CLOSE A FUEL PUMP CIRCUIT BREAKER THAT OPENED DURING PUMP OPERATION, DO THE APPLICABLE FIM PROCEDURE. A DAMAGED PUMP, OR A PROBLEM WITH THE PUMP WIRING CAN CAUSE THE CIRCUIT BREAKER TO OPEN. THIS CONDITION CAN CAUSE A FIRE, OR AN EXPLOSION.



MAKE SURE THAT THERE IS NO DAMAGE TO THE ELECTRICAL WIRING OR SYSTEM COMPONENTS RELATED TO THE OPEN CIRCUIT BREAKER. WHEN THE CIRCUIT BREAKER IS CLOSED, DAMAGED ELECTRICAL WIRING, COMPONENTS OR LOOSE TERMINALS CAN CAUSE SPARKS OR FIRES.



DO NOT RESET (CLOSE) A FUEL PUMP CIRCUIT BREAKER THAT HAS OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. REFER TO FIM 28-22-00/201. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

- (12) Close the circuit breaker(s).

NOTE: Reset of the fuel pump circuit breakers is a Critical Design Configuration Control Limitation (CDCCL) item.

SUBTASK 20-60-01-860-013

- (13) After you close the circuit breaker(s), make sure that there is no electrical arcing or other damage to the system.

SUBTASK 20-60-01-860-014

- (14) To make sure that the airplane system operates correctly, refer to the applicable procedure in the Aircraft Maintenance Manual (AMM).

————— **END OF TASK** —————

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CLEANING TO REMOVE COMBUSTIBLE MATERIAL (EZAP) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains scheduled maintenance task data.



EWIS

TASK 20-60-02-100-801

2. Cleaning to Remove Combustible Material

NOTE: This procedure is a scheduled maintenance task.

A. General

- (1) This procedure is an enhanced zonal analysis procedure (EZAP) task.
- (2) This procedure cleans the area(s) and/or items(s) to significantly reduce the accumulation of combustible material.

B. Definition:

- (1) A combustible material is any solid, liquid, or gaseous material that has the ability to cause a fire to be sustained after removal of the ignition source. Refer to Advisory Circular AC 25-27 for additional information regarding combustible materials and wiring contamination.

C. References

Reference	Title
20-41-00-910-801	Static Grounding (P/B 201)
20-60-07-913-801	Protection of the EWIS During Maintenance (P/B 201)
51-00	STRUCTURES
SWPM 20-10-04	Cleaning of Wire Harnesses

D. Tools/Equipment

Reference	Description
STD-123	Brush - Soft Bristle
STD-10711	Shop Vacuum (400Hz if using aircraft power)

E. Procedure

SUBTASK 20-60-02-010-001

- (1) Do this task: Static Grounding, TASK 20-41-00-910-801.



WARNING

EXERCISE EXTREME CAUTION WHEN WORKING AROUND ENERGIZED PANELS. HIGH VOLTAGES PRESENT CAN BE FATAL.

- (2) If it is necessary to touch the EWIS, it is recommended to remove electrical power in the area(s) or from the item(s) to be cleaned:

NOTE: You can remove all electrical power from the airplane if the removal from one or more systems is not possible.

- (a) Identify the applicable electrical system(s) in the area(s) and/or from the item(s) to be cleaned.
- (b) Open circuit breakers and switches for the applicable area(s) and/or from the item(s) to be cleaned.
- (c) Put a collar/warning tag on the applicable circuit breaker(s), and warning tag on the applicable switch(s) for the area(s) and/or from the item(s) to be cleaned.

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- (3) Remove panels as necessary to gain access to the area(s)/item(s).

SUBTASK 20-60-02-100-001

- (4) Do these steps to clean the area(s)/item(s):

NOTE: This procedure cleans the area(s)/item(s) where significant combustible material accumulates.

- (a) Do this task: Protection of the EWIS During Maintenance, TASK 20-60-07-913-801.



CAUTION

DO NOT CUT, CAUSE NICKS, OR CAUSE OTHER DAMAGE TO THE CABLES, WIRES, METAL-BRAIDED SHIELD, OR OVERBRAID. DAMAGE TO THESE COMPONENTS CAN CAUSE MALFUNCTIONS, OR DAMAGE TO OTHER EQUIPMENT.

- (b) Remove loose contamination by hand.
- (c) Use a vacuum, STD-10711 with a soft bristle brush head to remove accumulations of combustible materials.
- NOTE: The vacuum cleaner head should be made of plastic or non-conductive material.
- (d) Use a soft bristle brush, STD-123 to loosen accumulations of combustible materials that remain and vacuum the area(s)/item(s) again.
- (e) For contamination in the area(s) that can not be removed with a brush and vacuum, do the applicable procedure(s): STRUCTURES, SECTION 51-00.
- (f) For contamination on wiring harnesses that you can not remove with a brush and vacuum, do this procedure: SWPM 20-10-04.

SUBTASK 20-60-02-410-001



CAUTION

MAKE SURE THAT YOU REMOVE ALL TOOLS, LOOSE PARTS AND UNWANTED MATERIAL FROM THE AREA WHEN YOU COMPLETE MAINTENANCE. DAMAGE TO EQUIPMENT COULD OCCUR.

- (5) Install all panels removed for access.
- (6) Restore electrical power in the area(s) and/or from the item(s) that had the electrical power removed.
- (a) Remove the collar/warning tag on the applicable circuit breaker(s), and warning tag on the applicable switch(s) for the area(s) and/or from the item(s) that had the electrical power removed.

———— **END OF TASK** ————

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DETAILED INSPECTION OF EWIS (EZAP) - MAINTENANCE PRACTICES

1. General

A. This procedure contains scheduled maintenance task data.

 **SFAR 88**

 **EWIS**

TASK 20-60-03-100-801

2. Detailed Inspection of EWIS

NOTE: This procedure is a scheduled maintenance task.

A. General

- (1) This procedure is an Enhanced Zonal Analysis Procedure (EZAP) task.
- (2) This procedure performs a detailed inspection of Electrical Wiring Interconnection System (EWIS).

B. Definitions:

- (1) Electrical Wiring Interconnection System (EWIS): means any wire, power feeder, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy, including data and signals, between two or more intended termination points. EWIS is defined in full by 14 CFR section 25.1701.
- (2) Detailed Inspection (DET)—An intensive examination of a specific item, installation, or assembly to detect damage, failure, or irregularity. Available lighting is normally supplemented with a direct source of good lighting at an intensity deemed appropriate. Inspection aids such as mirrors, magnifying lenses, or other means may be necessary. Surface cleaning and elaborate access procedures may be required. A DET can be more than just a visual inspection, since it may include tactile assessment in which a component or assembly is checked for tightness/security. It may require the removal of items such as access panels and drip shields, or the moving of components.

C. References

Reference	Title
20-41-00-910-801	Static Grounding (P/B 201)
20-60-02-100-801	Cleaning to Remove Combustible Material (P/B 201)
20-60-07-913-801	Protection of the EWIS During Maintenance (P/B 201)
SWPM 20, Standard Wiring Practices	Standard Wiring Practices
SWPM 20-10-20	Standard Wiring Practices Manual

D. Procedure

SUBTASK 20-60-03-100-001

- (1) Do this task: Static Grounding, TASK 20-41-00-910-801.

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BE CAREFUL WHEN YOU DO WORK AROUND ENERGIZED PANELS. HIGH VOLTAGES CAN KILL YOU.

- (2) If it is necessary to touch the EWIS, it is recommended to remove electrical power from the EWIS to be inspected:

NOTE: You can remove all electrical power from the airplane if the removal from one or more systems is not possible.

- (a) Identify the applicable electrical system(s) for the EWIS to be inspected.
- (b) Open circuit breakers and switches for the EWIS to be inspected.
- (c) Put a collar/warning tag on the applicable circuit breaker(s), and warning tag on the applicable switch(s) for the EWIS to be inspected.

- (3) Remove panels as necessary to gain access to the EWIS.

- (4) Do these steps to perform a detailed inspection of the EWIS:

NOTE: You do not need to pull on the wire bundles, shake the wire bundles, or disconnect the connectors to perform this inspection.

- (a) Protect all EWIS during the inspection:



KEEP TOOLS, TOOL TRAYS, AND OTHER WORK ITEMS OFF OF THE WIRES. OBJECTS PUT ON THE WIRE BUNDLES OR THEIR RELATED COMPONENTS CAN CAUSE DAMAGE TO THE WIRES, INSULATION, AND CONNECTORS.



DO NOT PUT PRESSURE ON THE WIRE BUNDLES, ELECTRONIC SYSTEMS, OR STRUCTURES IN THE COMPARTMENT. PRESSURE CAN CAUSE DAMAGE TO WIRE BUNDLES AND ELECTRICAL CONNECTIONS.



DO NOT CUT, CAUSE NICKS, OR CAUSE OTHER DAMAGE TO THE CABLES, WIRES, METAL-BRAIDED SHIELD, OR OVERBRAID. DAMAGE TO THESE COMPONENTS CAN CAUSE MALFUNCTIONS, OR DAMAGE TO OTHER EQUIPMENT.

- 1) EWIS that are undisturbed and kept free of contamination will provide trouble-free service without the need for unscheduled maintenance.



DO NOT USE WIRE BUNDLES, TUBING, DUCTS, OR OTHER ENGINE COMPONENTS AS A STEP OR HAND-HOLD. DAMAGE TO EQUIPMENT CAN OCCUR.

- 2) EWIS can be easily damaged during the inspection if they are used as a handhold or support for personal equipment.
- (b) Check the EWIS and the area around them for combustible material such as dust, lint and other surface contamination.
- 1) If combustible material is found, do this task: Cleaning to Remove Combustible Material, TASK 20-60-02-100-801.



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- (c) Check the EWIS for: contact, chafing, sagging, security, visible damage, lacing tape/ties installation, sheath / conduit deformity or installation, end of sheath rubbing on end attachment, missing or damaged grommets, dust and lint accumulation, surface contamination, deterioration of previous repairs.
- (d) Check connectors for: external corrosion, backshell tail, rubber pad/packing on backshell, backshell wire securing device, missing or broken safety wire, discoloration or evidence of overheat on terminal lugs or blocks, torque stripe misalignment.
- (e) Check switches for rear protection cap damage.
- (f) Check ground points for: corrosion, bonding braid/bonding jumper, broken or disconnected braid, multiple strands corroded or broken.
- (g) Check EWIS clamps or brackets for: presence, corrosion, condition, bends or twists, attachment, protection/cushion.
- (h) Check EWIS supports such as rails, racks, shelves, or tubes/conduits for: breaks, deformity, missing fasteners, missing edge protection on rims of feed through holes, race track cushion damage.
- (i) If damage is found on any EWIS, do the following:
 - 1) Do this task: Protection of the EWIS During Maintenance, TASK 20-60-07-913-801
 - 2) Repair or replace per the applicable task: SWPM 20, Standard Wiring Practices.
- (j) If damage is found with the pressure seals, replace the component: SWPM 20-10-20.

SUBTASK 20-60-03-410-001



MAKE SURE THAT YOU REMOVE ALL TOOLS, LOOSE PARTS AND UNWANTED MATERIAL FROM THE AREA WHEN YOU COMPLETE MAINTENANCE. DAMAGE TO EQUIPMENT COULD OCCUR.

- (5) Install all panels removed for access.
- (6) Restore electrical power in the area(s) and/or from the item(s) that had the electrical power removed.
 - (a) Remove the collar/warning tag on the applicable circuit breaker(s), and warning tag on the applicable switch(s) for the area(s) and/or from the item(s) that had the electrical power removed.

————— **END OF TASK** —————

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GENERAL VISUAL INSPECTION OF EWIS (EZAP) - MAINTENANCE PRACTICES

1. General

A. This procedure contains scheduled maintenance task data.

 **SFAR 88**

 **EWIS**

TASK 20-60-04-100-801

2. General Visual Inspection of EWIS

NOTE: This procedure is a scheduled maintenance task.

A. General

- (1) SFAR 88
- (2) This procedure is an Enhanced Zonal Analysis Procedure (EZAP) task.
- (3) This procedure performs a general visual inspection of Electrical Wiring Interconnection System (EWIS).

B. Definitions:

- (1) Electrical Wiring Interconnection System (EWIS): means any wire, power feeder, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy, including data and signals, between two or more intended termination points. EWIS is defined in full by 14 CFR section 25.1701.
- (2) General Visual Inspection (GVI)—A visual examination of an interior or exterior area, installation, or assembly to detect obvious damage, failure, or irregularity. This level of inspection is made from within touching distance unless otherwise specified. A mirror may be necessary to enhance visual access to all exposed surfaces in the inspection area. This level of inspection is made under normally available lighting conditions such as daylight, hangar lighting, flashlight, or droplight and may require removal or opening of access panels or doors. Stands, ladders, or platforms may be required to gain proximity to the area being checked.

C. References

Reference	Title
20-41-00-910-801	Static Grounding (P/B 201)
20-60-02-100-801	Cleaning to Remove Combustible Material (P/B 201)
20-60-07-913-801	Protection of the EWIS During Maintenance (P/B 201)
SWPM 20, Standard Wiring Practices	Standard Wiring Practices
SWPM 20-10-20	Standard Wiring Practices Manual

D. Procedure

SUBTASK 20-60-04-040-001

- (1) Do this task: Static Grounding, TASK 20-41-00-910-801.

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BE CAREFUL WHEN YOU DO WORK AROUND ENERGIZED PANELS. HIGH VOLTAGES CAN KILL YOU.

- (2) If it is necessary to touch the EWIS, it is recommended to remove electrical power from the EWIS to be inspected:

NOTE: You can remove all electrical power from the airplane if the removal from one or more systems is not possible.

- (a) Identify the applicable electrical system(s) for the EWIS to be inspected.
 - (b) Open circuit breakers and switches for the EWIS to be inspected.
 - (c) Put a collar/warning tag on the applicable circuit breaker(s), and warning tag on the applicable switch(s) for the EWIS to be inspected.
- (3) Remove panels as necessary to gain access to the EWIS.
- (4) Do these steps to perform a general inspection of the EWIS:

NOTE: You do not need to pull on the wire bundles, shake the wire bundles, or disconnect the connectors to perform this inspection.

- (a) Protect all EWIS during the inspection:



KEEP TOOLS, TOOL TRAYS, AND OTHER WORK ITEMS OFF OF THE WIRES. OBJECTS PUT ON THE WIRE BUNDLES OR THEIR RELATED COMPONENTS CAN CAUSE DAMAGE TO THE WIRES, INSULATION, AND CONNECTORS.



DO NOT PUT PRESSURE ON THE WIRE BUNDLES, ELECTRONIC SYSTEMS, OR STRUCTURES IN THE COMPARTMENT. PRESSURE CAN CAUSE DAMAGE TO WIRE BUNDLES AND ELECTRICAL CONNECTIONS.



DO NOT CUT, CAUSE NICKS, OR CAUSE OTHER DAMAGE TO THE CABLES, WIRES, METAL-BRAIDED SHIELD, OR OVERBRAID. DAMAGE TO THESE COMPONENTS CAN CAUSE MALFUNCTIONS, OR DAMAGE TO OTHER EQUIPMENT.

- 1) EWIS that are undisturbed and kept free of contamination will provide trouble-free service without the need for unscheduled maintenance.



DO NOT USE WIRE BUNDLES, TUBING, DUCTS, OR OTHER ENGINE COMPONENTS AS A STEP OR HAND-HOLD. DAMAGE TO EQUIPMENT CAN OCCUR.

- 2) EWIS can be easily damaged during the inspection if they are used as a handhold or support for personal equipment.
- (b) Check the EWIS and the area around them for combustible material such as dust, lint and other surface contamination.
- 1) If combustible material is found, do this task: Cleaning to Remove Combustible Material, TASK 20-60-02-100-801.



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- (c) Check the EWIS for: contact, chafing, sagging, security, visible damage, lacing tape/ties installation, sheath / conduit deformity or installation, end of sheath rubbing on end attachment, missing or damaged grommets, dust and lint accumulation, surface contamination, deterioration of previous repairs.
- (d) Check connectors for: external corrosion, backshell tail, rubber pad/packing on backshell, backshell wire securing device, missing or broken safety wire, discoloration or evidence of overheat on terminal lugs or blocks, torque stripe misalignment.
- (e) Check switches for rear protection cap damage.
- (f) Check ground points for: corrosion, bonding braid/bonding jumper, broken or disconnected braid, multiple strands corroded or broken.
- (g) Check EWIS clamps or brackets for: presence, corrosion, condition, bends or twists, attachment, protection/cushion.
- (h) Check EWIS supports such as rails, racks, shelves, or tubes/conduits for: breaks, deformity, missing fasteners, missing edge protection on rims of feed through holes, race track cushion damage.
- (i) If damage is found on any EWIS, do the following:
 - 1) Do this task: Protection of the EWIS During Maintenance, TASK 20-60-07-913-801
 - 2) Repair or replace per the applicable task: SWPM 20, Standard Wiring Practices.
- (j) If damage is found with the pressure seals, replace the component: SWPM 20-10-20.

SUBTASK 20-60-04-410-003



MAKE SURE THAT YOU REMOVE ALL TOOLS, LOOSE PARTS AND UNWANTED MATERIAL FROM THE AREA WHEN YOU COMPLETE MAINTENANCE. DAMAGE TO EQUIPMENT COULD OCCUR.

- (5) Install all panels removed for access.
- (6) Restore electrical power in the area(s) and/or from the item(s) that had the electrical power removed.
 - (a) Remove the collar/warning tag on the applicable circuit breaker(s), and warning tag on the applicable switch(s) for the area(s) and/or from the item(s) that had the electrical power removed.

————— **END OF TASK** —————

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CIRCUIT BREAKER CYCLE - MAINTENANCE PRACTICES

1. General

- A. This procedure has this task:
 - (1) Circuit Breaker Cycle
- B. This procedure is for on-the-ground maintenance.
 - (1) This procedure is for on-the-ground maintenance and is preventative maintenance for those circuit breakers that are less frequently used. It is not necessary to do this procedure for frequently used circuit breakers. Because each airline operates differently, it is an airline decision as to which circuit breakers are frequently used and which circuit breakers are less frequently used.
 - (2) Research has shown that the cycling of less frequently used circuit breakers can help to improve operational system reliability. If a circuit breaker has not been operated for some time, it is possible that the circuit breaker may not open when an electrical fault occurs.
 - (3) Circuit breakers are located in all areas of the airplane such as the flight compartment, electrical equipment bays, cargo compartments, passenger compartment, and other areas.
 - (4) Too much repeated use of a circuit breaker can result in premature failure of the circuit breaker.

TASK 20-60-05-800-801

2. Circuit Breaker Cycle

A. References

Reference	Title
24-22-00-860-806	Remove Electrical Power (P/B 201)

B. Location Zones

Zone	Area
100	Lower Half of Fuselage
200	Upper Half of Fuselage

C. Procedure

SUBTASK 20-60-05-020-001

- (1) Do this task: Remove Electrical Power, TASK 24-22-00-860-806
NOTE: Electrical power must be off so that subsequent incorrect fault indications or nuisance messages are prevented.

SUBTASK 20-60-05-860-001

- (2) Do these steps to cycle a circuit breaker on the airplane.
 - (a) Open the circuit breaker.
 - (b) Do a visual check of the circuit breaker area for damage. Look for these types of damage:
 - 1) Electrical shorting
 - 2) Electrical arcing
 - 3) Discoloration of the circuit breaker
 - 4) Contamination of the circuit breaker
 - (c) If you find damage to the circuit breaker, replace the circuit breaker.
 - (d) Close the circuit breaker.

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- (e) Remove contamination, if necessary.

NOTE: After you open and close the circuit breaker, you can possibly find contamination.

- (f) If you find that the circuit breaker is unserviceable after you open and close it, replace the circuit breaker.

SUBTASK 20-60-05-860-002

- (3) If necessary, do this procedure again to cycle another circuit breaker.

———— **END OF TASK** ————

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ELECTRONIC LRU CLEANING

1. General

- A. This procedure cleans the electronic line replaceable units (LRU) and the area around it where dust can accumulate and obstruct filters and cooling systems.

TASK 20-60-06-100-801

2. Electronic LRU Cleaning

A. Tools/Equipment

Reference	Description
STD-123	Brush - Soft Bristle
STD-10711	Shop Vacuum (400Hz if using aircraft power)

B. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal	

C. Procedure

SUBTASK 20-60-06-010-001

- (1) Remove panels as necessary to gain access to the LRUs and the area around them (ref. AMM & WDM (applicable procedure(s)).

SUBTASK 20-60-06-100-001

- (2) Do the steps that follow to clean the LRUs and the area around them:
- (a) Remove any contamination by hand.
 - (b) Use a vacuum, STD-10711 to remove any loose dirt or debris.
 - (c) Use a soft bristle brush, STD-123 to loosen any dust on or around the LRU and vacuum the area again.
 - (d) Do the following steps to clean the LRU filters if applicable:
 - 1) Replace fiberglass and paper filters if contaminated.
 - 2) Clean metallic screens and filters with Series 80 solvent, B01000 if contaminated.

SUBTASK 20-60-06-410-001

- (3) Install all panels removed for access.

————— **END OF TASK** —————

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PROTECTION OF EWIS (EZAP) - MAINTENANCE PRACTICES

1. General

- A. This procedure has one task.
 - (1) Instructions for protections and caution information that will minimize contamination and accidental damage to EWIS, as applicable, during performance of maintenance, alteration, or repairs.
- B. This procedure is an Enhanced Zonal Analysis Procedure (EZAP) task.

TASK 20-60-07-913-801

2. Protection of the EWIS During Maintenance

A. General

- (1) This procedure gives instructions for the installation of temporary protection for EWIS during maintenance work when contamination or mechanical damage can occur.
- (2) Protect all airplane EWIS, regardless of the gauge or insulation material, during airplane maintenance to prevent or significantly decrease the potential for damage from contamination and debris.
 - (a) Protection of EWIS starts with identification of the potential for contamination or mechanical damage.
 - (b) The protection ends with making sure that EWIS is free of all sources of contamination.
 - (c) Prevention and frequent removal of contamination during all maintenance work is necessary to maintain EWIS in an airworthy condition.
 - (d) EWIS can be easily damaged during removal of airplane equipment, or if it is used as a handhold or support for personal equipment.
 - (e) In general, EWIS that is undisturbed and kept free of contamination will provide trouble-free service without the need for unscheduled maintenance.
- (3) To maintain necessary properties of EWIS, it must be kept free of chemicals and debris.
 - (a) Hydraulic fluid is a common cause of wire bundle and wire component degradation. Hydraulic fluid is very damaging to connector grommets, wire bundle clamps, and to wire insulation when exposed over a long time. This can cause indirect damage such as arcing and chafing, and break down of the insulation.
- (4) Make sure that EWIS is protected from the accumulation of contamination before you start maintenance work such as servicing, repairing, cleaning, or modifying.

B. Definition

- (1) Electrical Wiring Interconnection System (EWIS): means any wire, power feeder, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy, including data and signals, between two or more intended termination points. EWIS is defined in full by 14 CFR section 25.1701.

C. References

Reference	Title
20-60-02-100-801	Cleaning to Remove Combustible Material (P/B 201)
SWPM 20, Standard Wiring Practices	Standard Wiring Practices

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D. Procedure

SUBTASK 20-60-07-913-001



KEEP THESE MATERIALS AWAY FROM WIRES. THESE MATERIALS WILL DECREASE THE LIFE OF WIRES. IF YOU SPILL THESE MATERIALS, OR LET LEAKAGE GET ON THE WIRES, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that chemicals such as, but not limited to the following, are kept away from the EWIS:

- (a) Hydraulic fluid
- (b) Battery electrolytes
- (c) Fuel
- (d) Corrosion-inhibiting compounds

NOTE: Avoid overspray of CIC on wire bundles and joined electrical connectors. Light overspray to an adjacent area is acceptable.

- (e) Waste system chemicals
- (f) Cleaning agents
- (g) Deicing fluids
- (h) Paint
- (i) Sealants
- (j) Potting compounds.

SUBTASK 20-60-07-913-002



KEEP TOOLS, TOOL TRAYS, AND OTHER WORK ITEMS OFF OF THE WIRES. OBJECTS PUT ON THE WIRE BUNDLES OR THEIR RELATED COMPONENTS CAN CAUSE DAMAGE TO THE WIRES, INSULATION, AND CONNECTORS.



DO NOT PUT PRESSURE ON THE WIRE BUNDLES, ELECTRONIC SYSTEMS, OR STRUCTURES IN THE COMPARTMENT. PRESSURE CAN CAUSE DAMAGE TO WIRE BUNDLES AND ELECTRICAL CONNECTIONS.



DO NOT CUT, CAUSE NICKS, OR CAUSE OTHER DAMAGE TO THE CABLES, WIRES, METAL-BRAIDED SHIELD, OR OVERBRAID. DAMAGE TO THESE COMPONENTS CAN CAUSE MALFUNCTIONS, OR DAMAGE TO OTHER EQUIPMENT.



DO NOT USE WIRE BUNDLES, TUBING, DUCTS, OR OTHER ENGINE COMPONENTS AS A STEP OR HAND-HOLD. DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Install temporary protective covers on the areas below and adjacent to the maintenance area.

- (a) Use a cover that is applicable to protect components from the specific contaminant.
 - 1) Examples of covers are as follows:
 - a) Plastic sheeting for liquid

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- b) Canvas sheeting for liquid or debris
 - c) Paper for debris
 - d) Cardboard for debris.
- (b) Use tape to attach the cover to the aircraft structure.
- 1) Examples of tapes are:
 - a) Masking tape for debris
 - b) Vinyl tape for liquids.
 - 2) Make sure that the cover is in a shape to collect and contain fluids and debris.
 - 3) Install the tape carefully to prevent damage to the structure and hold the shape of the cover to collect and contain fluids and debris.
 - 4) Make sure that you do not tape the cover to any EWIS.
- (c) Make sure that the cover is attached in place.
- 1) Make sure that EWIS stay covered during all of the maintenance work.

E. Put the Airplane Back to Its Original Condition

SUBTASK 20-60-07-010-001

- (1) Carefully remove the temporary protective covers.
 - (a) Make sure that the contaminants are contained and do not spill.

SUBTASK 20-60-07-211-001

- (2) Examine the area to make sure that no contaminants were spilled.
 - (a) If there is contamination on the EWIS, do this procedure: Cleaning to Remove Combustible Material, TASK 20-60-02-100-801.
- (3) Make sure the EWIS was not damaged during the maintenance.
 - (a) If any of the EWIS was damaged during maintenance, repair or replace per the applicable task: SWPM 20, Standard Wiring Practices

————— **END OF TASK** —————

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INSTRUMENT PANEL CLEANING

1. General

- A. This procedure cleans the forward instrument panels located in the flight compartment.

TASK 20-60-08-100-801

2. Instrument Panel Cleaning

A. General

- (1) This procedure cleans the forward instrument panels area where dust can accumulate.

B. Consumable Materials

Reference	Description	Specification
B00130	Alcohol - Isopropyl	TT-I-735
G01043	Cloth - Lint-free	

C. Location Zones

Zone	Area
211	Flight Compartment, Left
212	Flight Compartment, Right

D. Instrument Panel Cleaning

SUBTASK 20-60-08-160-001



CAUTION

DO NOT USE ABRASIVE MATERIALS WHEN YOU CLEAN THE DISPLAY SURFACE. ABRASIVE MATERIALS WILL CAUSE SCRATCHES IN THE DISPLAY SURFACE.

- (1) Blow off the instrument panel with dry, filtered air to remove the large dust and dirt particles.

SUBTASK 20-60-08-160-002



CAUTION

DO NOT APPLY CLEANER DIRECTLY ON THE DISPLAY SURFACE OR THE UNIT. ALWAYS APPLY CLEANER TO THE CLOTH. THIS WILL HELP PREVENT DAMAGE TO THE DISPLAY SURFACE OR THE UNIT.

- (2) Soak a clean lint-free cloth, G01043 with alcohol, B00130.

SUBTASK 20-60-08-160-003



CAUTION

DO NOT USE TOO MUCH FORCE WHEN YOU CLEAN THE DISPLAY SURFACE. TOO MUCH FORCE WILL CAUSE DAMAGE TO THE DISPLAY SURFACE.

- (3) Clean the instrument panel with the moist lint-free cloth, G01043.

SUBTASK 20-60-08-160-004

- (4) Dry the instrument panel fully with a clean dry lint-free cloth, G01043.

———— **END OF TASK** ————

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