STANDARD OVERHAUL PRACTICES MANUAL

FASTENER INSTALLATION IN COMPOSITE STRUCTURES

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To: All holders of FASTENER INSTALLATION IN COMPOSITE STRUCTURES 20-50-18.

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INTRODUCTION

1. General

A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.

B. This manual is divided into separate sections:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) Effective Pages

(5) Contents

(6) Revision Record

(7) Record of Temporary Revisions

(8) Introduction

(9) Procedures

C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.

D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.

E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

FASTENER INSTALLATION IN COMPOSITE STRUCTURES

1. INTRODUCTION

A. The data in this subject comes from BAC 5063. The airline has a copy of the Boeing Process Specification Manual.

B. The data is general. It is not about all situations or specific installations. Use this data to help you write minimum requirements.

C. Refer to SOPM 20-00-00 for a full list of all the vendor names and addresses.

2. MATERIALS

NOTE: Equivalent substitutes can be used.

A. Lubricants

(1) Freon, oil-free

(2) Cetyl alcohol

(3) Freon TB-1

(4) Microcut 26

B. Unidirectional tape

(1) BMS 8-212, Class 1

(2) BMS 8-256

(3) BMS 8-297

C. Sealant

(1) BMS 5-95

3. EQUIPMENT

NOTE: Equivalent substitutes can be used.

A. Blind bolts – See Figure 4.

B. BACG20AL grommets:

(1) ST 1221C-CH countersink cutter

(2) ST 8703XB-20 countersink depth gage

(3) Installation tools – See Figure 7

(4) ST 1233H spotface cutter

(5) ST 1257B drill

C. Threaded swage-locking fasteners – See Figure 8

4. GENERAL

A. Clamp the components tightly together to prevent a gap between the components at the hole location while the hole is made.

B. Fastener holes must be perpendicular, within 2 degrees, to the surface against which the installed fastener will bear.

C. Fillet relief

(1) Fillet relief of fastener holes in composite structures is not permitted, unless the holes are for BACB30VG-series bolts installed with a decreased torque (usually in honeycomb structure):

BACB30VG Size	Torque (pound-inches)
6	25-35
8	25-35
10	50-75
12	75-100

(2) If the holes are for BACB30VG bolts, give the hole edges a radius or chamfer as shown in Figure 1.

(3) Fillet relief of holes for BACB30VG bolts must not cause fibers to break out of the external ply, unless within the limits specified in BAC 5063, Section 11.

(4) For fillet relief of holes for protruding-head fatigue-rated bolts, use countersunk washers per Table 4. A fatigue-rated bolt has an F in the class number, such as class number 200FC( ) for bolts BACB30LE or BACB30US.

(5) Where the fastener head bears against metal structure, use a fillet relief procedure or countersunk washer per BAC 5009(for bolts) or BAC 5004-2 (for hex drive fasteners and lockbolts) as necessary, for an acceptable gap between the fastener head and the surface of the part. Refer to BAC 5063, Section 11 for limits and other details.

D. Oil-free Freon, Boelube, cetyl alcohol or Freon TB-1 can be used as drill lubricants per BAC 5008 (SOPM 20-50-07). Microcut 26 can be used as a drill lubricant, but the drilled structure must be separated after the hole is made and all of the surfaces must be wiped dry with a cloth. Filtered air and carbon dioxide can be used as lubricants only when permitted by the overhaul instructions. Do not use other lubricants.

E. If the drill exit will be on a surface which is BMS 8-218 Aramid 350°F cure, we recommend that unidirectional tape be applied to the surface to help prevent damage to the surface as the drill breaks through. Also, to decrease fiber breakout and increase hole quality, use backup material, controlled rates of feed and speed, and the correct drills.

F. Unless specified by the overhaul instructions, use the final hole sizes as given in this subject.

G. Make sure all faying surfaces have no unwanted matter. Sealants or finishes are permitted as specified by the overhaul instructions.

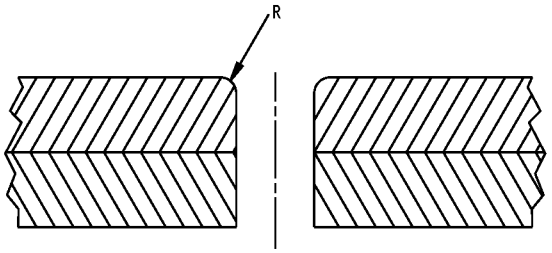
H. Be sure to vacuum or remove from the structure all carbon fiber particles that were made during hole preparation.

I. When the overhaul instructions specify a multiple-fastener installation without a tightening sequence, do not tighten the adjacent fasteners one after the other. A multiple-fastener installation is a row (5 or more fasteners in a line) or a pattern such as a circle, or multiple rows. For such installations, tighten opposite fasteners in an alternating pattern.

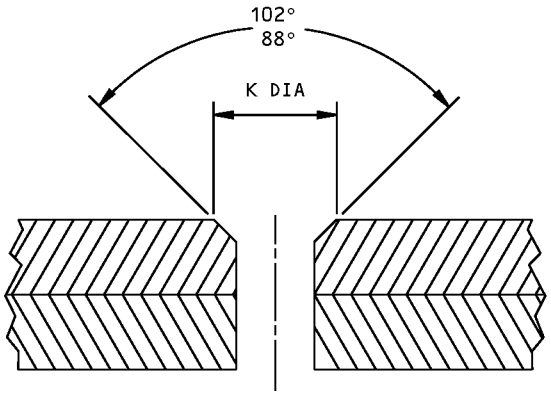
J. Do not use aluminum fasteners in carbon fiber reinforced plastic (CFRP) composites, unless specified by the overhaul instructions.

K. Do not install threaded swage-locking collars on hex drive pins. Do not install hex drive collars on threaded swage-locking pins. Although these combinations can make an installation which is apparently satisfactory, the collar will loosen and decrease the performance of the joint.

L. When you install permanent fasteners in fay seal applications, be sure to clamp the joint to make the sealant correctly squeeze out. Use sufficient clamp pressure to prevent separation. Permanent fasteners can be installed after 10 minutes of clamp pressure for BMS 5-45 class B-1/2 or class B-2 sealants, or after 20 minutes for sealants with longer squeeze-out life. The fasteners must be installed during the sealant squeeze-out life.



EXAMPLE HOLE WITH RADIUS



EXAMPLE HOLE WITH CHAMFER

BACB30VG( ) SIZE	R	K
5	0.025 0.015	0.2085 0.1885
6	0.025 0.015	0.2345 0.2145
8	0.025 0.015	0.2945 0.2745
10	0.030 0.020	0.3620 0.3420
12	0.030 0.020	0.4245 0.4045

ALL DIMENSIONS ARE IN INCHES

Hole Fillet Relief Data for BACB30VG Bolts with Decreased Torque
Figure 1

5. HEX DRIVE FASTENERS (Figure 2, Figure 3)

A. A hex drive fastener has an internal hole for a hex drive wrench in the threaded end of the shank (see Figure 2).

B. Unless the overhaul instructions are different, use the hole sizes shown in Table 1.

C. Pins or Bolts

(1) Use the pins or bolts specified by the overhaul instructions. If the length must be changed to get the pin protrusion requirements of BAC 5063, Section 11 because of changes in structural laminate thickness or shims, an adjustment of two grip lengths longer or shorter is permitted.

(2) If pins or bolts of the correct grip length are not available, you can use a longer grip length with washers. See Table 2 for washer selection. You can use a maximum of two washers under the head or collar, but no more than three washers on any one fastener.

D. Collars

(1) The collars are supplied lubricated by the manufacturer. Do not degrease or apply more lubrication.

(2) When collar replacement is necessary, do not use impact methods. Do not use the removed collars again.

E. Nuts

(1) When permitted by the overhaul instructions, locknuts can be used as an alternative to collars. Then washers must be added (Figure 3) because most nuts do not have the counterbore of the collar. See Table 3 and Table 4 for washer selection. See Table 1 to identify the nuts which have counterbores and thus can be used without counterbore substitution washers.

(2) Unless the overhaul instructions are different, tighten the locknuts to the torque shown in Table 1.

F. Tables

Table 1: HOLE SIZES AND LOCKNUT TORQUES

SHEAR TYPE						TENSION TYPE
P/N		**BACB30VT BACB30VU**	**BACB30FM BACB30FN BACB30MY BACB30NW BACB30NZ**			**BACB30JC BACB30MB BACB30NX BACB30NY**
LOCK-NUT		**BACN10JC BACN10YR BACN10YZ *[1] KFN305 *[1] MS21042 MS21043 NAS679 NAS1291**	**BACN10JC BACN10XJ *[1] BACN10YR KFN305 *[1] KFN511 *[1] KFN600 *[1] MS21042 MS21043 NAS679 NAS1291R600 *[1]**	**BACN10WM *[1]**	**KFN609 *[1]**	**BACN10GW BACN10MT *[1] BACN10YT *[1] KFN305 *[1] KFN511 *[1] MS21042 NAS1804 NAS1805**
FASTENER NOMINAL DIA. (INCH)	**MATING HOLE DIA. (INCH)**	**LOCKNUT TORQUE (POUND-INCHES)**				
5/32	0.167 0.164	25 15	25 15			35 25
3/16	0.193 0.190	35 25	35 25		28 23	40 30
1/4	0.253 0.250	80 60	80 60	80 60	75 60	95 80
5/16	0.315 0.312	160 130	160 130	145 125	150 120	200 150
3/8	0.378 0.375	240 200	240 200	230 200	210 180	360 260
7/16	0.440 0.437	330 270	330 270			480 390
1/2	0.503 0.500	430 370	430 370			800 640
9/16	0.565 0.562	575 500	575 500			900 740
5/8	0.628 0.625	700 625	700 625			1000 800
3/4	0.753 0.750	1000 900	1000 900			1650 1300

*[1] THESE NUTS HAVE A COUNTERBORE, THUS COLLAR COUNTERBORE SUBSTITUTION WASHERS ARE NOT NECESSARY.

Table 2: GRIP LENGTH WASHER SELECTION

MATERIAL OF MATING SURFACE	WASHER PART NUMBER			
	WASHER UNDER FASTENER HEAD	WASHER UNDER NUT OR COLLAR		
		NUT OR COLLAR MATERIAL		
		ALUMINUM	CRES	TITANIUM
CARBON FIBER/ EPOXY (TAPE OR FABRIC)	BACW10BP( )ACU *[1] BACW10CT( )CU *[2]	NOT PERMITTED	BACW10BP( )APU	BACW10BP( )APU
ARAMID/ EPOXY (TAPE OR FABRIC)	BACW10BP( )ACU *[1] BACW10CT( )CU *[2]	BACW10BN( )AP NAS1149D( )J	BACW10BP( ) APU	BACW10BP( )APU
FIBERGLASS TAPE OR FABRIC)	BACW10BP( )ACU *[1] BACW10CT( )CU *[2]	BACW10BN( )AP NAS1149D( )J	BACW10BP( )APU	BACW10BP( )APU
ALUMINUM	BACW10BP( )AC *[1] BACW10BN( )AC *[3]	BACW10BN( )AP NAS1149D( )J	BACW10BP( )AP	BACW10BN( )AP
TITANIUM	BACW10BP( )ACU*[1] BACW10CT( )CU *[2]	NOT PERMITTED	BACW10BP( )APU	BACW10BP( )APU
CRES	BACW10BP( )ACU *[1] BACW10CT( )CU *[2]	BACW10BN( )AP	BACW10BP( )APU	BACW10BP( )APU

*[1] DO NOT USE BACW10BP WASHERS UNDER THE HEADS OF HI-LOK, LOCKBOLT, OR SWAGE-LOCKING FASTENERS.

*[2] USE BACW10CT WASHERS ONLY UNDER THE HEADS OF HI-LOK, LOCKBOLT, AND SWAGE-LOCKING FASTENERS.

*[3] SHEAR APPLICATIONS ONLY.

Table 3: COLLAR COUNTERBORE SUBSTITUTION WASHER SELECTION

FASTENER PART NO.	FASTENER DIA (INCH)	COLLAR COUNTERBORE SUBSTITUTION WASHERS (INCH)
BACB30VT BACB30VU	ALL	ONE 1/16-THICK
ALL OTHERS	UP TO 3/8	ONE 1/16-THICK AND ONE 1/32-THICK
ALL OTHERS	7/16 - UP	TWO 1/16 THICK

Table 4: FILLET RELIEF WASHER SELECTION COLLAR COUNTERBORE SUBSTITUTION WASHER SELECTION

MATERIAL OF MATING SURFACE	WASHER PART NUMBER *[1]	WASHER PART NUMBER *[1]	WASHER PART NUMBER *[1]*[2]
	CRES/TI/MONEL FASTENERS	CRES/TI/MONEL FASTENERS	ALUMINUM FASTENERS
	WASHER UNDER NUT	WASHER UNDER FASTENER HEAD	
CARBON FIBER/ EPOXY (TAPE OR FABRIC)	BACW10BP( )APU NAS1149C( )R	BACW10BP( )ACU *[3] BACW10CT( )CU *[4]	NOT PERMITTED
ARAMID/ EPOXY (TAPE OR FABRIC)	BACW10BP( )ACU NAS1149C( ) R	BACW10BP( )ACU *[3] BACW10BP( )CT *[4]	BACW10BN( )AP NAS1149D( )J
FIBERGLASS (TAPE OR FABRIC)	BACW10BP( )APU NAS1149C( )R	BACW10BP( )ACU *[3] BACW10BP( )CTU *[3] BACW10CT( )CU *[4]	BACW10BN( )AP NAS1149D( )J
ALUMINUM	BACW10B( )DP BACW10BN( )AP *[5] NAS1149D( )J *[5]	BACW10BP( )CD *[3] BACW10BN( )AC *[5] NAS1149D( )J *[5]	BACW10BN( )AP NAS1149D( )J
TITANIUM	BACW10BP( )APU NAS1149C( )R	BACW10BP( )ACU *[3] BACW10CT( )CU *[4]	NOT PERMITTED
CRES	BACW10BP( )APU NAS1149C( )R	BACW10BP( )ACU *[3] BACW10CT( )CU *[4]	NOT PERMITTED

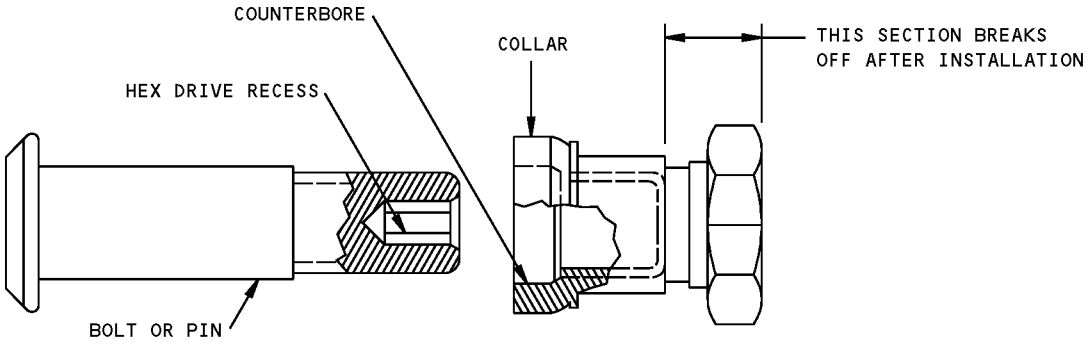
*[1] FOR SIZES SMALLER THAN 3/16 DIAMETER, NAS620( ) WASHERS CAN BE USED.

*[2] WHERE ELECTRICAL GROUNDING IS NECESSARY, AN960JD( ) WASHERS CAN BE USED FOR ALL SIZES.

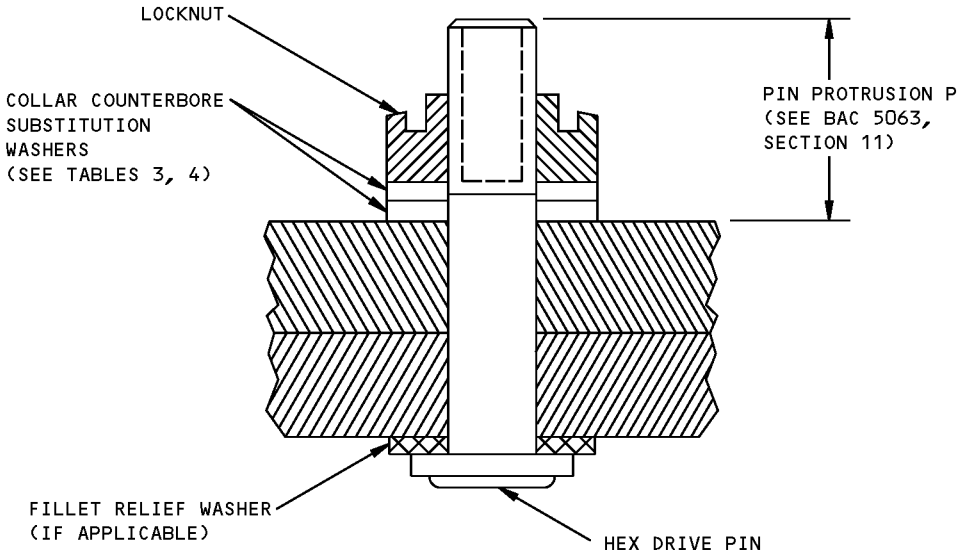
*[3] DO NOT USE BACW10BP WASHERS UNDER THE HEADS OF HI-LOK, LOCKBOLT, OR SWAGE-LOCKING FASTENERS.

*[4] USE BACW10CT WASHERS ONLY UNDER THE HEADS OF HI-LOK, LOCKBOLT, AND SWAGE-LOCKING FASTENERS.

*[5] SHEAR APPLICATIONS ONLY.



Typical Hex - Drive Fastener
Figure 2



Hex Drive Fastener Installation Details
Figure 3

6. BOLTS AND NUTS

A. Unless the overhaul instructions are different, use the hole sizes shown in Table 5.

B. Fastener threads are not permitted against the walls of holes in composite material. Refer to SOPM 20-50-01 for data about fastener threads against the walls of holes in metal.

C. Nuts must not engage the first incomplete thread next to the bolt shank.

D. All nut threads must be engaged. All of the chamfer on the end of the bolt must be out above the nut surface.

E. The nuts are supplied lubricated by the manufacturer. Do not degrease or apply more lubrication.

F. After a bolt is installed into the structure through a wet-sealed area, sealant removal from the bolt threads is not necessary if the nut is tightened during the sealant squeeze-out time, or if specified by the overhaul instructions.

G. Unless specified by the overhaul instructions, install bolts with their heads up or forward.

H. Refer to Paragraph 4.I. for instructions about multiple-fastener installations.

I. If the grip length must be changed because of changes in structural laminate thickness, an adjustment of two grip-length sizes longer or shorter is permitted.

J. Unless the overhaul manual instructions are different, tighten the nuts to the torques shown in Table 6.

(1) If the fasteners are in fay seal areas, complete the initial installation a minimum of 60 minutes before the end of the sealant squeeze-out life.

(2) Retighten all fasteners in fay seal areas to 80-100% of the maximum torque value shown. If the sealant is BMS 5-45 class B-1/2 or B-2, wait 10 minutes or more before you retighten the fasteners. If the sealant has a longer squeeze-out life than BMS 5-45 class B-1/2 or B-2, wait 20 minutes or more before you retighten the fasteners. Make sure all fasteners are tightened before the end of the sealant squeeze-out life.

K. For grip length adjustment or fillet relief, use a maximum of two washers under the bolt head or nut, but no more than three washers on any one fastener. Make your selection of washers per Table 2 or Table 4, as applicable.

Table 5: HOLE SIZES FOR BOLTS

FASTENER NOMINAL DIA (INCH)	HOLE SIZE (INCH)	FASTENER NOMINAL DIA (INCH)	HOLE SIZE (INCH)	FASTENER NOMINA DIA (INCH)	HOLE SIZE (INCH)	FASTENER NOMINAL DIA (INCH)	HOLE SIZE (INCH)
3/32	0.117 0.114	1/4	0.253 0.250	1/2	0.503 0.500	7/8	0.878 0.875
1/8	0.143 0.140	5/16	0.315 0.312	9/16	0.565 0.562	1	1.003 1.000
5/32	0.167 0.164	3/8	0.378 0.375	5/8	0.628 0.625	1 - 1/8	1.128 1.125
3/16	0.193 0.190	7/16	0.440 0.437	3/4	0.753 0.750	1 - 1/4	1.253 1.250

Table 6: NUT TORQUES

NUT	PART NO.	BACN10HR	BACN10HR NAS1804 NAS1805	NAS1804 NAS1805 BACN10GW BACN10JA BACN10JB	ALL	BACN10JD (THIN STYLE)
BOLT	CLASS	220 TENSION	200 TENSION	125, 110 SHEAR	96 SHEAR	ALL *[1]
	PART N0.	BACB30US (12 PT)	BACB30LE (12 PT)	BACB30LT BACB30UU BACB30WP (12 PT, 100 DEG.)	ALL 100 DEGREE REDUCED SHEAR HEAD FASTENERS AND BACB30XD	ALL BUT 100 DEG. REDUCED SHEAR HEAD FASTENERS AND BACB30XD
FASTENER NOMINAL DIA. (INCH)	NUT TORQUE (INCH-POUNDS) *[2]*[3]					
1/16	——	——	——	——	3.4-4.5	
3/32	——	——	——	——	6-8	
1/8	——	——	——	——	12-15	
5/32	——	——	15-20	10-13	15-17	
3/16	50-70	30-35	25-30	18-25	18-25	
1/4	90-125	65-100	50-80	30-40	30-50	
5/16	180-250	130-200	100-150	90-100	60-95	
3/8	300-500	220-410	160-240	95-105	95-160	
7/16	510-840	370-630	250-350	150-170	220-280	
1/2	870-1300	630-1070	480-790	220-245	290-510	
9/16	1300-1800	1000-1470	800-1150	290-325	480-850	
5/8	1900-2300	1400-1900	1100-1500	395-435	660-980	
3/4	3300-4300	2400-3500	2300-3000	——	1300-2000	
7/8	5100-6700	3700-5500	2500-4500	——	1500-2300	
1	7000-10300	5100-8900	3700-7500	——	2200-5300	
1-1/8	9500-12000	6800-10700	5000-9000	——	3000-6200	
1-1/4	15000-19200	11500-15700	9000-13000	——	5400-8600	

*[1] WHEN THE OVERHAUL INSTRUCTIONS LET YOU USE SHEAR RATED NUTS OR NUTPLATES, TIGHTEN TO THE INSTALLATION TORQUE FOR THE RELATED NUTS.

*[2] IF YOU INSTALL THE BOLT WITH A WRENCH ON THE HEAD, SUCH AS TO INSTALL THE BOLTS INTO PLATE-NUTS, CLIP NUTS, BARREL-NUTS, INSERTS, OR TAPPED HOLES, THE INSTALLATION TORQUE TO USE IS THE MAXIMUM TORQUE INDICATED IN THE TABLE FOR THE NUT +/-10 PERCENT.

*[3] WHEN BOLT PART NUMBER AND NUT PART NUMBER ARE IN DIFFERENT COLUMNS, USE THE INSTALLATION TORQUE FROM THE COLUMN WITH THE LOWER TORQUE VALUE.

7. BLIND BOLTS (Figure 4)

A. Use this procedure to install bolts, BACB30UY, BACB30UZ, BACB30VK, BACB30VL, BACB30XS, PLT 220, PLT 221, PLT 270, PLT 271, PLT 1055, PLT 1058, PLT 1064, PLT 1069, PLT 1070.

B. Unless the overhaul instructions are different, use the hole sizes shown in Figure 4, Table 1.

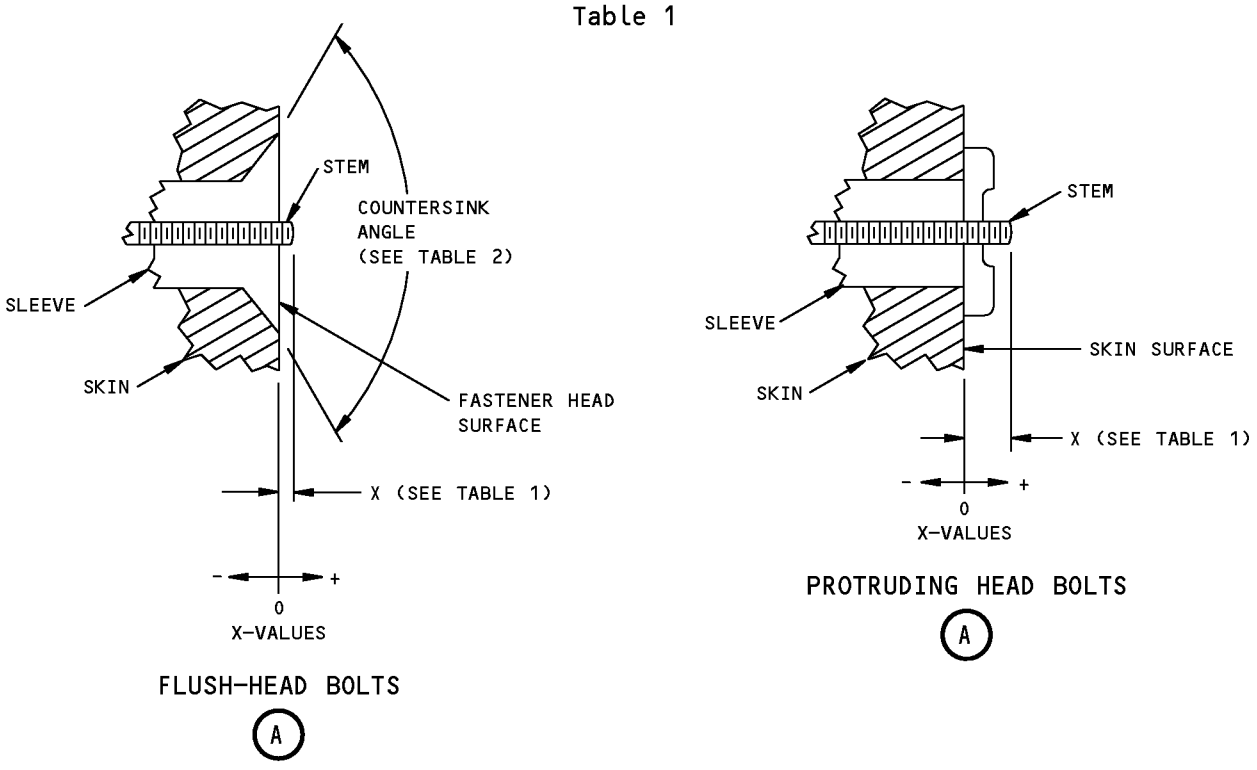
C. If the grip length must be changed because of changes in part thickness, an adjustment of one grip length size longer or shorter is permitted if the composite thickness is one inch or less, or two grip length sizes longer or shorter if the composite thickness is more than one inch.

D. See Figure 4 for data about tools, countersink requirements and lengths of the broken-off stem. The stem can be cut shorter if necessary, but the length must be within the Figure 4, Table 1 limits before you cut it. Do not remove material from the fastener head. Be careful not to damage the surface of the composite skin.

E. Use a countersink tool whose pilot pin minimum diameter is 0.002 inch smaller than the drill used to make the hole.

FASTENER NOMINAL DIAMETER	HOLE SIZE	FLUSH-HEAD BOLTS (SEE A)			PROTRUDING-HEAD BOLTS (SEE A)		
		PLT 1058 PLT 1064 PLT 1070	BACB30UZ BACB30VX BACB30XS		PLT 270 PLT 271 PLT 1069	BACB30UY BACB30VL	PLT 220 PLT 221 PLT 1055
		STEM BREAK - OFF LIMITS (X)					
5/32	0.680 0.655	---	+0.103 -0.000		---	+0.130 -0.000	---
3/16	0.2020 0.1995	+0.088 -0.000	+0.103 -0.000		+0.098 -0.010	+0.103 -0.000	+0.103 -0.015
7/32	1	+0.088 -0.000	+0.103 -0.000		+0.098 -0.010	+0.103 -0.000	+0.103 -0.015
1/4	0.2630 0.2605	+0.098 -0.000	+0.103 -0.000		+0.135 -0.047	+0.103 -0.000	+0.130 -0.015
9/32	1	+0.098 -0.000	+0.103 -0.000		+0.135 -0.047	+0.103 -0.000	+0.130 -0.032
5/16	0.3150 0.3125	+0.103 -0.000	---		+0.146 -0.043	---	+0.130 -0.027
3/8	0.3780 0.3750	+0.103 -0.000	---		+0.152 -0.049	---	+0.103 -0.027

Table 1



Blind Bolts Installation Details
Figure 4 (Sheet 1 of 2)

FASTENER NOMINAL DIAMETER	PLT 1058	BACB30UZ BACB30VK
	NOMINAL COUNTERSUNK ANGLE (DEGREES)	
5/32	---	130
3/16	100	130
1/4	100	130

Table 2

BLIND BOLT PART NUMBER	FASTENER DASH NUMBER	FASTENER NOMINAL DIAMETER	PISTOL	MONOGRAM		LOK-FAST	
				WRENCH ADAPTER	NOSE ADAPTER	WRENCH ADAPTER	NOSE ADAPTER
PLT1058 PLT1064(OS) PLT1070(OS)	-6	3/16	MP550	MP-6	MPR-6	TD2001	PW3002T
	-8	1/4	MP550	MP-8	MPR-8	TD2601	PW3602T
PLT270 PLT271(OS) PLT1069(OS)	-6	3/16	MP550	MP-6	MPP-6	TD2001	PW3002P
	-8	1/4	MP550	MP-8	MPP-8	TD2601	PW3602P
PLT220 PLT221(OS) PLT1055 BACB30UY BACB30VL	-6	3/16	MP550BF	MPBF-6	MPPBF-6	TD2001BF	PW3002P-BF
	-7(OS)	7/32	MP550BF	MPBF-7	MPPBF-7	TD-7-BF	BW7P-BF
	-8	1/4	MP550BF	MPBF-8	MPPBF-8	TD2601BF	PW3602P-BF
	-9(OS)	9/32	MP550BF	MPBF-10	MPTPBF-9	PT-9-BF	PT9P-BF
BACB30VL	-5D	5/32	MP550BF	MPBF-5	MPPBF-8		
	-6D	3/16	MP550BF	MPBF-6	MPPBF-8		
	-7D(OS)	7/32	MP550BF	MPBF-7	MPPBF-8		
	-8D	1/4	MP550BF	MPBF-8	MPPBF-8		
	-9D(OS)	9/32	MP550BF	MPBF-10	MPP-12		
BACB30UZ BACB30VK	-6	5/16	MP550BF	MPBF-6	MPRBF-6	TD2001BF	PW3002TBF
	-7(OS)	7/32	MP550BF	MPBF-7	MPRBF-7	TD-7-BF	PW7T-BF
	-8	1/4	MP550BF	MPBF-8	MPRBF-8	TD2601BF	PW3602T-BF
	-9(OS)	9/32	MP550BF	MPBF-10	MPRBF-9	PT-9-BF	PT9T-BF
BACB30VK	-5D	5/32	MP550BF	MPBF-5	MPPBF-8		
	-6D	3/16	MP550BF	MPBF-6	MPPBF-8		
	-7D(OS)	7/32	MP550BF	MPBF-7	MPPBF-8		
	-8D	1/4	MP550BF	MPBF-8	MPPBF-8		
	-9D(OS)	9/32	MP550BF	MPBF-10	MPP-12		
BAC30XS	-6	3/16	MP550BF	MPBF-6	MPPBF-8	TD2001BF	PW3002-BF
	-8	1/4	MP550BF	MPBF-8	MPPBF-8	TD2001BF	PW3002-BF

Table 3

*[1] REFER TO OVERHAUL INSTRUCTIONS ALL DIMENSIONS ARE IN INCHES

Blind Bolts Installation Details
Figure 4 (Sheet 2 of 2)

8. LOCK BOLTS (Figure 5)

A. Lockbolts are permanent fasteners which include a pin with annular (circumferential) grooves and a collar which is swaged onto the installed pin.

B. Unless the overhaul instructions are different, use the hole sizes shown in Figure 5.

C. If the grip length must be changed because of changes in part or shim thickness, an adjustment of two grip length sizes longer or shorter is permitted. Do not use washers to adjust the grip length.

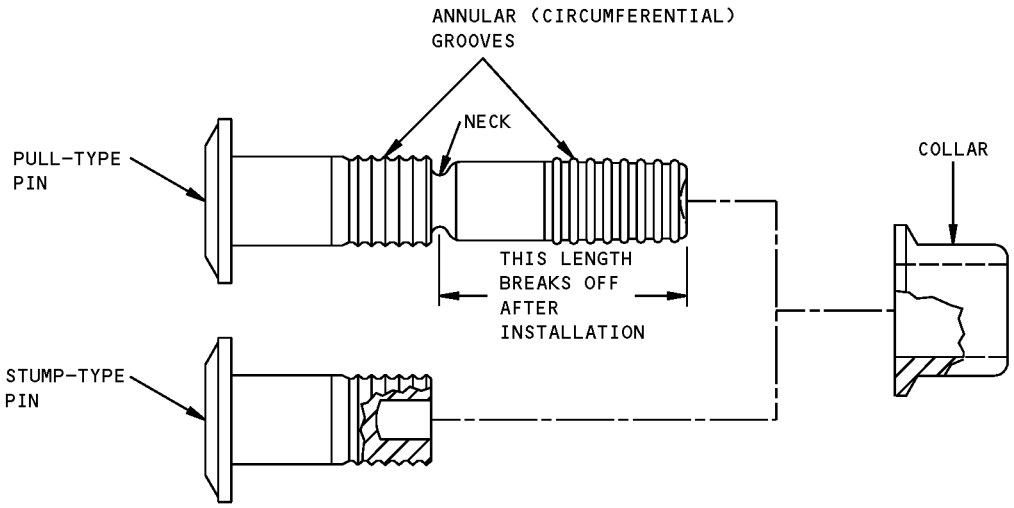
D. The collars are supplied lubricated by the manufacturer. Do not degrease or apply more lubrication.

E. Make sure you turn BACC30BN collars as shown, to put the flange against the structure surface. These collars can be installed on surfaces with a slope of up to 5 degrees, as shown.

F. During installation keep the swaging die aligned with the lockbolt axis within 3 degrees.

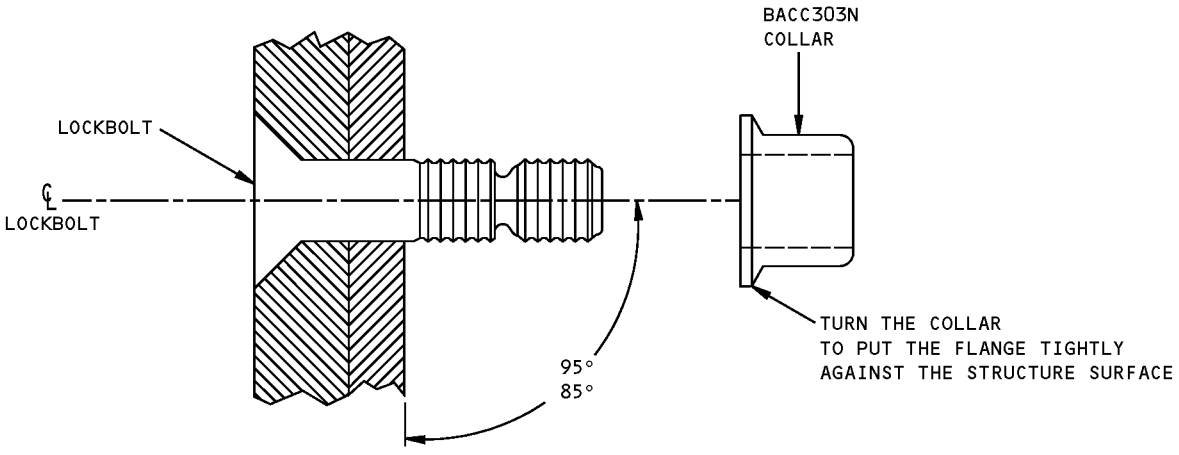
G. Do not use an impact method to swage the collars on composite structures.

H. Unless the lockbolt has a sealant escape groove, remove sealant and other unwanted matter from the annular grooves before you install the collar. Visible signs of sealant are acceptable. On lockbolts with sealant escape grooves (H code in the part number), do not remove the sealant, and be sure to swage the collar within the sealant squeeze-out time.



TYPICAL LOCKBOLT DETAILS

FASTENER NOMINAL DIAMETER	HOLE SIZE	FASTENER NOMINAL DIAMETER	HOLE SIZE
5/32	0.167 0.165	5/16	0.315 0.312
3/16	0.193 0.190	3/8	0.378 0.375
1/4	0.253 0.250	1/2	0.503 0.500



BACC30BN COLLAR INSTALLATION DETAILS

Lockbolt Installation Details
Figure 5

9. OVERSIZE FASTENERS

A. Use these procedures to install fasteners in holes made larger during repair of the composite component.

B. Unless the overhaul instructions are different, use the hole sizes and fastener substitutions shown in Table 7, Table 8, Table 9, and/or Table 10.

C. If the grip length must be changed on these oversize fasteners, you can use a maximum of two washers under the nut or collar and a maximum of one washer under the fastener head. If washers are necessary to adjust the grip length or because the standard fastener used them, you can machine the bores of standard washers to the size necessary to fit the oversize fastener. If you use oversize washers, they must be of the same material as the standard or original washers. See Table 2 for grip length washer selections.

D. Countersink Repairs

(1) Oversize countersinks can be repaired with BACW10DW and BACW10DX conical washers as shown in Figure 6.

(2) Install these washers with wet BMS 5-95 sealant. Push them down into the countersink to squeeze out the sealant. You can use your fingers. If this location is for a removable fastener, remove unwanted sealant from the installed washer before you install the fasteners.

(3) Install the fastener within the squeeze-out time of the sealant.

Table 7: HOLE SIZES FOR OVERSIZE FASTENERS

ORIGINAL FASTENER STANDARD SIZE	HEX DRIVE FASTENERS LOCKBOLTS THREADED SWAGE-LOCKING FASTENERS		BOLTS	
	1/64 OVERSIZE	1/32 OVERSIZE	1/64 OVERSIZE	1/32 OVERSIZE
3/32	– – –	– – –	– – –	0.143 0.140
1/8	– – –	0.193 0.190	– – –	0.193 0.190
5/32	– – –	0.193 0.190	– – –	0.193 0.190
3/16	0.206 0.203	0.221 0.218	0.206 0.203	0.222 0.219
1/4	0.268 0.265	0.284 0.281	0.269 0.263	0.284 0.281
5/16	0.331 0.328	0.346 0.343	0.331 0.328	0.347 0.344
3/8	0.393 0.390	0.409 0.406	0.394 0.390	0.409 0.406
7/16	0.456 0.453	0.471 0.468	0.456 0.453	0.471 0.468
1/2	0.518 0.515	0.534 0.531	0.519 0.516	0.534 0.531

Table 7: HOLE SIZES FOR OVERSIZE FASTENERS (Continued)

ORIGINAL FASTENER STANDARD SIZE	HEX DRIVE FASTENERS LOCKBOLTS THREADED SWAGE-LOCKING FASTENERS		BOLTS	
	1/64 OVERSIZE	1/32 OVERSIZE	1/64 OVERSIZE	1/32 OVERSIZE
9/16	0.580 0.577	0.596 0.593	0.581 0.578	0.596 0.593
5/8	0.643 0.640	0.658 0.655	0.644 0.641	0.659 0.656
3/4	0.768 0.765	0.783 0.780	0.769 0.766	0.784 0.781
7/8	0.893 0.890	0.908 0.905	0.894 0.891	0.909 0.781
1	1.018 1.015	1.033 1.030	1.019 1.016	1.034 1.031

Table 8: HOLE SIZES FOR OVERSIZE BLIND BOLTS

ORIGINAL FASTENER STANDARD SIZE	ALL BLIND BOLTS	PLT1069 PLT1070	BACB30UY BACB30VL	BACB30UZ BACB30VK
	1/64 OVERSIZE	1/32 OVERSIZE	1/32 OVERSIZE	1/32 OVERSIZE
5/32	– – –	– – –	0.2030 0.2010	0.2095 0.1895
3/16	0.2180 0.2160	0.2330 0.2310	0.2410 0.2210	0.2385 0.2185
1/4	0.2790 0.2770	0.2940 0.2920	0.3030 0.2830	0.3005 0.2805

Table 9: FASTENER SUBSTITUTIONS

STANDARD SIZE *[1]	1/64 INCH OVERSIZE *[1]	1/32 INCH OVERSIZE *[1]
BACB30LH ( )*( )	BACB30LH ( )*( )X	BACB30LH ( )*( )Y
BACB30LJ ( )*( )	BACB30LJ ( )*( )X	BACB30LJ ( )*( )Y
BACB30LK ( )*( )	BACB30LK ( )*( )X	BACB30LK ( )*( )Y
BACB30MB ( )*( )	BACB30MC ( )*( )	BACB30MD ( )*( )
BACB30MR ( )*( )	BACB30MR ( )*( )X	BACB30MR ( )*( )Y
BACB30MS ( )*( )	BACB30MS ( )*( )X	BACB30MS ( )*( )Y
BACB30MY ( )*( )	BACB30MY ( )*( )X	BACB30MY ( )*( )Y
BACB30NM ( )*( )	BACB30NM ( )*( )X	BACB30NM ( )*( )Y
BACB30NN ( )*( )	BACB30NN ( )*( )X	BACB30NN ( )*( )Y
BACB30NR ( )*( )	BACB30NR ( )*( )X	BACB30NR ( )*( )Y

Table 9: FASTENER SUBSTITUTIONS (Continued)

STANDARD SIZE *[1]	1/64 INCH OVERSIZE *[1]	1/32 INCH OVERSIZE *[1]
BACB30NT ( )-( )	BACB30LK ( )U( )X	BACB30LK ( )U( )Y
BACB30NT ( )K( )	BACB30NT ( )K( )X	BACB30NT ( )K( )Y
BACB30NU ( )*( )	BACB30NU ( )*( )X	BACB30NU ( )*( )Y
BACB30NW ( )*( )	BACB30NW ( )*( )X	BACB30NW ( )*( )
BACB30NX ( )*( )	BACB30NX ( )*( )X	BACB30NX ( )*( )Y
BACB30NY ( )*( )	BACB30NY ( )*( )X	BACB30NY ( )*( )Y
BACB30NZ ( )*( )	BACB30NZ ( )*( )X	BACB30NZ ( )*( )Y
BACB30US ( )*( )	BACB30US ( )*( )X	BACB30US ( )*( )Y
BACB30UU ( )*( )	BACB30UU ( )*( )X	BACB30UU ( )*( )Y
BACB30VF ( )*( )	BACB30VF ( )*( )X	BACB30VF ( )*( )Y
BACB30VN ( )*( )	BACB30MY ( )*( )X	BACB30MY ( )*( )Y
BACB30VT ( )*( )	BACB30VT ( )*( )X	BACB30VT ( )*( )Y
BACB30VU ( )*( )	BACB30NZ ( )*( )X	BACB30NZ ( )*( )Y
BACB30VY ( )*( )	BACB30NX ( )*( )X	BACB30NX ( )*( )Y
BACB30VZ ( )*( )	BACB30NX ( )*( )X	BACB30NX ( )*( )Y
BACB30WB ( )*( )	BACB30WM ( )*( )X	BACB30WM ( )*( )Y
BACB30WB ( )K( )	BACB30XR ( )K( )X *[2]	BACB30XR ( )K( )Y *[3]
BACB30WC ( )*( )	BACB30WM ( )*( )X	BACB30WM ( )*( )Y
BACB30WD ( )*( )	BACB30NY ( )*( )X	BACB30NY ( )*( )Y
BACB30WD ( )K ( )	BACB30XF ( )K( )X *[2]	BACB30XF ( )K( )Y *[3]
BACB30WP ( )*( )	BACB30WP ( )*( )X	BACB30WP ( )*( )Y
BACB30XB ( )K( )	BACB30XG ( )K( )X *[2]	BACB30XG ( )K( )Y *[3]
BACB30XC ( )K( )	BACB30XH ( )K( )X *[2]	BACB30XH ( )K( )Y *[3]
BACB30XE ( )K( )	BACB30XE ( )K( )X	BACB30XE ( )K( )Y
BACB30XF ( )K( )	BACB30XF ( )K( )X	BACB30XF ( )K( )Y
BACB30XG ( )K( )	BACB30XG ( )K( )X	BACB30XG ( )K( )Y
BACB30XH ( )K( )	BACB30XH ( )K( )X	BACB30XH ( )K( )Y
BACB30XR ( )K( )	BACB30XR ( )K( )X	BACB30XR ( )K( )Y
BACB30XW ( )K( )	BACB30XW ( )K( )X	BACB30XW ( )K( )Y
BACB30XY ( )K( )	BACB30XY ( )K( )X	BACB30XY ( )K( )Y
BACC30AB ( )S	BACB30AB ( )S	BACB30AB ( )SY
BACC30AG ( )	BACB30AG ( )	NOT AVAILABLE
BACC30BH ( )	BACB30BH ( )	NOT AVAILABLE
BACC30BH ( )S	BACB30BH ( )S	NOT AVAILABLE

Table 9: FASTENER SUBSTITUTIONS (Continued)

STANDARD SIZE *[1]	1/64 INCH OVERSIZE *[1]	1/32 INCH OVERSIZE *[1]
BACC30BN ( )	NOT AVAILABLE	NOT AVAILABLE
BACC30BS ( )	BACC30BS ( )	NOT AVAILABLE
BACC30CG ( )	BACC30CG ( )	BACC30CG ( )Y
BACC30CG ( )K	BACC30CG ( )K	BACC30CG ( )KY
BACC30CH ( )	BACC30CH ( )	BACC30CH ( )Y
BACC30CH ( )K	BACC30CH ( )K	BACC30CH ( )KY
BACC30CJ ( )	BACC30CJ ( )	BACC30CJ ( )Y
BACC30CJ ( )K	BACC30CJ ( )K	BACC30CJ ( )KY
BACC30CK ( )	BACC30CK ( )	BACC30CK ( )Y
BACC30M ( )	BACC30M ( )	NOT AVAILABLE
BACC30X ( )S	BACC30X ( )S	HL1393DU-( )
BACW10BP ( )APU	BACW10BP ( )1APU	BACW10BP ( )2APU

*[1] THE PARENTHESES INDICATE THE LOCATION OF THE DIAMETER AND LENGTH CODE NUMBERS. THE ASTERISK INDICATES THE LOCATION OF A DASH OR A CODE LETTER. FOR BOLTS TO BE AN APPROVED SUBSTITUTE, THE OVERSIZE PART NUMBER MUST HAVE THE SAME DIAMETER AND LENGTH CODE NUMBERS, AND DASH OR CODE LETTERS, AS IN THE STANDARD SIZE PART NUMBER.

*[2] USE MATING COLLAR BACC30CG FOR COLLAR SIDE SLOPES UP TO 1/2 DEGREE. USE MATING COLLAR BACC30CH FOR COLLAR SIDE SLOPES LARGER THAN 1/2 DEGREE.

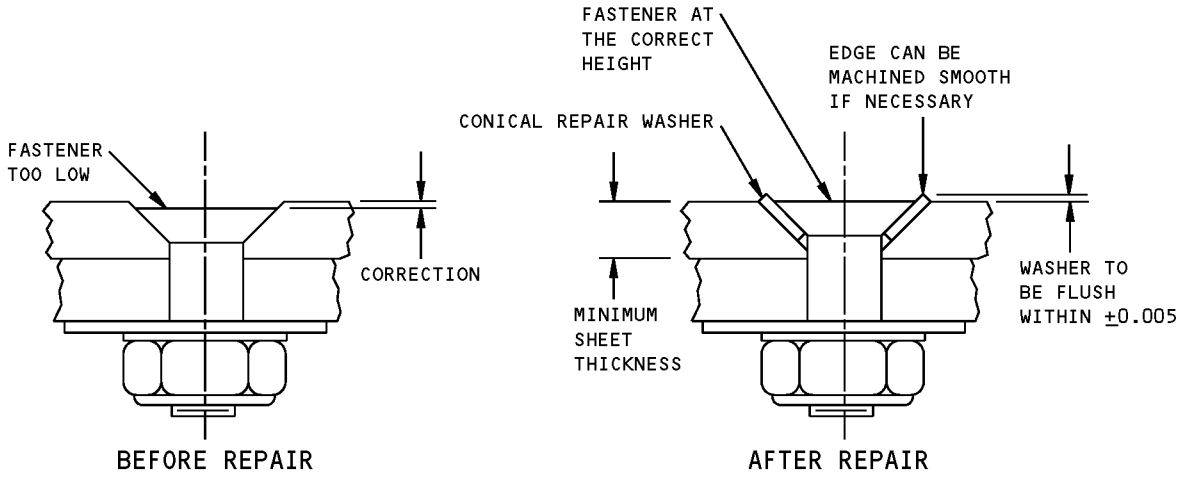
*[3] USE MATING COLLAR BACC30CG( )Y FOR COLLAR SIDE SLOPES UP TO 1/2 DEGREE. USE MATING COLLAR BACC30CH( )Y FOR COLLAR SIDE SLOPES LARGER THAN 1/2 DEGREE.

Table 10: BLIND BOLT SUBSTITUTION

STANDARD SIZE	1/64 INCH OVERSIZE	1/32 INCH OVERSIZE
BACB30UY 6 ( )	NONE	BACB30UY 7 ( )
BACB30UY 8 ( )	NONE	BACB30UY 9 ( )
BACB30UZ 6 ( )	NONE	BACB30UZ 7( )
BACB30UZ 8 ( )	NONE	BACB30UZ 9( )
BACB30VL 5 ( )	NONE	BACB30VL 6 ( )
BACB30VL 6 ( )	NONE	BACB30VL 7 ( )
BACB30VL 8 ( )	NONE	BACB30UL 9( )
BACB30VK 5 ( )	NONE	BACB30VK 6 ( )
BACB30VK 6 ( )	NONE	BACB30VZ 7 ( )
BACB30VK 8 ( )	NONE	BACB30VK 9( )
BACB30XS 6 ( )	NONE	BACB30XS 7 ( )
BACB30XS 8 ( )	NONE	BACB30XS 9 ( )
PLT 1058-( )-( )	PLT 1064-( )-( )	PLT 1070-( )-( )
PLT 220-( )-( )	PLT 221-( )-( )	PLT 1055-( )-( )

Table 10: BLIND BOLT SUBSTITUTION (Continued)

STANDARD SIZE	1/64 INCH OVERSIZE	1/32 INCH OVERSIZE
PLT 270-( )-( )	PLT 271-( )-( )	PLT 1069-( )-( )



FASTENER	HEAD STYLE	NOMINAL DIAMETER	REPAIR WASHER	CORRECTION LIMIT (MAX.)	MINIMUM SHEET THICKNESS
BACB30UZ ( ) BACB30VK ( ) BACB30WB ( ) BACB30WC ( )	130 DEGREES	3/16	BACW10DW3	0.022	0.090
		1/4	BACW10DW4	0.022	0.120
		5/16	BACW10DW5	0.022	0.130
		3/8	BACW10DW6	0.022	0.140
BACB30JC ( ) BACB30LP ( ) BACB30MS ( ) BACB30MN ( ) BACB30NY ( ) BACB30NZ ( ) BACB30QA ( ) BACB30VF ( ) BACB30WD ( ) BACB30WE ( ) BACB30XS ( )	100 DEGREES	3/16	BACW10DX3	0.021	0.155
		1/4	BACW10DX4	0.021	0.200
		5/16	BACW10DX5	0.021	0.240
		3/8	BACW10DX6	0.021	0.280

ALL DIMENSIONS ARE IN INCHES

Countersink Repairs
Figure 6

10. BACG20AL GROMMETS

A. Use this procedure to install BACG20AL aluminum grommets in the composite structure (Figure 7).

B. Unless the overhaul instructions are different, use the hole sizes shown in Figure 7, Table 1.

C. Countersink the near side as shown with an ST1221C-CH cutter. You can measure the depth with an ST8703XB-20 countersink depth gage for BACR15FV rivets. The measured depth will be 0.0037-0.0083 inch deeper than the set zero with a -6 block.

D. Countersink the far side as shown in Figure 7, (Sheet 1).

E. Installation

(1) Use the tool parts shown.

(2) Put the grommet into the panel.

(3) Assemble the tool parts through the grommet as shown.

(4) Connect the puller to the air supply. For nominal grommets, control the air pressure at 13-18 psi. For oversize grommets, control the air pressure to the minimum value at which the tool will operate, but no higher than 18 psi.

(5) Operate the tool to swage the grommet material over the structure, as shown.

(6) Examine the swaged, flared end of the grommet without magnification. Cracks in the flared end of the grommet are acceptable if they do not go into the grommet material below the flush line.

(7) Machine the flared end of the grommet flush with the surface as shown, with an ST1233H spotface cutter.

(8) Examine the bore of the grommet for defects. If necessary, machine the bore to the size shown in Figure 7, Table 2.

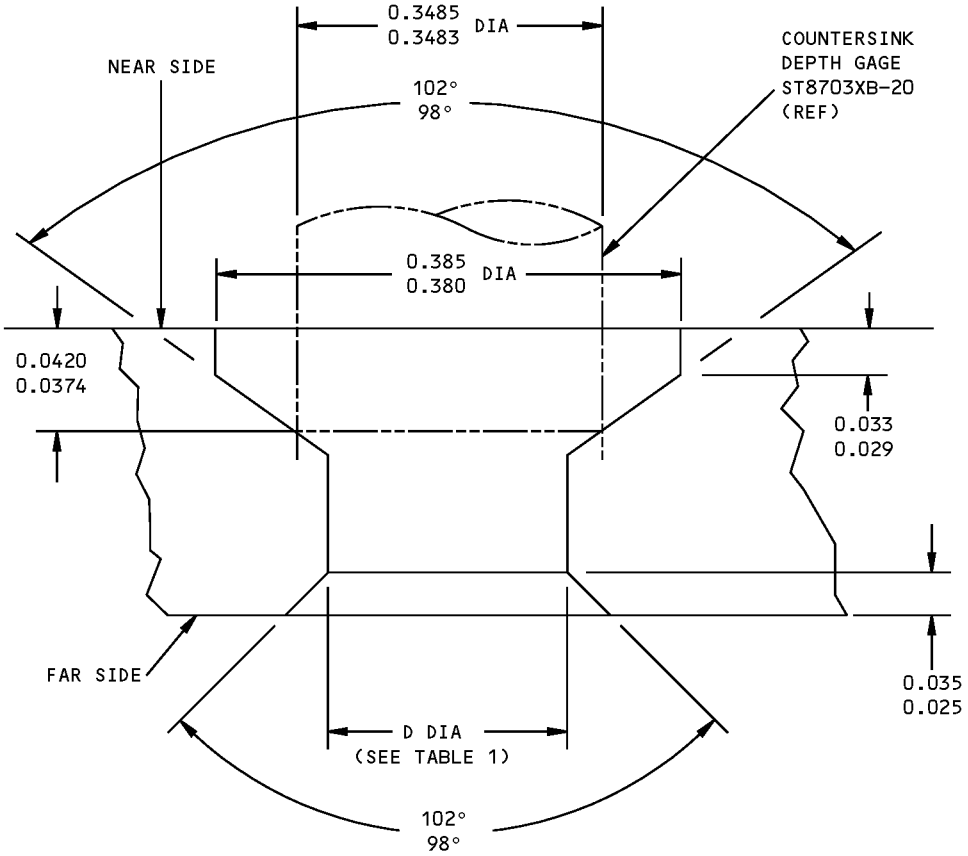
F. Removal

(1) Get an ST1257B drill with a diameter 0.002-inch smaller than the hole in the structure (Diameter D, Figure 7, Table 1).

(2) Align the drill with the center of the grommet.

(3) Drill through the grommet at a speed of 500 rpm or less.

(4) Remove the grommet. Compare the hole size with the Figure 7, Table 1 values before you install a new grommet.



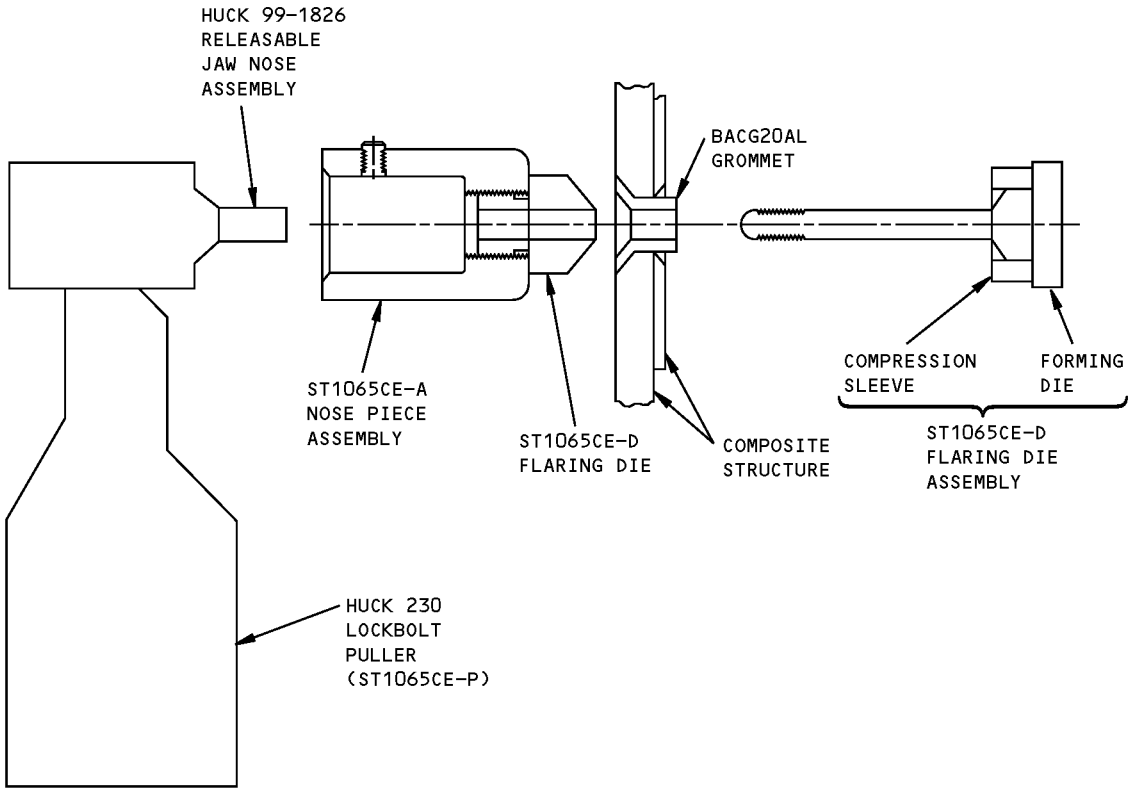
HOLE PREPARATION

GROMMET SIZE	HOLE SIZE (D DIA)
STANDARD	0.251 0.247
1/64 OVERSIZE	0.267 0.263
1/32 OVERSIZE	0.282 0.278

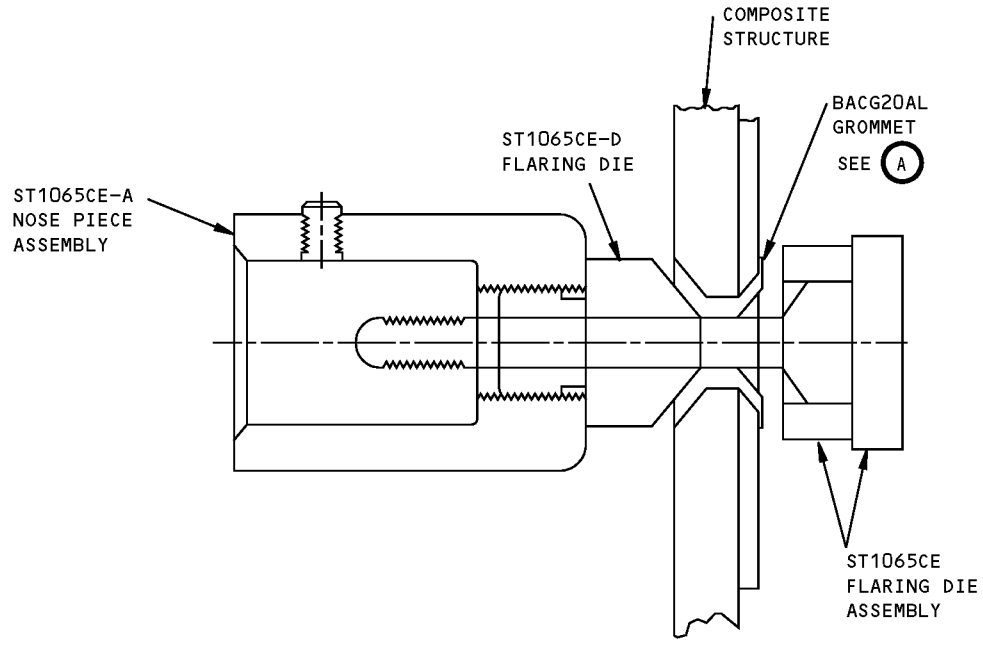
HOLE SIZES
TABLE 1

ALL DIMENSIONS ARE IN INCHES

BACG20AL Grommet Installation Details
Figure 7 (Sheet 1 of 3)

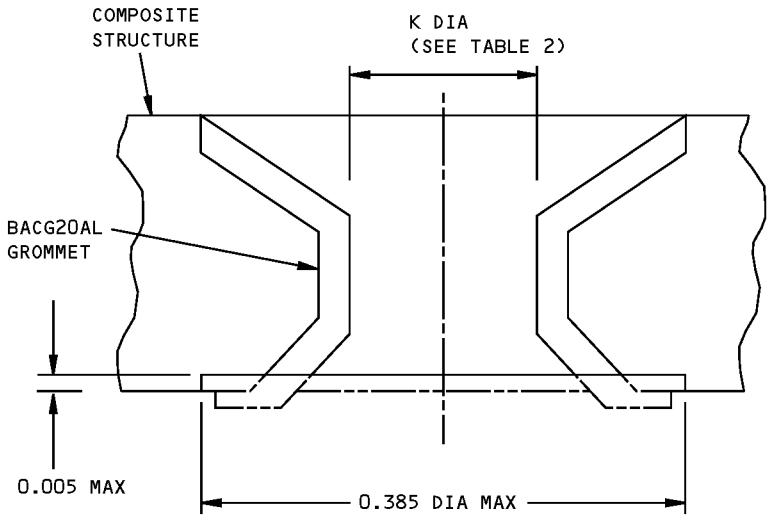


TOOL SETUP



SWAGING COMPLETE

BACG20AL Grommet Installation Details
Figure 7 (Sheet 2 of 3)



GROMMET INSTALLATION COMPLETE

(A)

GROMMET SIZE	INSTALLED GROMMET BORE SIZE (K DIA)
STANDARD	0.206 0.202
1/64 OVERSIZE	0.221 0.217
1/32 OVERSIZE	0.237 0.233

INSTALLED GROMMET BORE SIZES
TABLE 2

ALL DIMENSIONS ARE IN INCHES

BACG20AL Grommet Installation Details
Figure 7 (Sheet 3 of 3)

11. THREADED SWAGE-LOCKING FASTENERS

A. A threaded swage-locking fastener has threads with five flutes (grooves) equally spaced around the circumference. The mating collar has three equally-spaced lobes which engage the installation tool. As the tool turns, it swages the lobes into the flutes to lock the collar tightly in position. The fastener has an internal hex-drive hole in the end to not let the fastener turn in the hole while the collar is installed (Figure 8).

B. Unless the overhaul instructions are different, use the hole sizes shown in Figure 8, Table 1.

C. If the grip length must be changed because of changes in structural laminate thickness, an adjustment of two grip-length sizes longer or shorter is permitted.

D. If fasteners of the correct grip length are not available, you can use longer fasteners with a maximum of two washers under the fastener head or collar, but no more than three washers on each fastener. See Table 2 for grip length washer selections.

E. The collars are supplied lubricated by the manufacturer. Do not degrease or apply more lubrication.

F. When collar replacement is necessary, do not use impact methods. Do not use the removed collars or fasteners again.

G. Installation

(1) Use the special Delta-Rad drivers to install the collars.

(2) Install the fastener in the structure, with the head against the structure surface.

(3) If the slope of the surface under the collar will be less than 1/2 degree, use the standard threaded swage-locking collars. If the slope is more than 1/2 degree, use a self-aligning collar or washer assembly.

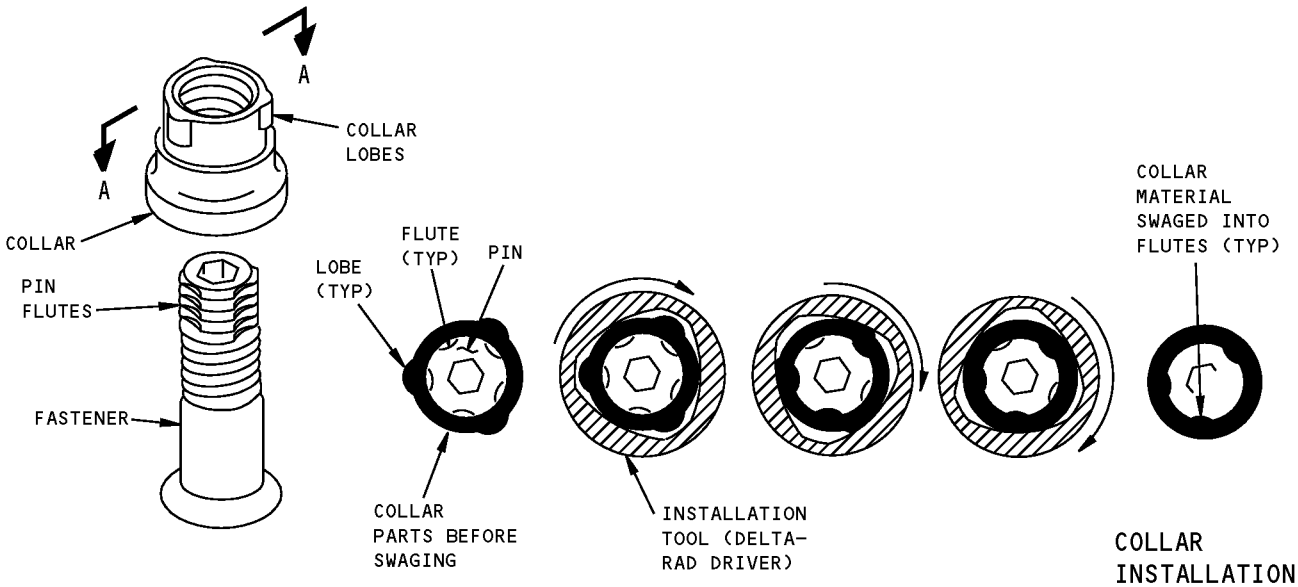
(4) Unless you use an automatic feed or nut retention system, start the collar on the fastener by hand, and turn it a minimum of 3/4 turn before you use installation tools. Then put the installation tool tightly down on the collar. Make sure the hex key goes into the mating hex hole in the fastener. Make sure the tool engages the lobes on the collar. Then operate the tool. When its socket turns freely on the collar, the lobes are swaged into the thread flutes and the installation is complete.

(5) If you use an automatic feed or nut retention system, put the tool on the collar and operate the tool until the collar is tightly against the structure.

(6) If the hole is a clearance fit with the fastener, make sure the hex key is engaged with the mating hex hole in the fastener, or the fastener will turn with the collar and cause damage to the structure or its finish.

(7) If the overhaul instructions specify installation with wet sealant, let the sealant stay on the threads and be sure to install the collar while the sealant is wet.

(8) Do not try to swage again an installed collar. If the collar is not completely swaged, remove the collar and its fastener and install a new fastener with a new collar.



A-A

TYPICAL THREADED SWAGE-LOCKING FASTENER

FASTENER NOMINAL DIAMETER	HOLE SIZE
5/32	0.167 0.164
3/16	0.193 0.190
1/4	0.253 0.250
5/16	0.315 0.312
3/8	0.378 0.375

HOLE SIZES
TABLE 1

ALL DIMENSIONS ARE IN INCHES

Threaded Swage-Locking Fastener Installation Details
Figure 8