Torlon Adhesive Cutter Kits & Related Surface Preparation Tools for Bonded Nutplate Installation

Instruction Manual

THE AIR FORCE RESEARCH LABORATORY
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MATERIALS & MANUFACTURING DIRECTORATE

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The processes, techniques and instructions contained within this manual were developed by the Air Force Research Laboratory, Materials and Manufacturing Directorate, Systems Support Division (AFRL/RXS) and the University of Dayton Research Institute (UDRI).

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1. SCOPE

1.1 Purpose

The following procedure details the process steps for the use of the Torlon Adhesive Cutter (TAC) kits and related Surface Preparation Tools for bonded nutplate installation. This procedure has proven to significantly reduce the time required to safely, rapidly and effectively replace a bonded nutplate that has been damaged or failed during the installation or removal of covers while also providing superior bonding. This process assumes that the nutplate has been removed as a direct result of the failure.

1.2 Application

This document defines the recommended tools and procedures in order to enable the rapid replacement of nutplates using the suite Surface Preparation Tools.

2. RECOMMENDED TOOLS AND CONSUMABLES

Only the items listed below are recommended to be used to affect a nutplate replacement. The list of items are: Tools (Table I, Figures 1-5), the Surface Preparation Verification Kit SA3001-HZE (Figure 6) and Consumable Items (Table II).

2.1 Tools

Table I. Tools
Surface Preparation Kit (Figures 1 thru 5)

Part Description	***Manufacturers' Part Number***	***Cage Code***
Pelican Case with foam inserts	P-1607NKT4L-001	0J1C6
Layer 1		
600 RPM Drill Motor	14CFS97-51	15826
Chuck Key	1006375	15826
Flashlight	68602	56654
Inspection Mirror	STNSM325GLAS	60923
Torlon Adhesive Cutter Kit (Mandrel Mounted for use with Drill Motor)	***ESCKD008***	***0J1C6***
0.750" Torlon Adhesive Cutter (Mandrel Mounted) 8-32 Thread Pitch	TACS-C-1*	0J1C6
1.00" Torlon Adhesive Cutter (Mandrel Mounted) 10-32 Thread Pitch	TACS-C-2*	0J1C6
1.00" Torlon Adhesive Cutter (Mandrel Mounted) 8-32 Thread Pitch	TACS-C-3*	0J1C6
1.30" Torlon Adhesive Cutter (Mandrel Mounted) 10-32 Thread Pitch	TACS-C-4*	0J1C6
0.189" Mandrel (Standard) 8-32 Thread Pitch	STAC-M-3	0J1C6
0.249" Mandrel (Standard) 10-32 Thread Pitch	STAC-M-4	0J1C6
0.312" Mandrel (Standard) 10-32 Thread Pitch	STAC-M-5	0J1C6
0.374" Mandrel (Standard) 10-32 Thread Pitch	STAC-M-6	0J1C6
0.189" Mandrel (Segmented & Tetherable) 8-32 Thread Pitch (4 pieces)	TTAC-M-3	0J1C6
0.249" Mandrel (Segmented & Tetherable) 10-32 Thread Pitch (4 pieces)	TTAC-M-4	0J1C6
0.312" Mandrel (Segmented & Tetherable) 10-32 Thread Pitch (4 pieces)	TTAC-M-5	0J1C6

Part Description	***Manufacturers' Part Number***	***Cage Code***
0.374" Mandrel (Segmented & Tetherable) 10-32 Thread Pitch (4 pieces)	TTAC-M-6	0J1C6
Swivel Assembly (8-32 Thread Pitch)	TACS-S-1	0J1C6
Swivel Assembly (10-32 Thread Pitch)	TACS-S-2	0J1C6
1/2 – 7/8 – 11/16 Combo Flat Wrench (For cutters, mandrels, swivels, and ATC Surface Preparation Tool)	TACW-W-1	0J1C6
Layer 2		
Andrews Tool Company (ATC) Surface Preparation Tool	ATCP2L7-USPPR500-88R	30RT2
Torlon Adhesive Cutter Kit (ATC Surface Preparation Tool Mounted)	***ESCKA009***	***0J1C6***
Alignment tool for ATC Surface Preparation Tool	ATC00531	0J1C6
0.750" Torlon Adhesive Cutter (ATC Surface Preparation Tool) 10-32 Thread Pitch	TACA-C-1*	0J1C6
1.00" Torlon Adhesive Cutter (ATC Surface Preparation Tool) 10-32 Thread Pitch	TACA-C-2*	0J1C6
Torlon Adhesive Cutter Adapter (ATC Surface Preparation Tool) 10-32 Thread Pitch	ATAC-A-1	0J1C6
Locating Buttons – Size 3	ATM191	0J1C6
Locating Buttons – Size 4	ATM250	0J1C6
Locating Buttons – Size 5	ATM312	0J1C6
Locating Buttons – Size 6	ATM375	0J1C6
Quick Change Back-up Pad – Small	ATM483	0J1C6
Quick Change Back-up Pad – Large	ATM484	0J1C6
1/2" – 7/8" – 11/16" Combo Flat Wrench (For cutters, mandrels, swivels, and ATC Surface Preparation Tool)	TACW-W-1	0J1C6
Layer 3 RAT or NAT		
Rotary Abrasion Tool (RAT)		
Rotary Abrasion Tool Body (4 pieces – top, base, ratchet, and stem)	CF35323	44P23
Nutplate Insert – 3 (3/16")	CF35323 Detail 3	44P23
Nutplate Insert – 4 (1/4")	CF35323 Detail 4	44P23
Nutplate Insert – 5 (5/16")	CF35323 Detail 5	44P23
Nutplate Insert – 6 (3/8")	CF35323 Detail 6	44P23
Nutplate Abrasion Tool (NAT)		
Nutplate Abrasion Tool Body (2 Pieces –Top/Base)	ESNAT-1	0J1C6
Nutplate Insert – 3 (3/16")	ESNAT-1-3	0J1C6
Nutplate Insert – 4 (1/4")	ESNAT-1-4	0J1C6
Nutplate Insert – 5 (5/16")	ESNAT-1-5	0J1C6
Nutplate Insert – 6 (3/8")	ESNAT-1-6	0J1C6
T-Handle with Keyless Chuck	ESRTH001	0J1C6
Adhesive Dispenser	DMA50	6R3E4
8:1 Adhesive Dispenser Slide	PLA 050-10 10:1	6R3E4
2:1 Adhesive Dispenser Slide	PLA 050-01 1:1 /2:1	6R3E4
Layer 4		
Air Hose (25 ft.)	FAX781-6-2FF2B-3000	3CU40
Air hose Air Fitting/Adapter	FAX-DC7024	3CU40

* Torlon Adhesive Cutters are considered a consumable tool and listed in Table II. Consumable Items

Figure 1a. Surface Preparation Kit – Tools for Bulk Adhesive/Sealant Removal and Final Structure/Nutplate Surface Preparation – with Rotary Abrasion Tool (RAT)

Figure 1b. Surface Preparation Kit – Tools for Bulk Adhesive/Sealant Removal and Final Structure/Nutplate Surface Preparation – with Nutplate Abrasion Tool (NAT)

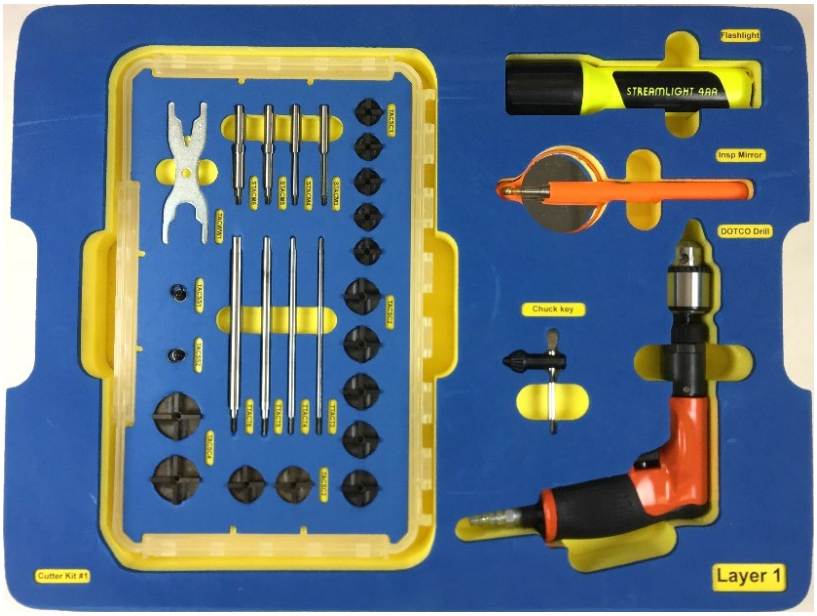


Figure 2. Surface Preparation Kit – Layer 1: Drill Motor & Associated Torlon Adhesive Cutter Kit

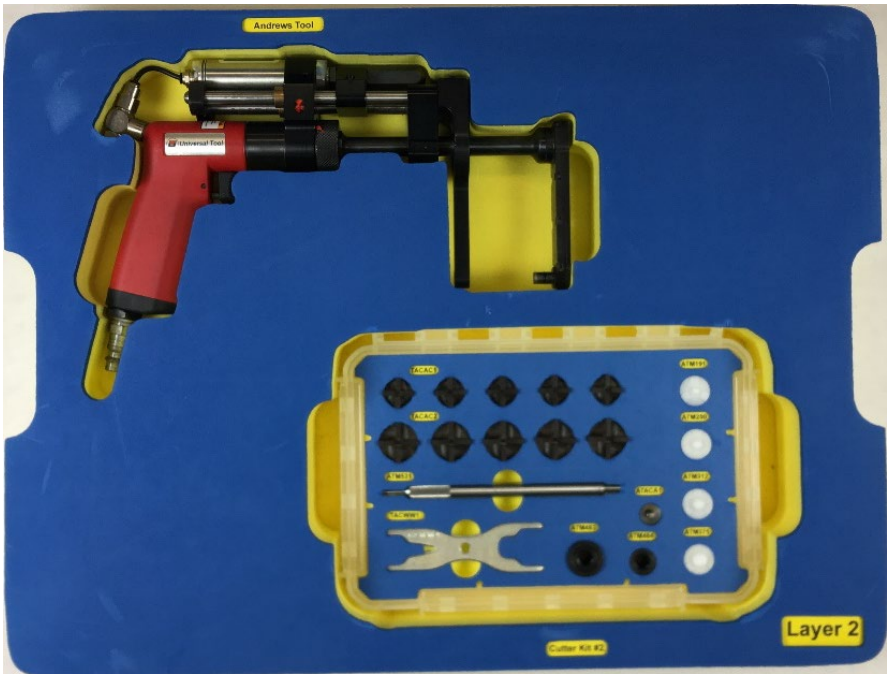


Figure 3. Surface Preparation Kit – Layer 2: ATC Surface Preparation Tool & Associated Torlon Adhesive Cutter Kit

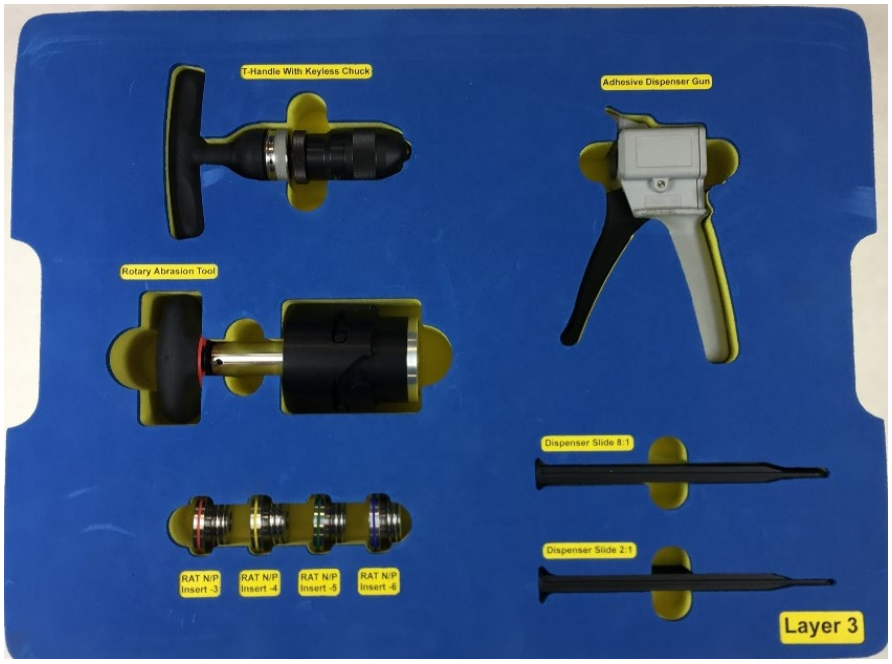


Figure 4a. Surface Preparation Kit – Layer 3: T-handle, Rotary Abrasion Tool (RAT) with Inserts and Adhesive Dispensing Gun with Slides

Figure 4b. Surface Preparation Kit – Layer 3: T-handle, Nutplate Abrasion Tool (NAT) with Inserts and Adhesive Dispensing Gun with Slides

Figure 5. Surface Preparation Kit – Layer 4: Air Hose and Adapter

2.2 Surface Preparation Verification Kit (Figure 6)

SPVK (Surface Preparation Verification Kit) SA3001-HZE		
Part Description	**Part Number**	**Cage Code**
Pelican Case with foam insert	11437	3T4L3
Surface Analyst Unit - Hazardous Environment Certified	SA3001-HZE	3T4L3
Battery (2 ea.)	11217-2	3T4L3
Battery Charger Base Assembly	11222	3T4L3
AC Adapter	11166	3T4L3
EMI Shield – Aircraft Carrier Operation	11526	3T4L3
Wrist strap	11365	3T4L3

Figure 6. Surface Preparation Verification Kit SA3001-HZE (Hazardous Environment Certified)

2.3 CONSUMABLES

Table II. Consumable Items

Torlon Adhesive Cutters for Mandrels (Layer 1), Drill Motor and T-Handle (Layer 3)				
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**
CR3	0.75" Torlon Adhesive Cutter 8-32 Thread	Performance Plastics LTD	TACS-C-1	0J1C6
CR3 (OS)	1.00" Torlon Adhesive Cutter 8-32 Thread (Over Sized)	Performance Plastics LTD	TACS-C-2	0J1C6
CR4, CR5, CR6	1.00" Torlon Adhesive Cutter 10-32 Thread	Performance Plastics LTD	TACS-C-3	0J1C6
CR6 (OS)	1.30" Torlon Adhesive Cutter 10-32 Thread (Over Sized)	Performance Plastics LTD	TACS-C-4	0J1C6

Product Vendors

Nutplate Size	Performance Plastics Part #	Cage Code
CR3	TACS-C-1	0J1C6
CR3 (OS)	TACS-C-2	0J1C6
CR4, CR5, CR6	TACS-C-3	0J1C6
CR6 (OS)	TACS-C-4	0J1C6

Torlon Adhesive Cutters for ATC Surface Prep Tool (Layer 2)				
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**
CR3	0.75" Torlon Adhesive Cutter 10-32 Thread	Performance Plastics LTD	TACA-C-1	0J1C6
CR4, CR5, CR6	1.00" Torlon Adhesive Cutter 10-32 Thread	Performance Plastics LTD	TACA-C-2	0J1C6

Product Vendors

Nutplate Size	Performance Plastics Part #	Cage Code
CR3	TACA-C-1	0J1C6
CR4, CR5, CR6	TACA-C-2	0J1C6

Abrasive Pads for ATC Surface Prep Tool (Layer 2)				
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**
CR3	0.75" w/TR Abrasive Pads (Norton VTME) Size -3 Nutplate	Norton/Saint-Gobain Abrasives	69957317253	079E9
CR3(OS), CR4, CR5, CR6	1.00" w/TR Abrasive Pads (Norton VTME) Size -3 (Over Sized) -4, -5, -6 Nutplates	Norton/Saint-Gobain Abrasives	69957317252	079E9
CR6(OS)	1.30" w/TR Abrasive Pads (Norton VTME) Size -6 Dome Style Nutplate (Over Sized)	Norton/Saint-Gobain Abrasives	69957344851	079E9

Product Vendors

Nutplate Size	**Performance Plastics Part #**	**Cage Code**	**Andrews Tool Company Part #**	**Cage Code**	**MSC Industrial Direct Part #**	**Cage Code**
CR3	ESCKA-AP-075	0J1C6	69957317253	30RT2	38958518	4J007
Abrasive Pads	ESCKA-AP-100	0J1C6	69957317252	30RT2	38958542	4J007
CR6 (OS)	ESCKA-AP-130	0J1C6	69957344851	30RT2	30359095	4J007

Abrasive Pads for Mandrels (Layer 1), Drill Motor and T-Handle (Layer 3)				
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**
CR3	0.75" x 0.200" 8-32 Thread Abrasive Pads (Mandrel Mounted - Norton VTME) Size -3 Nutplate	Norton/Saint-Gobain Abrasives	66261157379	079E9
CR3 (OS)	1.00" x 0.200" 8-32 Thread Abrasive Pads (Mandrel Mounted - Norton VTME) Size -3 Nutplate (Over Sized)	Norton/Saint-Gobain Abrasives	69957312311	079E9
CR4	1.00" x 0.260" 10-32 Thread Abrasive Pads (Mandrel Mounted - Norton VTME) Size -4 Nutplate	Norton/Saint-Gobain Abrasives	66261157382	079E9
CR5	1.00" x 0.330" 10-32 Thread Abrasive Pads (Mandrel Mounted - Norton VTME) Size -5 Nutplate	Norton/Saint-Gobain Abrasives	66261157383	079E9
CR6	1.00" x 0.380" 10-32 Thread Abrasive Pads (Mandrel Mounted - Norton VTME) Size -6 Open Style Nutplate	Norton/Saint-Gobain Abrasives	66261157384	079E9
CR6 (OS)	1.30" x 0.380" 10-32 Thread Abrasive Pads (Mandrel Mounted - Norton VTME) Size -6 Dome Style Nutplate (Over Sized)	Norton/Saint-Gobain Abrasives	69957312418	079E9

Product Vendors

Nutplate Size	**Performance Plastics Part #**	**Cage Code**	**AndrewsTool Company Part #**	**Cage Code**	**MSC Industrial Direct Part #**	**Cage Code**
CR3	ESCKD-AP-CR3	0J1C6	66261157379	30RT2	32307886	4J007
CR3 (OS)	ESCKD-AP-CR3OS	0J1C6	69957312311	30RT2	55917207	4J007
CR4	ESCKD-AP-CR4	0J1C6	66261157382	30RT2	32308058	4J007
CR5	ESCKD-AP-CR5	0J1C6	66261157383	30RT2	32308181	4J007
CR6	ESCKD-AP-CR6	0J1C6	66261157384	30RT2	32308223	4J007
CR6 (OS)	ESCKD-AP-CR6OS	0J1C6	69957312418	30RT2	30359145	4J007

Abrasive Pads for Nutplate Abrasion Tool (Layer 3 or Stand-a-Lone NAT Kit)				
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**
CR3	1.30" x 0.26" Abrasive Pad (Nutplate Abrasion Tool) DIB ZMD S9344 NORTON BHME CR3	Norton/Saint-Gobain Abrasives	69957309470	079E9
CR4	1.30" x 0.35" Abrasive Pad (Nutplate Abrasion Tool) DIB ZMD S9344 NORTON BHME CR4	Norton/Saint-Gobain Abrasives	69957309472	079E9
CR5	1.30" x 0.50" Abrasive Pad (Nutplate Abrasion Tool) DIB ZMD S9344 NORTON BHME CR5	Norton/Saint-Gobain Abrasives	69957309473	079E9
CR6	1.30" x 0.58" Abrasive Pad (Nutplate Surface Tool) DIB ZMD S9344 NORTON BHME CR6	Norton/Saint-Gobain Abrasives	69957309474	079E9

Product Vendors

Nutplate Size	**Performance Plastics Part #**	**Cage Code**	**Andrews Tool Company Part #**	**Cage Code**	**MSC Industrial Direct Part #**	**Cage Code**
CR3	NAT-AP-CR3	0J1C6	69957309470	30RT2	55909931	4J007
CR4	NAT-AP-CR4	0J1C6	69957309472	30RT2	55910509	4J007
CR5	NAT-AP-CR5	0J1C6	69957309473	30RT2	55911879	4J007
CR6	NAT-AP-CR6	0J1C6	69957309474	30RT2	55913321	4J007

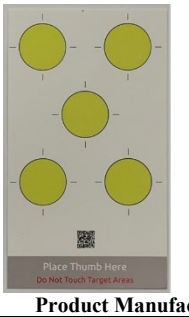
Nutplate Repair Kit (Abrasive Pads only)				
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**
CR3 thru CR6	Nutplate Abrasive Kit (All Sizes of Abrasive Pads included (50 Each))	Norton/Saint-Gobain Abrasives	69957367347	079E9

Product Vendors

Nutplate Size	**Performance Plastics Part #**	**Cage Code**	**Andrews Tool Company Part #**	**Cage Code**	**MSC Industrial Direct Part #**	**Cage Code**
CR3 thru CR6	NRK-AP	0J1C6	69957367347	30RT2	99617482	4J007

Product Manufacturer and Vendor

Bottle Brush (for fastener hole cleaning prior to bonding)							
Nutplate Size	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**	**Vendor**	**Vendor Part #**	**Cage Code**
CR3, CR3(OS), CR4	1/4" Diam Helical Nylon Tube (Bottle) Brush Single Spiral, 0.01" Filament Diam, 2 Brush Length, 6-1/4" OAL, 3/32" Diam Shank (used clean fastener hole on aircraft structure prior to preparing bond area)	Weiler Abrasive Corporation	44110	17699	MSC	82071796	4J007
CR5, CR6, CR6(OS),	1/2" Diam Helical Nylon Tube (Bottle) Brush Single Spiral, 0.01" Filament Diam, 3" Brush Length, 8-1/2" OAL, 1/8" Diam Shank (used clean fastener hole on aircraft structure prior to preparing bond area)	Weiler Abrasive Corporation	91119	17699	MSC	64713043	4J007



Product Manufacturer and Vendor

Item	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**	**Vendor**	**Vendor Part #**	**Cage Code**
Performance Check Cards	Performance Check Surface Pack (PCS), Pack of 25 Cards	BTG Labs	11693	17699	BTG Labs	11693	3T4l3
Water Cartridge	Fluid Cartridge	BTG Labs	11118-6	17699	BTG Labs	11118-6	3T4l3

Product Manufacturer and Vendor

Adhesive Mixing Tip							
Item	**Item Description**	**Manufacturer**	**Manufacturer Part #**	**Cage Code**	**Vendor**	**Vendor Part #**	**Cage Code**
Mixing Tip	Mixing Tip with red defuser (Pack of 100 tips)	Click Bond	CB106	66530	Enfasco Inc	CB106	1U749

Cage Code: 0J1C6
Performance Plastics
4435 Brownway Ave.
Cincinnati, OH 45209
Direct: 513-321-8401
Email: orders@performanceplastics.com
www.performanceplastics.com

Cage Code: 30RT2
Andrews Tool Company
2026 W Pioneer Pkwy (B10)
Arlington, TX 76013
Direct: 817-274-7418
Email: Sales@andrewstool.com
www.andrewstool.com

Cage Code: 66530
Click Bond Inc.
2151 Lockheed Way
Carson City, Nevada, 89706
Email: sales@clickbond.com
www.clickbond.com

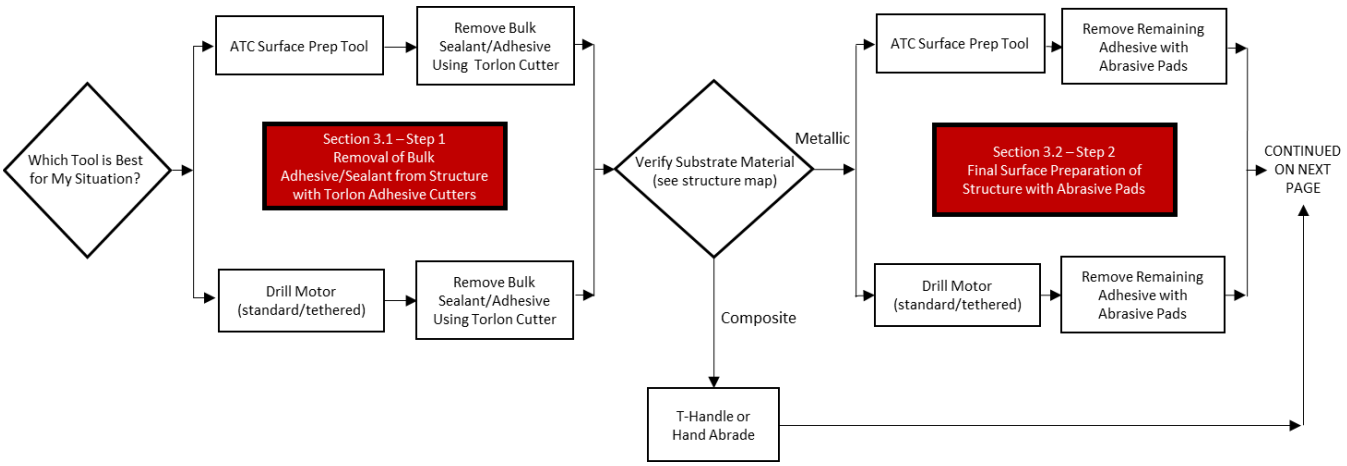
Cage Code: 3T4L3
BTG Labs
4914 Gray Rd
Cincinnati, OH 45232
Direct: 513-469-1800 ext. 103
Email:info@brighton-science.com
www.store.btglabs.com/

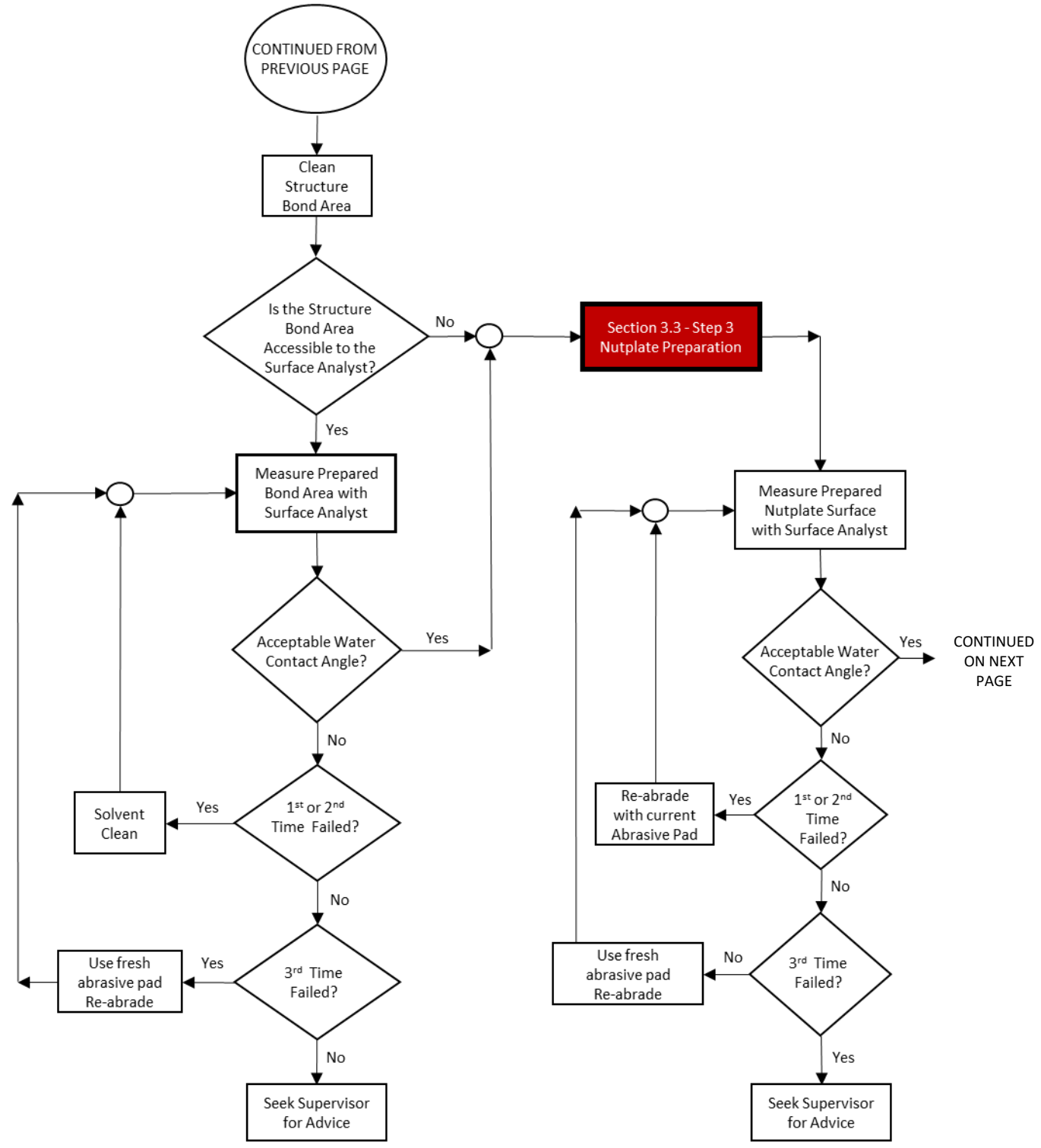
Cage Code: 4J007
MSC Industrial Supply Co.
15600 Trinity Blvd #104
Fort Worth, Texas 76155
Direct: 214-638-0900
Email: mayp@msc.com
www.mscdirect.com

Cage Code: 1U749
Enfasco Inc.
1675 Hylton Road
Pennsauken, NJ 08110-1313
Direct: 856-662-7660
Toll Free: 866-856-2726
Email: Sales@enfasco.com
www.enfasco.com

3. PROCEDURES FOR USE

The use of the Surface Preparation Kit tools (Figures 1a & 1b) provides options for tool selections depending on several factors with speed and nutplate site access being key to selecting the proper tools for the process. The following flow chart details the important steps and show key decision points in the process:





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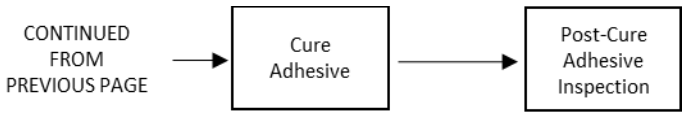


3.1 Step 1: Removal of Bulk Adhesive/Sealant from Structure with Torlon Adhesive Cutters

If adhesive and/or sealant are remaining on the structure after nutplate removal/failure, follow the procedure in Sections 3.1.1, 3.1.4, 3.1.5 or 3.1.6. If there is no sealant/adhesive on the structure, proceed to section 3.2. The process allows for two different methods for removal of remnant materials. For all areas including limited access areas, the best option may be to use the drill motor (see Section 3.1.1), the T-handle (see Section 3.1.5), or the fish through configuration (see Section 3.1.6) with the Torlon Adhesive Cutter attached. For speedier processing of nutplates with full access, the best option may be to use the ATC Surface Preparation Tool with the Torlon Adhesive Cutter attached (see Section 3.1.4). For tools required in Step 1, see Figure 7 thru Figure 9.

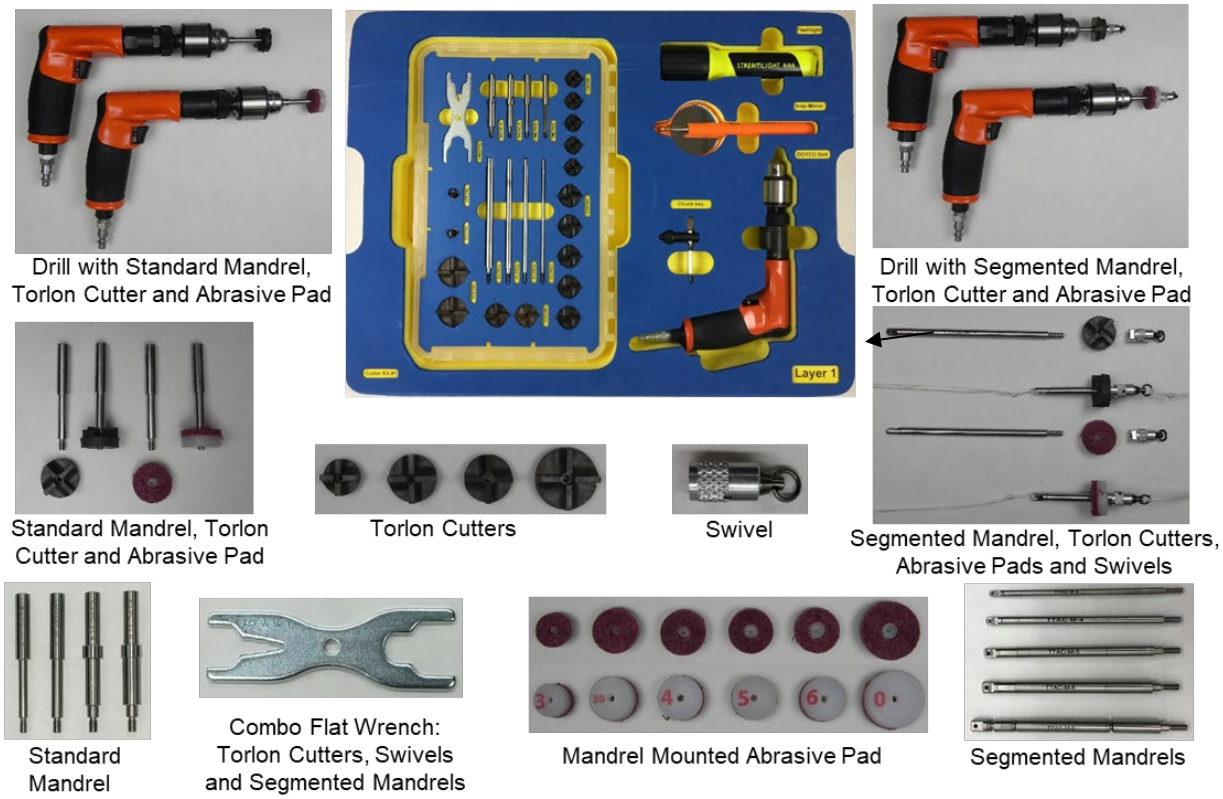


Figure 7. Surface Preparation Kit – Layer 1: Drill Motor and Associated Tools in Various Configurations

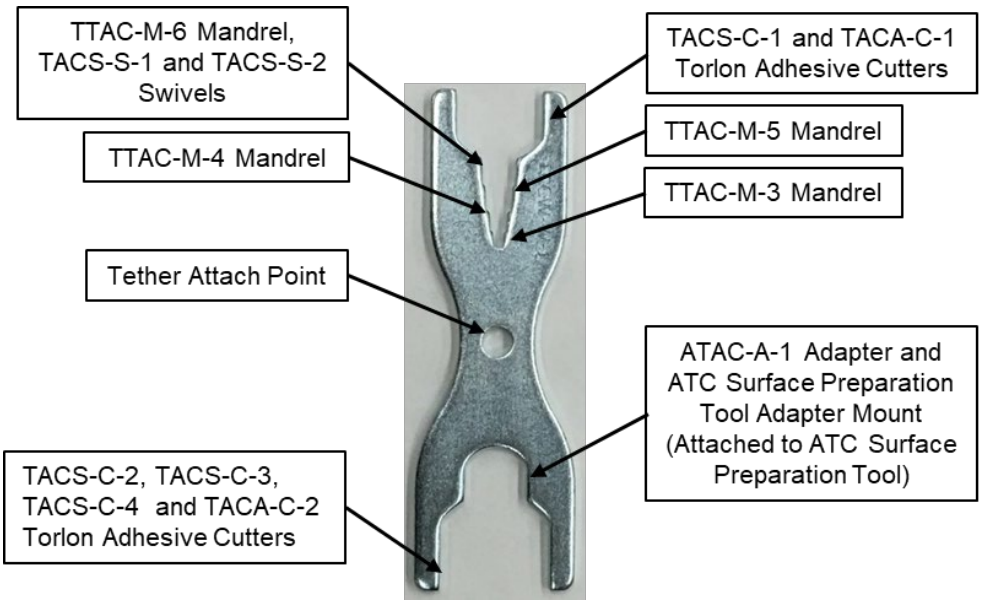


Figure 8. Combo Flat Wrench

Figure 9. Surface Preparation Kit – Layer 2: ATC Surface Preparation Tool and Associated Tools in Various Configurations

3.1.1 Process for Removal of Bulk Sealant/Adhesive with Torlon Adhesive Cutters (Drill Motor) (Figure 10)

NOTE: Do not lubricate motor. Lubrication of the drill motor may cause contamination of the bond surface.

NOTE: For all pneumatic equipment, 90-100 psi is required

NOTE: Ensure the Torlon Adhesive Cutter cutting edges are sharp and in their as-manufactured configuration (Figure 14(a)) prior to use. See Section 3.1.3 for details on how to properly re-sharpen the Torlon Adhesive Cutter.

i. Select the correct Torlon Adhesive Cutter based on the size of the replacement nutplate (Figure 10(a)):

For standard sized nutplate bases

Nutplate Size	Torlon Cutter	Part Number
CR3 (3/16”)	0.75” diameter cutter	TACS-C-1
CR4 (1/4”)	1” diameter cutter	TACS-C-2
CR5 (5/16”)	1” diameter cutter	TACS-C-2
CR6 (3/8”)	1.3” diameter cutter	TACS-C-4

For oversize cutters

Nutplate Size	Torlon Cutter	Part Number
CR3 (3/16”)	1” diameter cutter	TACS-C-2
CR4 (1/4”)	1.3” diameter cutter	TACS-C-4

CR5 (5/16”)	1.3” diameter cutter	TACS-C-4

ii. Select the proper mandrel diameter for the hole diameter in the affected area
    1. Open Access to Nutplate Repair Area:

Hole Size	Mandrel Size	Part Number
0.190” – 0.249”	0.189” mandrel	STAC-M-3
0.250” – 0.312”	0.249” mandrel	STAC-M-4
0.313” – 0.374”	0.312” mandrel	STAC-M-5
0.375” – 0.410”	0.374” mandrel	STAC-M-6

    2. Limited Access to Nutplate Repair Area (when fishing of the tools Is required):

Hole Size	Mandrel Size	Part Number
0.190” – 0.249”	0.189” mandrel	TTAC-M-3
0.250” – 0.312”	0.249” mandrel	TTAC-M-4
0.313” – 0.374”	0.312” mandrel	TTAC-M-5
0.375” – 0.410”	0.374” mandrel	TTAC-M-6

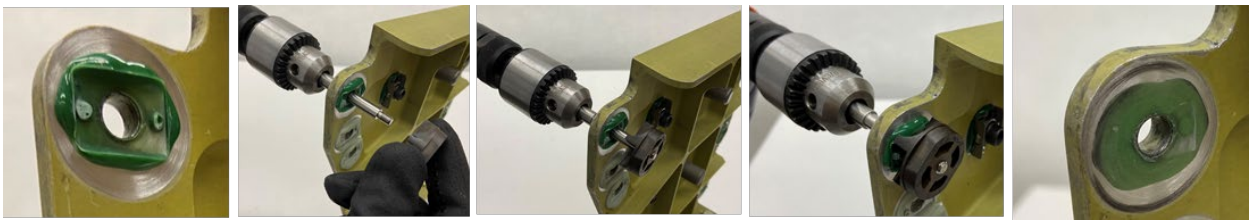
        a. Tether Attachment with Swivel Assembly (when fishing of the tools is required):

Nutplate Size	Part Number
CR3 (3/16”)	TACS-S-1
CR4 and Larger	TACS-S-2

iii. Insert mandrel into structure, chucked (Figure 10(b)) or un-chucked
iv. Attach the selected Torlon cutter to the end of the corresponding mandrel and hand tighten (Figure 10(b))

CAUTION: Do **NOT** overtighten the Torlon cutter on to the mandrel. Damage to the cutter can occur.

v. If the swivel is required, hand tighten it to the end of the mandrel
vi. If required, attach a tether to both ends
vii. Ensure the cutting surfaces of the Torlon tool are facing the remnant materials on the structure (Figure 10(c))
viii. Press the trigger to start spinning the mandrel (Figure 10(d)). While spinning the mandrel, slowly draw the cutting surface towards the remnant material on the structure. Continue residual material removal until most of the remnant materials are removed (Figure 10(e)). A thin residual layer of adhesive may remain on the structure (i.e. a “ghosting layer”).



(a) (b) (c) (d) (e)

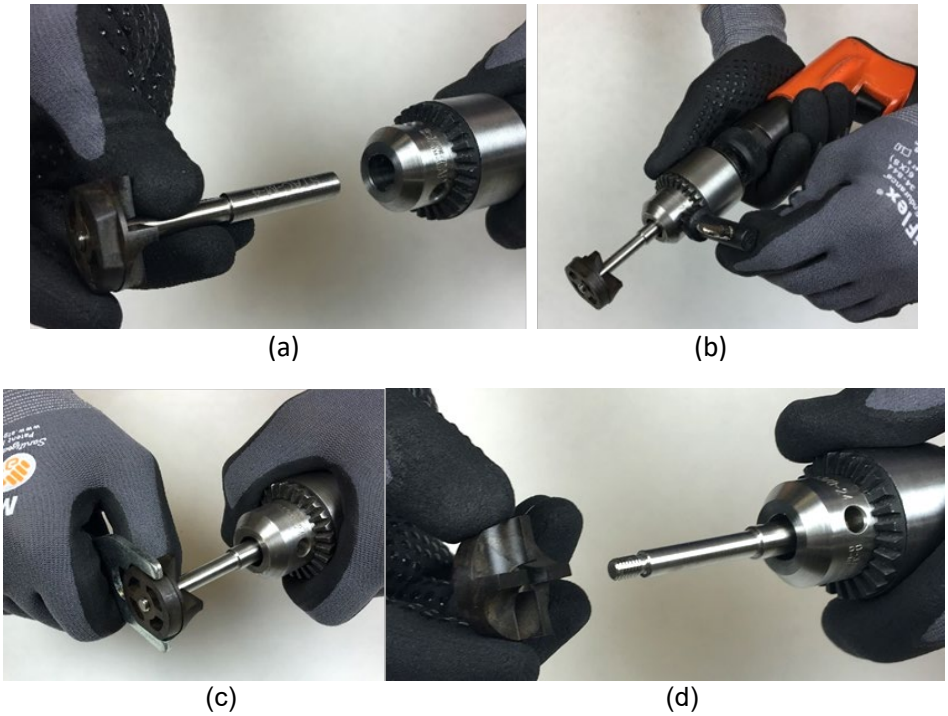
Figure 10. Removal of Residual Sealant/Adhesive with Torlon Adhesive Cutters – Drill Motor – Standard and Segmented Mandrel

ix. Using the provided wrench, remove the Torlon cutter from the tool
x. Go to Step 2 (Section 3.2) for Next Process Step

3.1.2. Removing Stuck Torlon Adhesive Cutters and Loosening Mandrel Segments (Figure 11)

If a Torlon Adhesive Cutter cannot be easily removed from a standard mandrel follow the steps delineated below:

i. Re-chuck removed mandrel into the drill (Figure 11(a) and (b))
ii. Using combo flat wrench, place on flat area of Torlon Adhesive Cutter (Figure 11(c))
iii. Turn to loosen (Figure 11(d))



(a) (b)

(c) (d)

Figure 11. Removing Torlon Adhesive Cutters from the Standard Mandrel – Drill Motor

If a Torlon Adhesive Cutter and swivel assembly cannot be easily removed from a segmented mandrel follow the steps delineated below:

i. Re-chuck removed mandrel into the drill (Figure 12(a) and (b))
ii. Using combo flat wrench, place on flat area of swivel (Figure 12(c))
iii. Turn to loosen (Figure 12(d))
iv. Using combo flat wrench, place on flat area of Torlon Adhesive Cutter and turn to loosen (Figure 12(e) and (f))

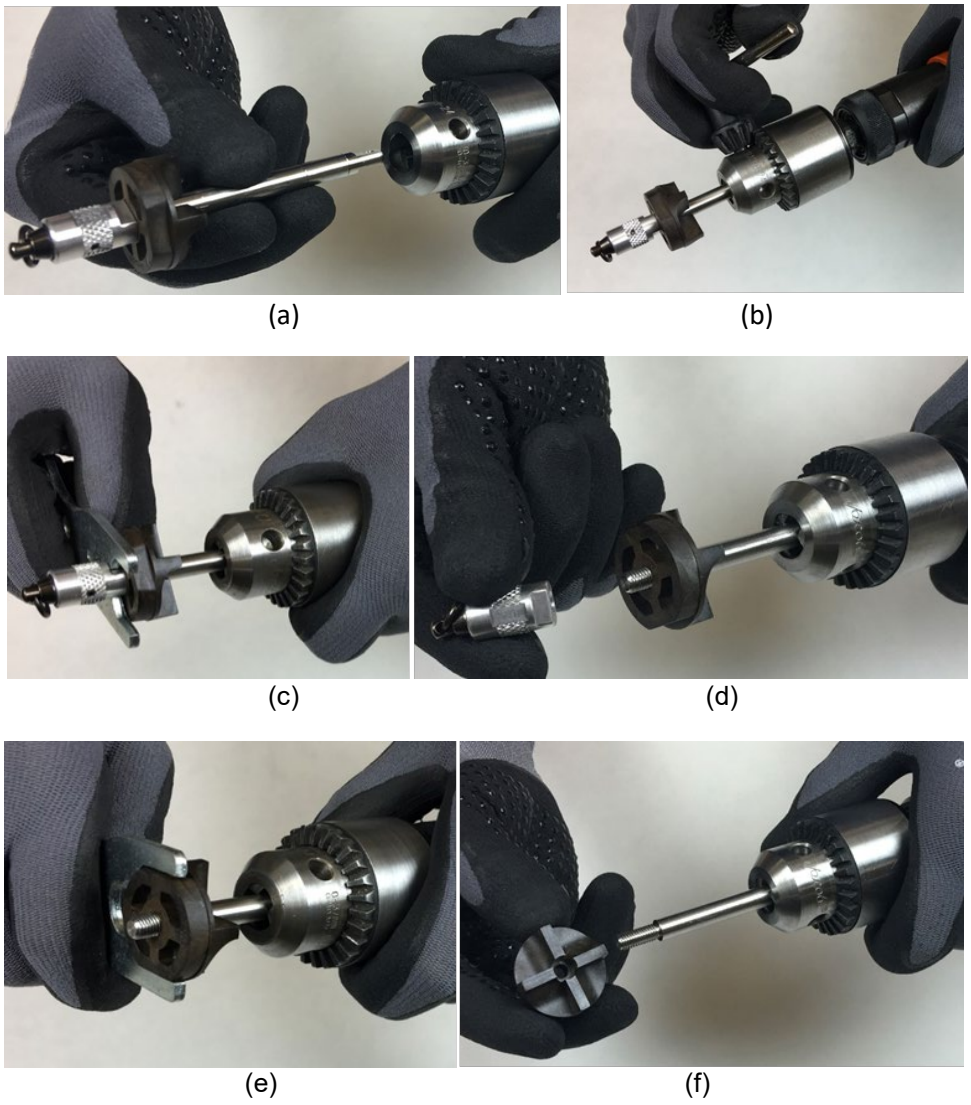


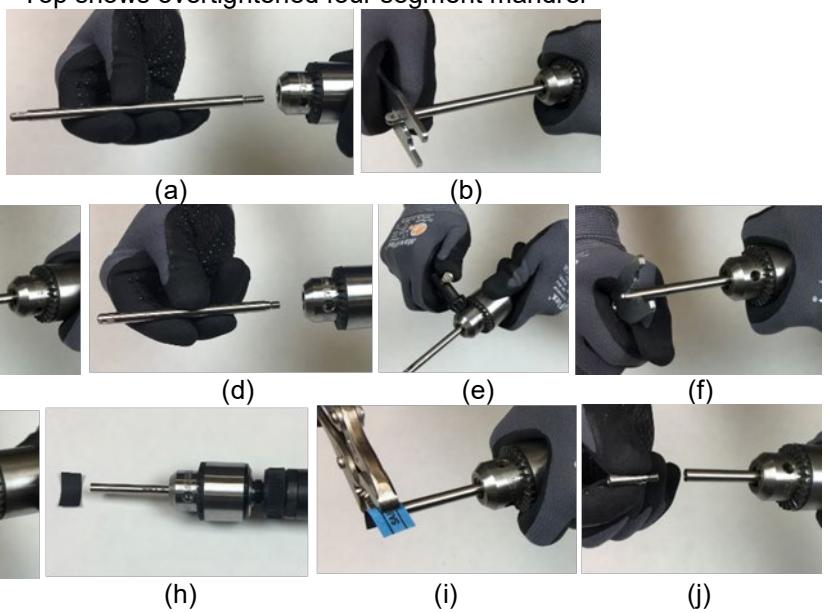
Figure 12. Removing Torlon Adhesive Cutters and Swivels from the Segmented Mandrel Drill Motor

If a segmented mandrel cannot be easily disassembled, follow the steps delineated below:

i. Chuck mandrel in drill (Fig 13(a))
ii. Apply combo flat wrench to eyelet (Fig 13(b))
iii. Loosen assembly (Figure 13(c))
iv. Place remaining overtightened mandrel segment into drill chuck (Fig 13(d))
v. Tighten chuck (Figure 13(e))
vi. Apply combo flat wrench to eyelet, loosen assembly (Fig 13(f))
vii. Remove mandrel segment (Figure 13(g))
viii. Obtain a small piece of sand paper (Figure 13(h))
ix. Wrap sand paper (abrasive surface of the sand paper should contact the mandrel) around the mandrel and lightly grip with vice-grips and turn (Figure 13(i))
x. Remove last mandrel segment (Figure 13(j))

CAUTION: Do **NOT** grip the thin walled mandrel sections with the vice-grips. This can permanently deform the mandrel making them non-usable.

Top shows overtightened four segment mandrel

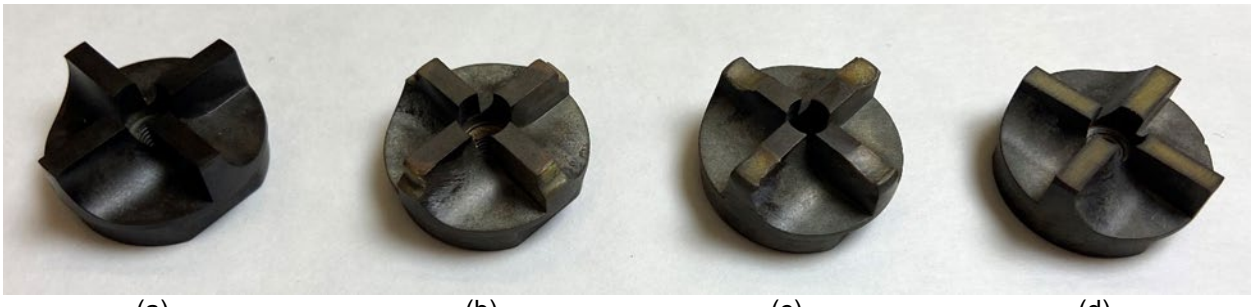


(a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

Figure 13. Loosening of Mandrel Segments

3.1.3 Returning As-Manufactured Sharp Edges to Torlon Adhesive Cutters (Figure 15)

Torlon Adhesive Cutters can lose their sharp edges in the normal course of operation. Figure 14 depicts some of these cases.



(a) (b) (c) (d)

Figure 14. Cutting Surface Conditions of the Torlon Adhesive Cutter

(a) As-manufactured cutting edges, (b) damaged cutting edges due to hitting structure or adjacent hardware, (c) damaged cutting edge due to operation at higher than 650 RPM (d) restored to as-manufactured cutting edges

Note: Without sharp cutting edges the cutter's ability to properly prepare the bond surface will be diminished resulting in the nutplate bond area not being cleared of residual adhesive. This will prevent the new nutplate from properly seating on the structure during the bonding process and will result in premature nutplate failure.

The steps delineated below describe how to properly re-sharpen the Torlon Adhesive Cutters:

i. Place 120-180 grit abrasive paper on a flat surface
ii. Place damaged/worn Torlon adhesive cutter, blade side down on the abrasive paper (Fig 15 (a))
iii. Move cutter back and forth on the abrasive paper until the cutting edges have been restored (Fig 15 (a)-(c))

Figure 15. Restoration of the Cutting Surface of the Torlon Adhesive Cutter

3.1.4 Process for Removal of Bulk Sealant/Adhesive with Torlon Adhesive Cutters (ATC Surface Preparation Tool) (Figure16)

NOTE: Ensure the Torlon Adhesive Cutter cutting edges are sharp and in their as-manufactured configuration (Figure 14(a)) prior to use. See Section 3.1.3 for details on how to properly re-sharpen the Torlon Adhesive Cutter.

NOTE: Do not lubricate ATC Surface Preparation Tool. Lubrication of the tool may cause contamination of the faying surface.

NOTE: For all pneumatic equipment, 90-100 psi is required

Confirm that the ATC Surface Preparation Tool is in proper alignment before use. When properly aligned the locating button will center on the Torlon Adhesive Cutter and just barely touch it when the tool is activated (but not on the structure). If the locating button and Torlon Adhesive Cutter are not aligned, the cutter will not center on the fastener hole and thus it will not remove the adhesive/sealant in the foot print of the new nutplate. This will prevent the nutplate from properly seating on the structure and will lead to premature nutplate failure. See Appendix A for alignment adjustment.

i. Select the correct Torlon cutter for the corresponding size of nutplate
    1. CR3 (3/16") nutplate – ¾" diameter cutter
    2. CR4 (1/4") or larger nutplate – 1" diameter cutter
ii. Using the ATC Surface Preparation Tool (Figure A-16(a)), select the correct ATC Surface Preparation Tool locator button for the affected area hole size:
    1. CR3 (3/16") locating buttons for hole sizes 0.190" – 0.249"
    2. CR4 (1/4") locating buttons for hole sizes 0.250" – 0.312"
    3. CR5 (5/16") locating buttons for hole sizes 0.313" – 0.374"

4. CR6 (3/8”) locating buttons for hole sizes 0.375” and up

iii. Attach tool to the Torlon Adhesive Cutter Adapter. Then, attach the adapter to the ATC Surface Preparation Tool such that it seats flush with the threaded adapter flange.

iv. Guide the locating button to the hole in the structure so that the Torlon Adhesive Cutting surface faces the remnant materials (see Figure 16(b))

v. Press the trigger to start the Torlon Adhesive Cutter spinning and the tool will clamp on to the structure (Figure 16(c)). Additional pressure can be added by clamping with hand (Figure 16(d)). Continue the operation until no adhesive material or a thin residual layer remains on the structure (Figure 16(e)).

vi. Go to Step 2 (Section 3.2) for the Next Process Step.

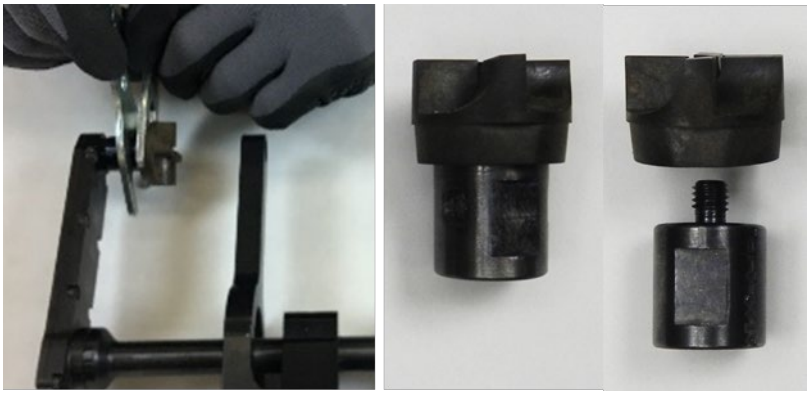
(a) (b) (c) (d) (e)

Figure 16. Removal of Bulk Adhesive/Sealant with Torlon Adhesive Cutters ATC Surface Preparation Tool

If a Torlon Adhesive Cutter cannot be easily removed from the Torlon Adhesive Cutter Adapter follow the steps delineated below (Figure 17)

i. Using two combo flat wrenches – place one on the flat area of Torlon Adhesive Cutter and one on the flat area of the Torlon Adhesive Cutter adapter and turn to loosen (Fig 17(a)). Note: this process can be accomplished while the Torlon Adhesive Cutter Adapter is connected to ATC Surface Preparation Tool or disconnected from it (Fig 17(b)).

ii. Separate Torlon Adhesive Cutter from Adapter (Figure 17(c))



(a) (b) (c)

Figure 17. Removing Torlon Adhesive Cutters from the Torlon Adhesive Cutter Adapter ATC Surface Preparation Tool

3.1.5 Process for Removal of Bulk Sealant/Adhesive with Torlon Adhesive Cutters (T-handle) (Figure 18 and Figure 19)

Figure 18. T-Handle with Torlon Adhesive Cutter for Removal of Bulk Adhesive/Sealant

NOTE: Ensure the Torlon Adhesive Cutter cutting edges are sharp and in their as-manufactured configuration (Figure 14(a)) prior to use. See Section 3.1.3 for details on how to properly re-sharpen the Torlon Adhesive Cutter.

NOTE: If the Torlon Adhesive Cutter as-manufactured configuration is not restored, the effectiveness of for the cutter will be diminished and the nutplate bond area will not be cleared of residual adhesive. This will prevent the new nutplate from properly seating on the structure during the nutplate bond process and will result in premature nutplate failure.

i. Select the correct Torlon Adhesive Cutter based on the size of the replacement nutplate

For standard sized nutplate bases

Nutplate Size	Torlon Cutter	Part Number
CR3 (3/16”)	0.75” diameter cutter	TACS-C-1
CR4 (1/4”)	1” diameter cutter	TACS-C-2
CR5 (5/16”)	1” diameter cutter	TACS-C-2
CR6 (3/8”)	1.3” diameter cutter	TACS-C-4

For larger sized nutplate bases

Nutplate Size	Torlon Cutter	Part Number
CR3 (3/16”)	1” diameter cutter	TACS-C-2
CR4 (1/4”)	1.3” diameter cutter	TACS-C-4
CR5 (5/16”)	1.3” diameter cutter	TACS-C-4

ii. Select the proper mandrel diameter for the hole diameter in the affected area

1. Open Access to Nutplate Repair Area:

Hole Size	Mandrel Size	Part Number
0.190” – 0.249”	0.189” mandrel	STAC-M-3
0.250” – 0.312”	0.249” mandrel	STAC-M-4
0.313” – 0.374”	0.312” mandrel	STAC-M-5
0.375” – 0.410”	0.374” mandrel	STAC-M-6

2. Limited Access to Nutplate Repair Area (when fishing of the tools is required):

Hole Size	Mandrel Size	Part Number
0.190” – 0.249”	0.189” mandrel	TTAC-M-3
0.250” – 0.312”	0.249” mandrel	TTAC-M-4
0.313” – 0.374”	0.312” mandrel	TTAC-M-5
0.375” – 0.410”	0.374” mandrel	TTAC-M-6

a. Tether Attachment with Swivel Assembly (when fishing of the tools is required)

Nutplate Size	Part Number
CR3 (3/16”)	TACS-S-1
CR4 and Larger	TACS-S-2

CAUTION: Do **NOT** overtighten the Torlon Cutter onto the mandrel. Damage to cutter can occur.

iii. Insert mandrel into structure, chucked (Fig 19(b)) or un-chucked
iv. Attach the selected Torlon Adhesive Cutter to the end of the corresponding mandrel and hand tighten (Fig 19(b))
v. If the swivel is required, hand tighten it to the end of the mandrel
vi. If required, attach a tether to both ends and fish the cutter assembly to the nutplate location
vii. If tethered, remove tether and/or eyelet
viii. Ensure the cutting surfaces of the Torlon tool are facing the remnant materials on the structure (Fig 19(c))
ix. Pull back on the T-handle and activate the ratcheting mechanism (Fig 19(d)). Check the structure surface frequently to ensure no damage is being done.
x. Continue residual material removal until most of the remnant materials are removed (Fig 19(e)). A thin residual layer of adhesive may remain on the structure (i.e. a “ghosting layer”).

(a) (b) (c) (d) (e)

Figure 19. Removal of Bulk Adhesive/Sealant with Torlon Adhesive Cutters – T-Handle

xi. Using the provided combo flat wrench, remove the Torlon Adhesive Cutter from the mandrel in a similar fashion as described in Section 3.1.2 for the Drill Motor

xii. Go to Step 2 (Section 3.2) for Next Process Step

3.1.6 Process for Removal of Bulk Sealant/Adhesive with Torlon Adhesive Cutters in the Fish through Configuration (Figure 20)

i. Select the correct combination of mandrel segments for fishing the Torlon Adhesive Cutter through the structure. Note: usually the shortest length is what is best (i.e. segments 1 & 4) as this will allow for easier ingress and egress through the structure lighting holes (Fig 20).

ii. Attach the swivel and then the string at both ends to fish through the structure feeding the long end of the mandrel through the structure hole.

iii. Untie the string on the long end of the mandrel and insert into either the drill motor or the T-handle. Use as previously described.

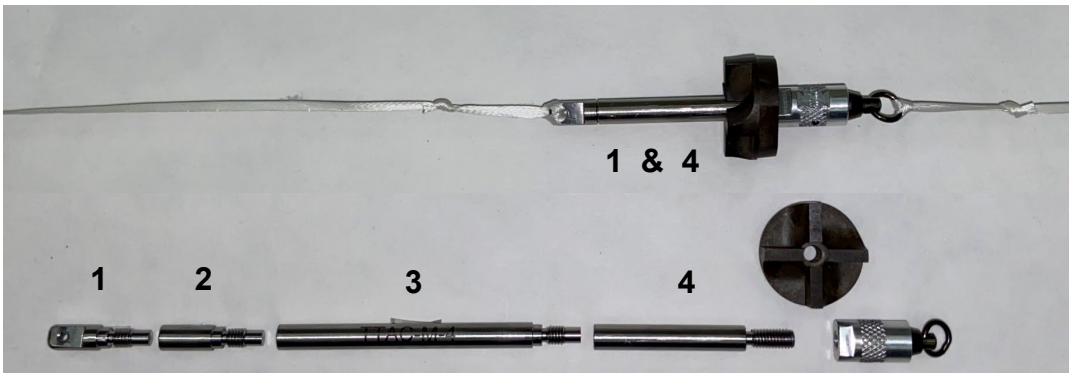


Figure 20. Segmented Mandrels in Standard Fish through Configuration with Torlon Adhesive Cutter (Use Shortest Length Possible to Ease Fishing through Tight Confines)

3.2 Step 2: Final Surface Preparation of Structure with Abrasive Pads

The process allows for three different methods for the final surface preparation of the structure for a new nutplate. For limited access areas, the only option may be to use the drill motor with an abrasive pad attached to a mandrel through the hole of the affected location (see Section 3.2.1). For nutplates near the edges of access covers/panels, the ATC Surface Preparation Tool with an abrasive pad may be a speedier option if these areas can be reached, i.e. if it is within the throat depth of this tool (see Section 3.2.2). This process shall only be used for metal surfaces. For composite surfaces, the T-handle shall be used (see Section 3.2.3).

CAUTION: Do **NOT** use abrasive pads in combination with drill motor or ATC Surface Preparation Tool to abrade composite surfaces. Doing so will cause serious damage to the aircraft structure requiring extensive repair.

3.2.1 Final Surface Preparation of Metallic Structure Surface with Abrasive Pads (Drill Motor) (Figures 21 – 24)

NOTE: Do not lubricate motor. Lubrication of the drill motor may lead to contamination of the bond surfaces.

NOTE: Do not operate the drill above 650 rpm. Melting of the abrasive pad will occur and contaminate the bond surface.

NOTE: For all pneumatic equipment, 90-100 psi is required.

i. Select the correct abrasive pad for the corresponding size of nutplate and tool to perform the abrasion (See Table II. Consumable Items – Abrasive Pads for Mandrels (Layer 1), Drill Motor and T-Handle (Layer 3))
ii. Select the proper mandrel diameter for the hole diameter in the affected area
    1. Open Access to Nutplate Repair Area:

Hole Size	Mandrel Size	Part Number
0.190” – 0.249”	0.189” mandrel	STAC-M-3
0.250” – 0.312”	0.249” mandrel	STAC-M-4
0.313” – 0.374”	0.312” mandrel	STAC-M-5
0.375” – 0.410”	0.374” mandrel	STAC-M-6

    2. Limited Access to Nutplate Repair Area (when fishing of the tools is required):

Hole Size	Mandrel Size	Part Number
0.190” – 0.249”	0.189” mandrel	TTAC-M-3
0.250” – 0.312”	0.249” mandrel	TTAC-M-4
0.313” – 0.374”	0.312” mandrel	TTAC-M-5
0.375” – 0.410”	0.374” mandrel	TTAC-M-6

    Tether Attachment with Swivel Assembly (when fishing of the tools is required):

Nutplate Size	Part Number
CR3 (3/16”)	TACS-S-1
CR4 or larger	TACS-S-2

iii. Thread an unused abrasive pad onto the mandrel – hand snug (Fig 21(b)).
iv. Press the trigger to start spinning the mandrel. While the pad is spinning, draw the abrasive pad towards the surface of the structure (Fig 21(c) and (Fig 21(d)). Abrade the surface until properly prepared – exposing metallic surface (Fig 21(e)). Dwell no longer than 10 seconds initially before checking level of adhesive removal and every 5 seconds thereafter. If the pad gets clogged, replace with a new pad.

(a) (b) (c) (d) (e)

Figure 21. Final Surface Preparation of Structure with Abrasive Pads (Metallic Structure only) Drill Motor – Standard and Segmented Mandrel

v. Clean the surface using DYSOL solvent DS-104 or DS-108 saturated AMS 3819 cloth (Fig 22(b)). Note: if in a limited access area (when fishing of the tools is required), fabrication of unique wipers will be necessary (Fig 23) to follow the process below (bottle brushes will not be used in a fish through scenario).

NOTE: Wipe in one direction (e.g. clockwise)

vi. Clean the inside of the hole with DYSOL solvent DS-104 or DS-108 soaked bottle brush (Fig 22 (c)). This can reduce the number of wipes required to obtain a clean surface. Note: utilize one bottle brush per task.

vii. Wipe the surface clean using DYSOL solvent DS-104 or DS-108 saturated AMS 3819 cloth (Fig 22(d))

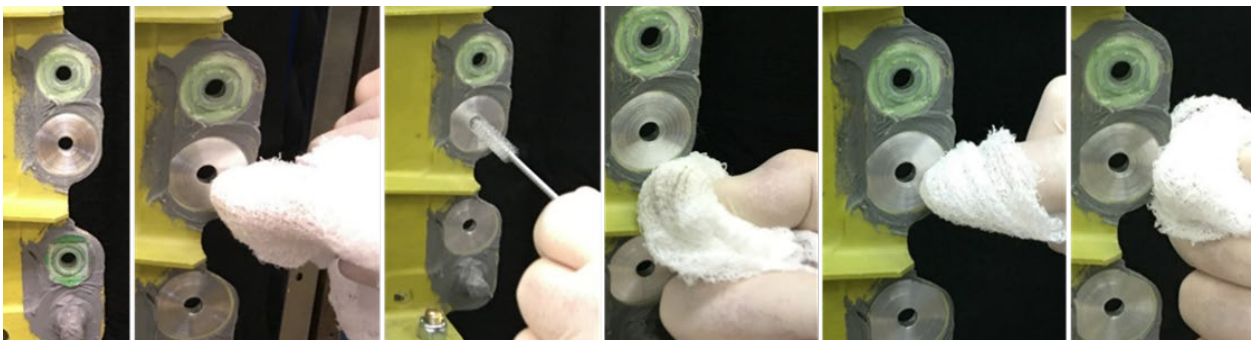
viii. While the surface is still wet with solvent, wipe the surface dry with a dry AMS 3819 (Fig 22(e))

ix. Check that the cloth is visibly clean (Fig 22(f)). If not, repeat sub-steps “vii” and “viii” until the wiper comes away clean.

x. Where access allows, verify the readiness of the structure for bonding by measuring with the Surface Analyst per Appendix B. The cleaning procedure (steps iii – viii), can be repeated to achieve an acceptable water contact angle with the Surface Analyst. For instruction on use of the Surface Analyst, see Appendix B.

xi. After preparation of the aircraft structure, proceed to Step 3 (Section 3.3)

NOTE: This process may require the use of several pads to completely remove residual materials



(a) (b) (c) (d) (e) (f)

Figure 22. Cleaning Abraded Area

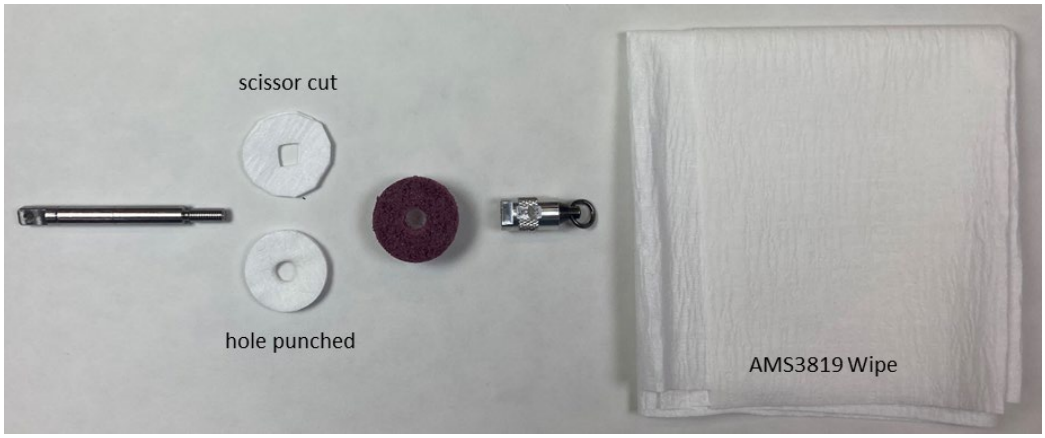


Figure 23. Fabrication of Limited Access Wipes

Wipes for cleaning of restricted/limited access nutplate bond structure area can be hole punched or cut from approved AMS3819 wipes

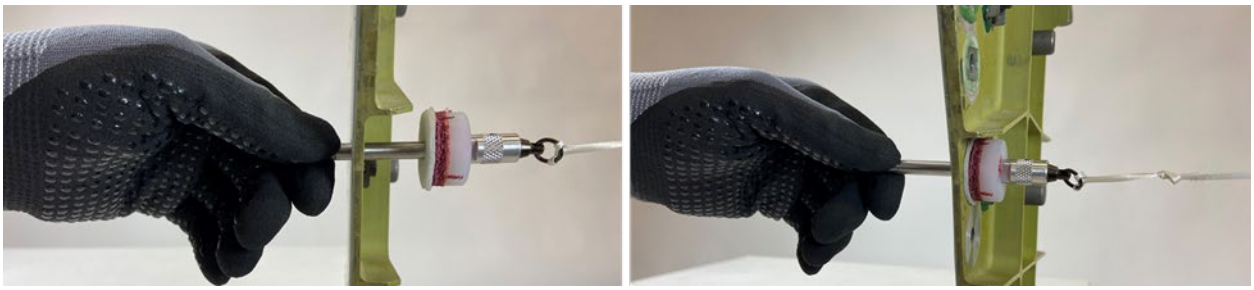


Figure 24. Cleaning the Abraded Surface for Limited Access Areas

Utilizing an abrasive pad as a backing for the modified AMS3819 wipes – wipe until the wipe shows no presence of debris

3.2.2 Final Surface Preparation of Metallic Structure with Abrasive Pads (ATC Surface Preparation Tool) (Figure 25)

CAUTION: Do **NOT** use abrasive pads in combination with ATC Surface Preparation Tool to abrade composite surfaces. Doing so will cause serious damage to the aircraft structure requiring extensive repair. See Section 3.2.3 for how to abrade composite structure safely with abrasive pads attached to mandrels and chucked into the T-handle (Figure 26).

NOTE: Confirm that the ATC Surface Preparation Tool is in proper alignment before use. When properly aligned the locating button will center on the Torlon Adhesive Cutter and just barely touch it when the tool is activated (but not on the structure). If the locating button and Torlon Adhesive Cutter are not aligned, the cutter will not center on the fastener hole and thus it will not remove the adhesive/sealant in the footprint of the new nutplate. This will prevent the nutplate from properly seating on the structure and will lead to premature nutplate failure. See Appendix A or alignment adjustment.

NOTE: Do not lubricate ATC Surface Preparation Tool. Lubrication of the tool may cause contamination of the faying surface.

NOTE: For all pneumatic equipment, 90-100 psi is required

i. Using the ATC Surface Preparation Tool with the quick change adapter, select the abrasive pad that corresponds to the same diameter Torlon Adhesive Cutter used (See Table II. Consumable Items – Abrasive Pads for ATC Surface Prep Tool (Layer 2))
   ATC Surface Preparation Tool
   a. CR3 (3/16”) nutplate –0.75” diameter abrasive pad
   b. CR4 (1/4”) or CR5 (5/16”) – 1” diameter abrasive pad
   c. CR6 (3/8”) – 1.3” diameter abrasive pad

ii. Select the proper locating buttons for the corresponding hole:
   1. CR3 locating buttons for hole sizes 0.190” – 0.249”
   2. CR4 locating buttons for hole sizes 0.250” – 0.312”
   3. CR5 locating buttons for hole sizes 0.313” – 0.374”
   4. CR6 locating buttons for hole sizes 0.375” and up
   And attach locating button to ATC Surface Preparation Tool (Fig 25(a))

iii. Attach the abrasive pad to the ATC Surface Preparation Tool (Fig 25(a))

iv. Press the trigger to start the abrasive pad spinning and the tool will clamp on to the structure (Fig 25(b) and (c)). Additional pressure can be added by clamping with hand (see Fig 25(d)).

v. Abrade the surface until all residual adhesive is removed (see Fig 25(e)). If no adhesive was on the surface at the beginning, then abrade until the abrasion creates a new abrasion pattern on the structure surface. If the pad gets clogged, replace with a new pad.

NOTE: Several pads may be required to achieve the proper amount of abrasion

vi. Clean the surface using DYSOL solvent DS-104 or DS-108 saturated AMS 3819 cloth (Fig 22(b))

vii. Clean the inside of the hole with DYSOL solvent DS-104 or DS-108 soaked bottle brush (Fig 22(c))

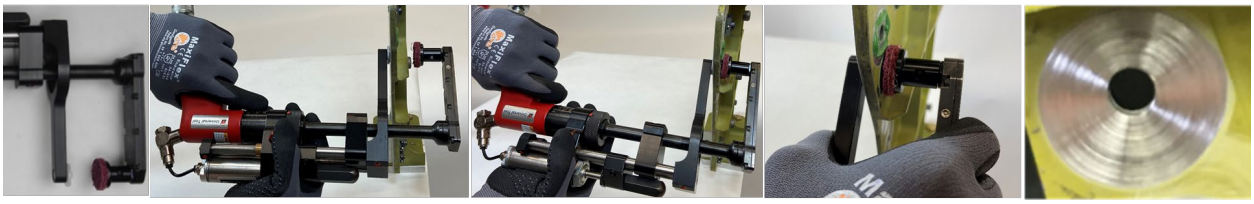
viii. Wipe the surface clean using DYSOL solvent DS-104 or DS-108 saturated AMS 3819 cloth (Fig 22(d))

ix. While the surface is still wet with solvent, wipe the surface dry with a dry AMS 3819 (Fig 22(e))

x. Check that the cloth is visibly clean (Fig 22(f)). If not, repeat sub-steps “viii” and “ix” until the wiper comes away clean.

xi. When access allows, verify the readiness of the structure for bonding by measuring with the Surface Analyst per Appendix B. The cleaning procedure (steps iii – x), can be repeated to achieve an acceptable water contact angle with the Surface Analyst. For instruction on use of the Surface Analyst, see Appendix B.

xii. After preparation of the aircraft structure, proceed to Step 3 (Section 3.3)



(a) (b) (c) (d) (e)

Figure 25. Final Surface Preparation of Structure with Abrasive Pads (Metallic Structure only) ATC Surface Preparation Tool

3.2.3 Final Surface Preparation of Composite Structure Surface with Abrasive Pads (T-handle) In Standard or Segmented Mandrel Configuration (Figure 26)

NOTE: Abrasive pads attached to mandrels and chucked into the T-handle shall be used to prepare composite surfaces for bonding

i. Insert mandrel into structure, chucked (Fig 26(b)) or un-chucked
ii. Attach the selected abrasive pad (See Table II. Consumable Items – Abrasive Pads for Mandrels (Layer 1), Drill Motor and T-Handle (Layer 3)) to the end of the corresponding mandrel and hand tighten. Ensure the abrasive surface of the pad is facing the remnant materials on the structure (Fig 26(b)).
iii. Pull back on the T-handle and activate the ratcheting mechanism to abrade the structure (Fig 26(d)). Check the structure surface frequently to ensure no damage is being done.
iv. Continue residual material removal until most of the remnant materials are removed (Fig 26(e)). Note that traces of coatings, adhesives, and sealant should be gone, but avoid abrading into carbon fibers.
v. Clean the surface using DYSOL solvent DS-104 or DS-108 saturated AMS 3819 cloth (process is the same as previously described in Section 3.2.1 (Fig. 22) for metallic structure). If in a limited access area (when fishing of the tools is required), fabrication of unique wipers will be necessary (Fig 23) to follow the process depicted in Fig 24 (bottle brushes will not be used in a fish through scenario).
vi. Clean the inside of the hole with DYSOL solvent DS-104 or DS-108 soaked bottle brush (Fig 22(c)). This can reduce the number of wipes required to obtain a clean surface. Note: Utilize one bottle brush per task.
vii. Wipe the surface clean using DYSOL solvent DS-104 or DS-108 saturated AMS 3819 cloth (Fig 22(d))
viii. While the surface is still wet with solvent, wipe the surface dry with a dry AMS 3819 (Fig 22(e))
ix. Check that the cloth is visibly clean (Fig 22(f)). If not, repeat sub-steps “vii” and “viii” until the wiper comes away clean.
x. Where access allows, verify the readiness of the structure for bonding by measuring with the Surface Analyst per Appendix B. The cleaning procedure (steps iii – viii), can be repeated to achieve an acceptable water contact angle with the Surface Analyst. For instruction on use of the Surface Analyst, see Appendix B.
xi. After preparation of the aircraft structure, proceed to Step 3 (Section 3.3)

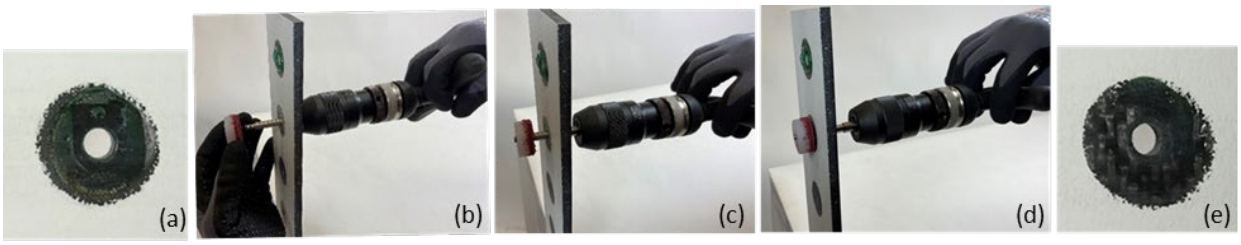


Figure 26. Final Surface Preparation of Composite Structure with Abrasive Pads (T-Handle) Standard or Segmented Mandrel Configuration

3.3 Step 3: Nutplate Preparation

Use of the Rotatory Abrasion Tool (RAT) or the Nutplate Abrasion Tool (NAT) is acceptable for the preparation of the nutplate surfaces for bonding

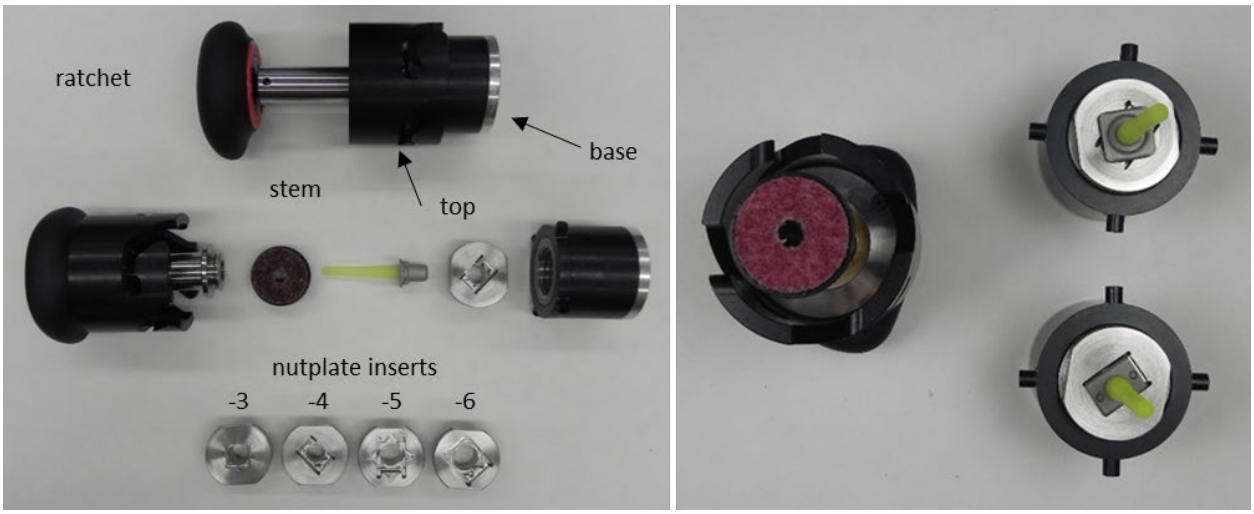
NOTE: Do not touch the surface of the abrasive pad

3.3.1 Process for Preparation of Nutplates with Rotary Abrasion Tool (RAT) (Figure 27- Figure 29)

i. Thread an unused abrasive pad that correlates to the size of the nutplate being installed onto the RAT stem (Fig 28(a) and (b)) (See Table II. Consumable Items – Abrasive Pads for RAT or NAT (Layer 3 or Stand-a-Lone NAT Kit))
ii. Thread the RAT Insert that matches the size of the nutplate base being installed onto the RAT base (Fig 28(c))

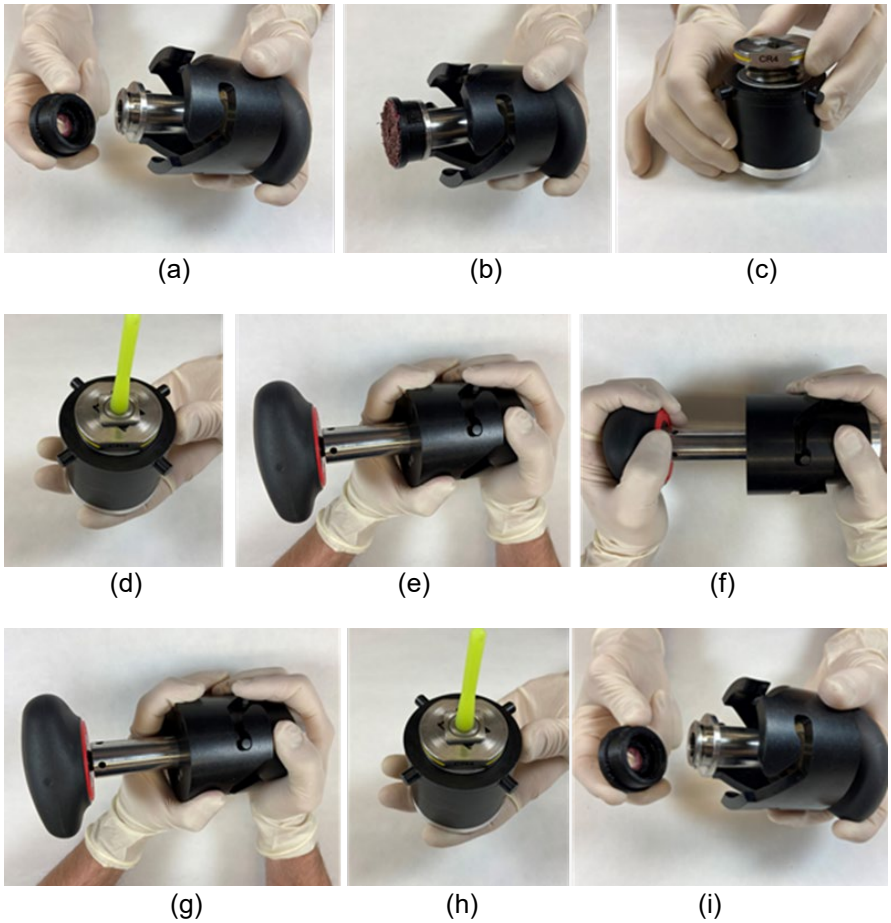
Nutplate Size	Nutplate Base Size	Insert Size
CR3 (3/16”)	Standard	3
CR4 (1/4”)		4
CR5 (5/16”)		5
CR6 (3/8”)		6
CR3 (3/16”)	Larger than Standard (Oversized)	4
CR4 (1/4”)		5
CR5 (5/16”)		6

iii. Seat nutplate into RAT insert (Fig 28(d))
iv. Press and lock RAT top onto the base (Fig 28(e))
v. Using the ratchet, rotate the RAT stem clockwise 15 revolutions (Fig 28(f)). Observe the red line indicator to ensure that all 15 revolutions have been met.
vi. Separate RAT top from base (Fig 28(g))
vii. Ensure nutplate is properly seated in RAT insert (Fig 28(h))
viii. Discard the abrasive pad (Fig 28(i)). If the abrasion pad is difficult to remove, change the direction of the ratchet to counter clockwise to assist with removal. Be sure to return the ratchet direction back to clockwise.
ix. Verify surface is ready for bonding using the Surface Analyst. (See Appendix B)
x. Repeat steps b through i until an acceptable water contact angle is achieved
xi. After preparation of the nutplate is complete, follow standard practice for nutplate installation, curing the adhesive, touching up finishes, and applying sealant as required



(a) (b)

Figure 27. Rotary Abrasion Tool (RAT) (a) Exploded view (b) Top view



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 28. Operation of the Rotary Abrasion Tool (RAT)

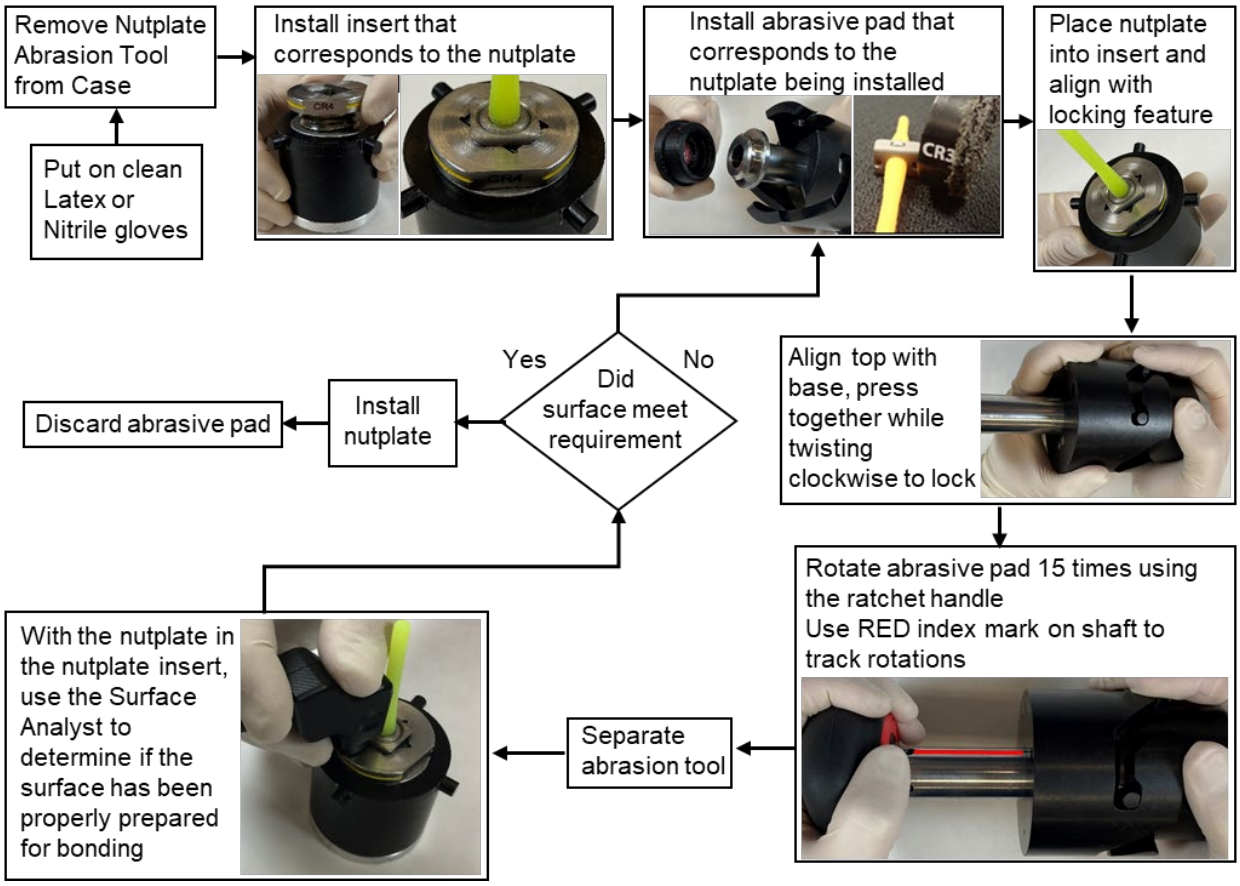


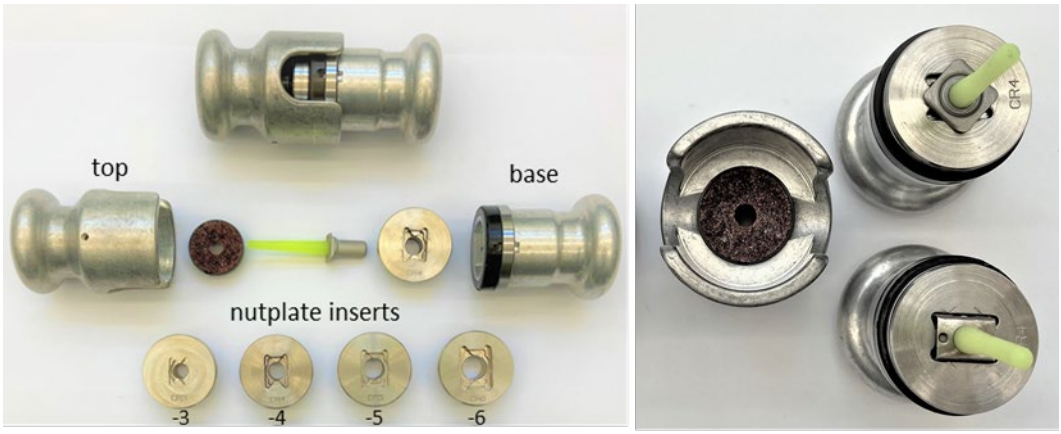
Figure 29. Rotary Abrasion Tool (RAT) Process Flow Utilization – Progression of Nutplate Surface Preparation for Bonding

3.3.2 Process for Preparation of Nutplates with Nutplate Abrasion Tool (NAT) (Figure 30 thru Figure 32)

i. Align flats on an unused abrasive pad with flats in the NAT top and snap into place (Fig 31 (a) and (b)) (See Table II. Consumable Items - Abrasive Pads for RAT or NAT (Layer 3 or Stand-a-Lone NAT Kit))

Nutplate Size	Nutplate Base Size	Insert Size
CR3 (3/16”)	Standard	3
CR4 (1/4”)		4
CR5 (5/16”)		5
CR6 (3/8”)		6
CR3 (3/16”)	Larger than standard (Oversized)	4
CR4 (1/4”)		5
CR5 (5/16”)		6

ii. Snap the nutplate insert that matches the size of the nutplate being installed into the NAT base (Fig 31(c))
iii. Seat nutplate into cavity of the nutplate insert (Fig 31(d))
iv. Align top with base, press together (Fig 31(e))
v. Oscillate the abrasive pad back and forth 15 times by rotating the NAT top and base back and forth (Fig 31(f))
vi. Separate NAT top from base (Fig 31(g))
vii. Ensure nutplate is properly seated in the nutplate insert (Fig 31(h))
viii. Discard the abrasive pad (Fig 31(i))
ix. Verify surface is ready for bonding using the Surface Analyst (See Appendix B)
x. Repeat steps n through t until an acceptable water contact angle is achieved
xi. After preparation of the nutplate is complete, follow standard practice for nutplate installation, curing the adhesive, touching up finishes, and applying sealant as required.



(a) (b)

Figure 30. Nutplate Abrasion Tool (NAT) (a) Exploded view (b) Top view

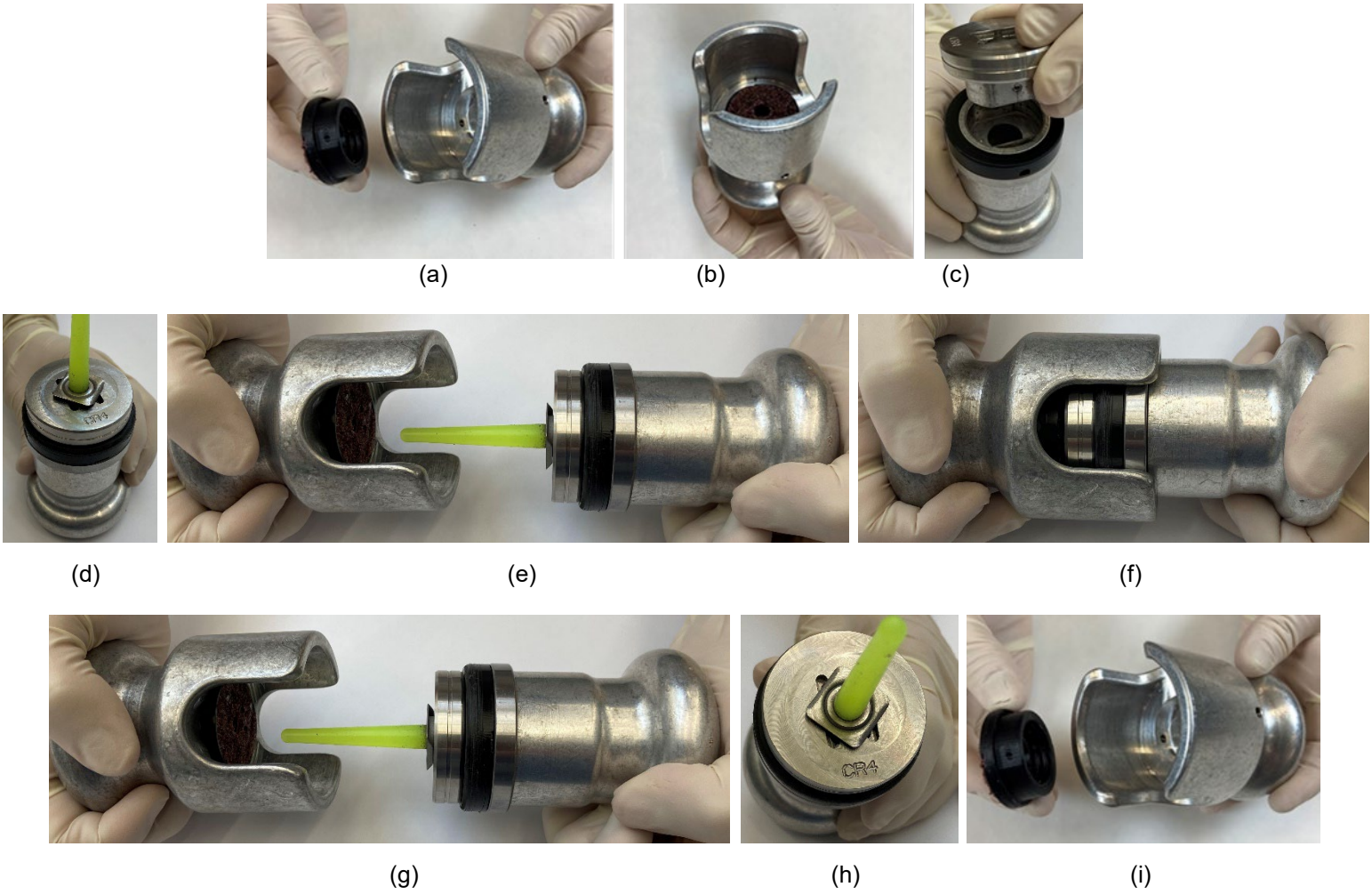


Figure 31. Operation of the Nutplate Abrasion Tool (NAT)

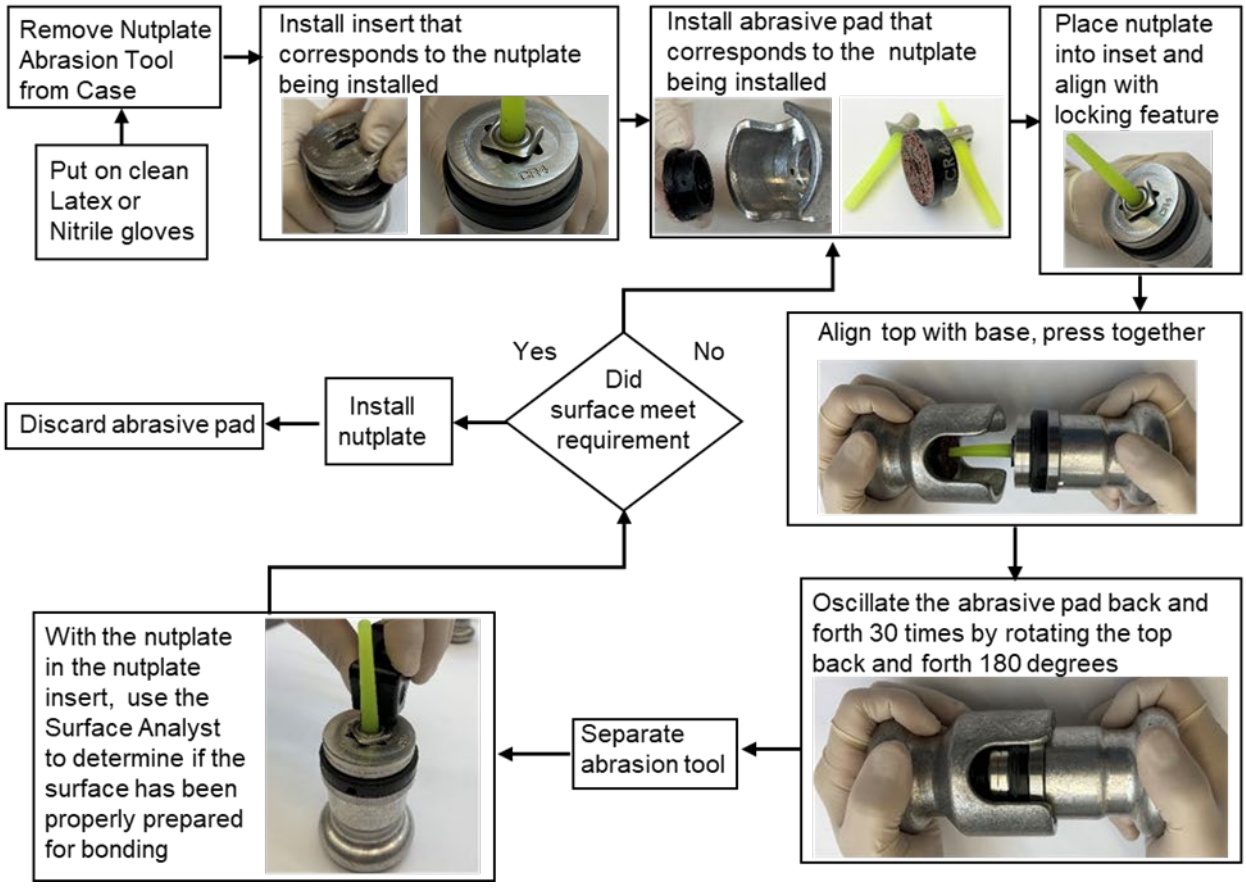


Figure 32. Nutplate Abrasion Tool (NAT) Process Flow Utilization – Progression of Nutplate Surface Preparation for Bonding

Appendix A

Re-alignment of the ATC Surface Preparation Tool

i. Align spindle lock hole with hole in the L foot spindle and L foot spindle tube (Fig A-1(a))
ii. Insert Spindle Lock/Alignment Tool and remove Spindle Quick Change Adapter (left hand threads) (Fig A-1(b))
iii. Remove Alignment/Spindle Lock Tool (Fig A-1(c))
iv. Loosen socket head cap screws on L foot clamp (bottom plate) and loosen knurled jam nut (slightly) where shaft meets the pneumatic tool and align transfer housing and L foot (Fig A-1(d))
v. Thread Spindle Lock/Alignment Tool into L foot and through Transfer Housing and tighten socket head cap screws 1/4 turn, alternating as to assure an even draw down, until tight and then tighten knurled jam nut (Fig A-1(e))
vi. Remove Alignment/Spindle Lock Tool (verify alignment of transfer housing and L foot) (Fig A-1(f))
vii. Align spindle lock hole with hole in the L foot spindle and L foot spindle tube and insert Spindle Lock/Alignment Tool (Fig A-1(g))
viii. Install Spindle Quick Change Adapter (left hand threads) (Fig A-1(h))
ix. Remove Alignment/Spindle Lock Tool (Fig A-1(i))

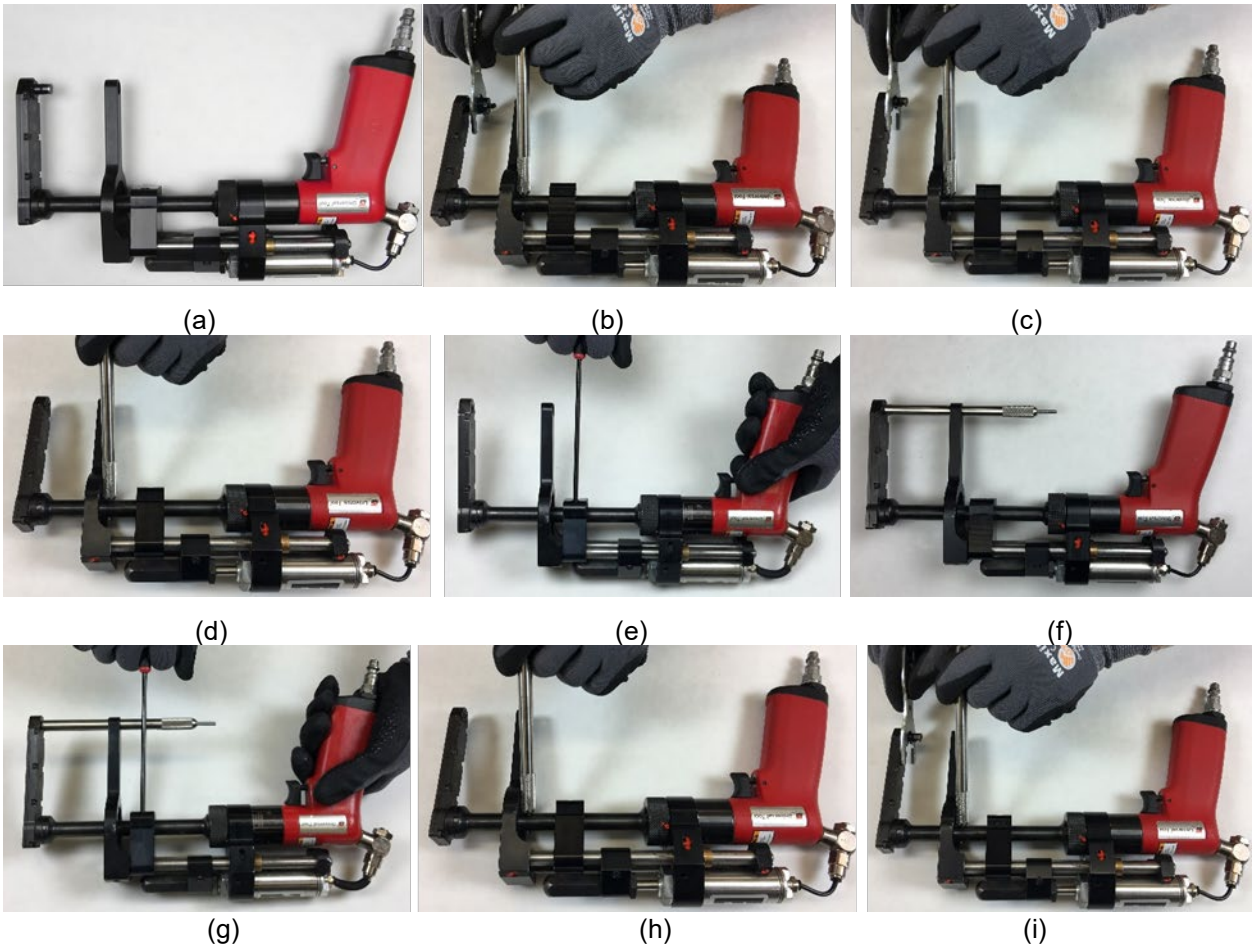


Figure A-1. Steps for Proper Re-alignment of ATC Surface Preparation Tool

Appendix B

Use of the Surface Analyst (SA)

Review Figures B-1 – B-4 for familiarization with the Surface Analyst

i. Press one of the On/Accept buttons (green check marks) until the LED status lights turn on
    1. There is an initial warm-up time of up to 3-minutes
    2. A prime shot will be required if the instrument has been idle

ii. Complete Performance Check when prompted

NOTE: Wear gloves while handling the Performance Check Surface (PCS) card. Do not touch the yellow target areas.

    1. Follow the prompts on the screen
    2. Once a “Check Passed” is achieved, proceed

iii. Select the correct surface profile (see Figure B-5)

NOTE: Ensure the contact surface of the inspection head is clean

iv. Take a measurement (see Figure B-6)
    1. Place the inspection head squarely onto area to be measured. Make sure the inspection head sits flush and is stable on the surface.

NOTE: Do not move the inspection head while taking a measurement or a faulty measurement will result

    2. Press one of the On/Accept buttons (green check marks)

NOTE: The water cartridge has a capacity for 1,000 measurements. The screen displays the number of measurements made with that water cartridge. After 1,000 measurements, the water cartridge shall be replaced.

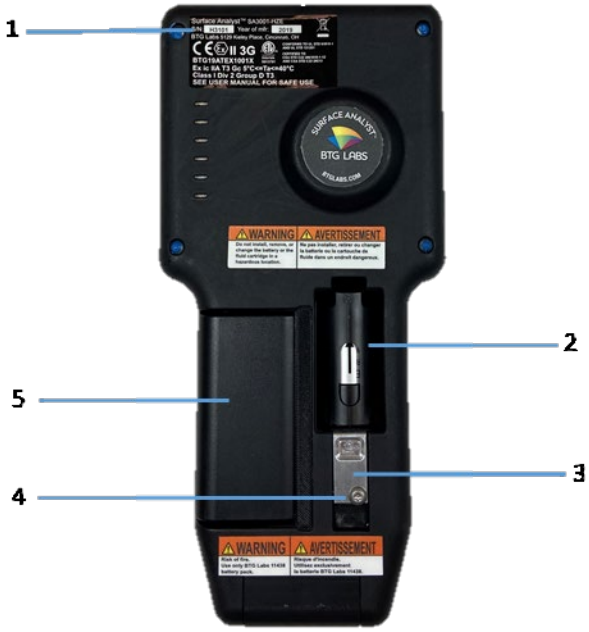
v. Drop Detection
    1. After a measurement is made, the Surface Analyst will detect and trace the outline of the water droplet
    2. Using Figures B-7 – B-8, determine if the drop detection is acceptable (i.e. “OK”)
        a. If the drop detection is acceptable (i.e. “OK”), press one of the On/Accept buttons (green check marks)
        b. If the drop detection is not acceptable (i.e. not “OK”), press one of the Reject buttons (red X marks)

vi. Instrument Reading
    1. The acceptable water contact angles are below:
        a. Metal – 20° - 50° (Ti-6Al-4V and 2000 & 7000 series Al)
        b. Nutplate – 20° - 50° (A286 SS)
        c. Composite – 20° - 40° (carbon fiber/5250-4 and carbon fiber/977-3)

Figure B-1. Surface Preparation Verification Kit – SA3001-HZE

1	Tether	6	Reject buttons
2	Touchscreen	7	Foot of inspection head
3	On/Accept buttons	8	Wrist strap anchor
4	Indicator lights	9	Inspection head
5	Wrist strap		

Figure B-2. Front View - Surface Analyst Features



1	Surface Analyst serial number	4	Lockout screw
2	Cartridge bay	5	Battery
3	Cartridge release lever		

Figure B-3. Back View - Surface Analyst Features

1	Battery release button
2	Power jack

Figure B-4. Side View - Surface Analyst Features

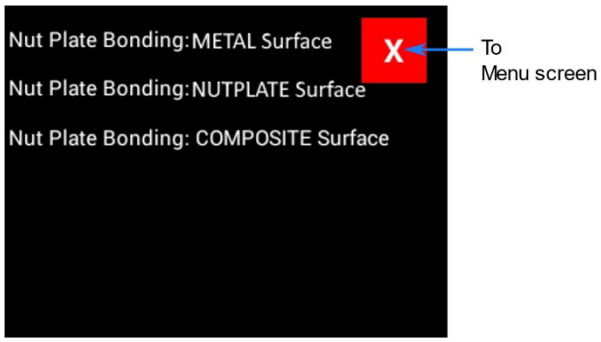


Figure B-5. Profile Menu

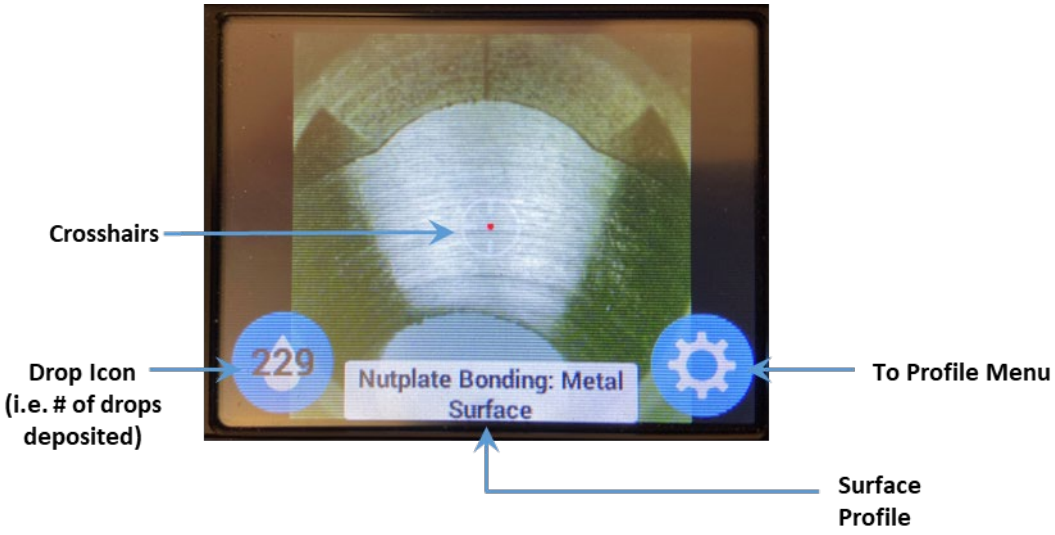


Figure B-6. Measurement Screen for Nutplate Bonding on Metallic Aircraft Structure

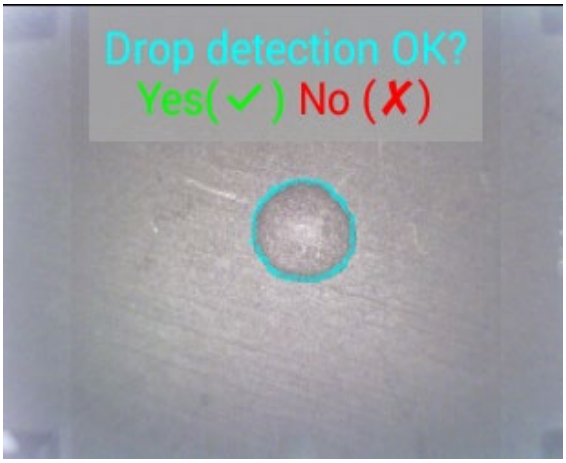


Figure B-7. Example of Acceptable Drop Detection

By looking at the location of the blue dots, if the blue dots outline the edge of the water droplet, then the Surface Analyst has detected the edge of the water droplet well, therefore the response to the "Drop detection OK?" is "Yes (✓)". Press one of the On/Accept buttons (green check marks).

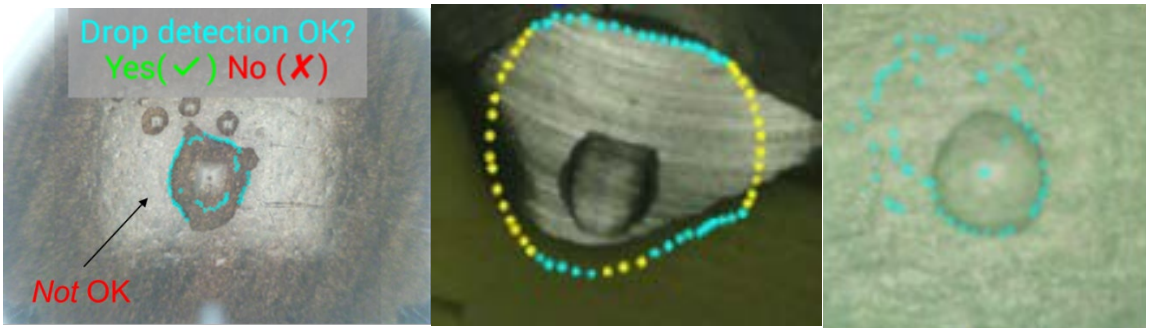


Figure B-8. Example of Unacceptable Drop Detection

By looking at the location of the blue dots, if the blue dots do not outline the edge of the water droplet, then the Surface Analyst has not detected the edge of the water droplet well, therefore the response to the “Drop detection OK?” is “No (×)”. Press one of the Reject buttons (red x marks).

Appendix C

Additional Surface Preparation Tool Kit Configurations

Figure C-1. Compact Surface Preparation Kit (2 Layer)
EnduroSharp® Part Number: ESNSP-LA-003

The 2 Layer Compact Surface Preparation Kit is an abbreviated version of the 4 layer Surface Preparation Kit – it does not include the air hose (with adapter) and replaces the NAT for the RAT. It is smaller in size (24.25” x 19.43” x 8.68”) than the 4 layer Surface Preparation Kit and lighter in weight.

Figure C-2. Fly Away Compact Surface Preparation Kit (2 Layer)
EnduroSharp® Part Number: ESNSP-FA-002

The Fly Away Compact Surface Preparation Kit is also an abbreviated version of the 4 layer Surface Preparation Kit but does not include the air hose (with adapter), the ATC Surface Preparation Tool (and associated Torlon Adhesive Cutter Kit), and replaces the NAT for the RAT. It is significantly smaller in size (19.17” x 12.80” x 6.89”) than the 4 layer Surface Preparation Kit and lighter in weight.

Figure C-3. Nutplate Abrasion Tool (NAT)
EnduroSharp® Part Number: ESNAT-1

The NAT consist of 1 aluminum upper handle (top), 1 aluminum lower handle (base) and 4 nutplate base inserts (CR3, CR4, CR5, and CR6).