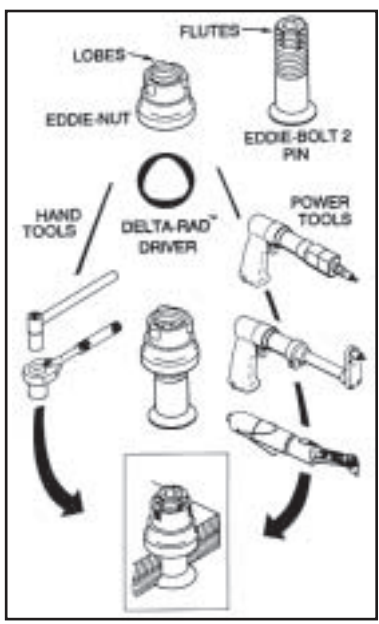
HOWMET AEROSPACE

Eddie-Bolt® 2 Fastening System

PROCESS MANUAL

INTRODUCTION

The Eddie-Bolt® 2 is a high-performance aerospace fastening system. The Eddie-Pin™ is designed with five flutes in the upper portion of the threaded area which allow a positive mechanical lock to be made during installation with the free-running Eddie-Nut™. Three external lobes on the Eddie-Nut™ serve as driving lands. During installation, the Delta-Rad™ driver, with its internal three-sided shape, fits over the three external lobes of the Eddie-Nut™. Torque is applied and, upon reaching the required clamp load, the lobes automatically deform into and across the flutes of the Eddie-Pin™ to form a positive mechanical lock and complete the Foreign Object Debris (FOD) – free installation.



The purpose of this manual is to provide general guidelines regarding the use of the Eddie-Bolt® 2 fastening system.
In the event of conflict between this manual and the user's company policies, the user should refer to his/her own company's policies.

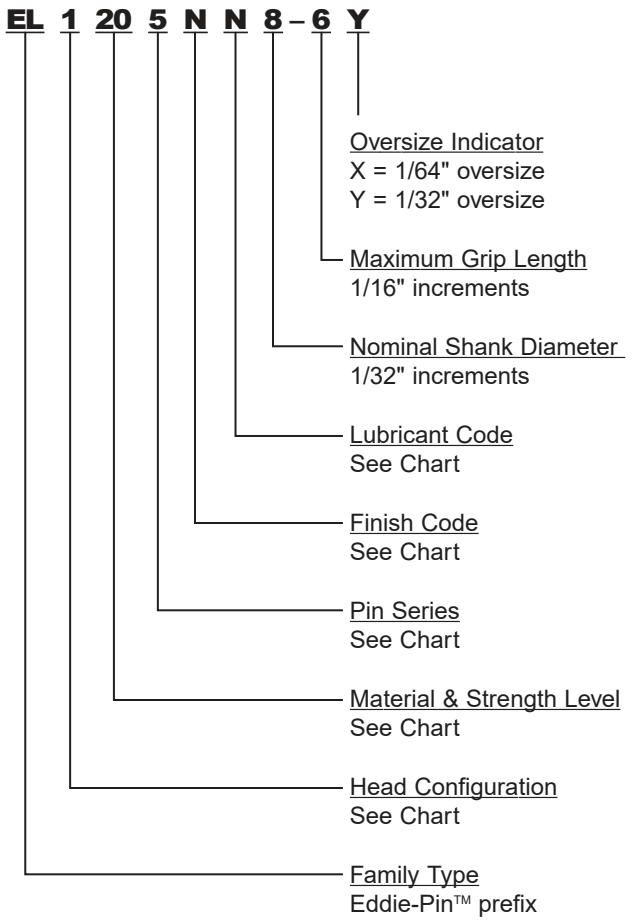
ANATOMY OF THE Eddie-Bolt® 2 FASTENING SYSTEM

Eddie-Nut™

Eddie-Pin™

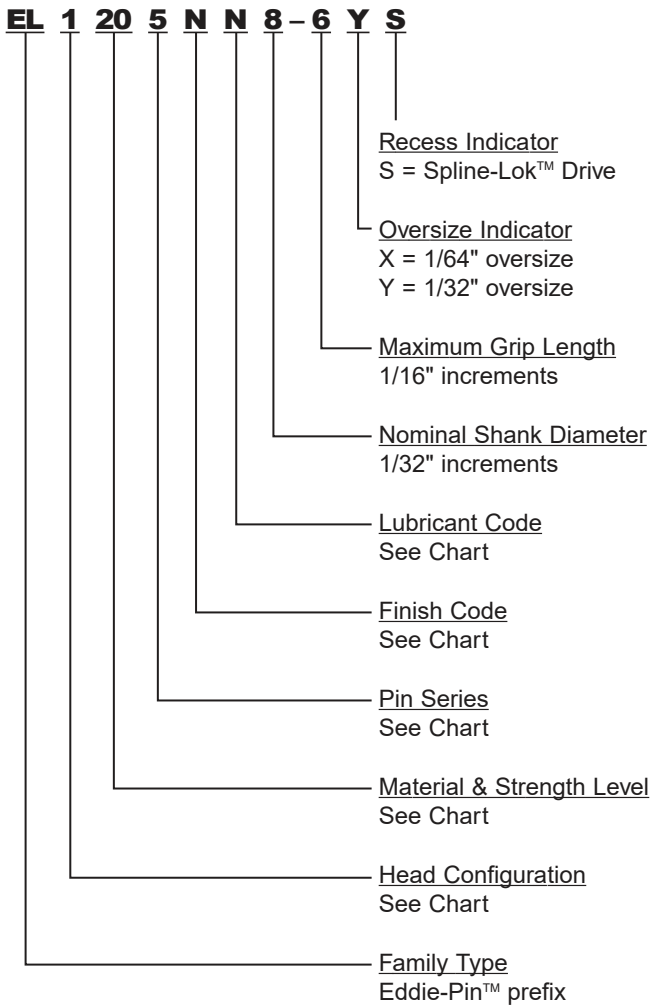
PART NUMBER SYSTEM

Eddie-Pin™ Part Number Code Example
(Hex Recess):



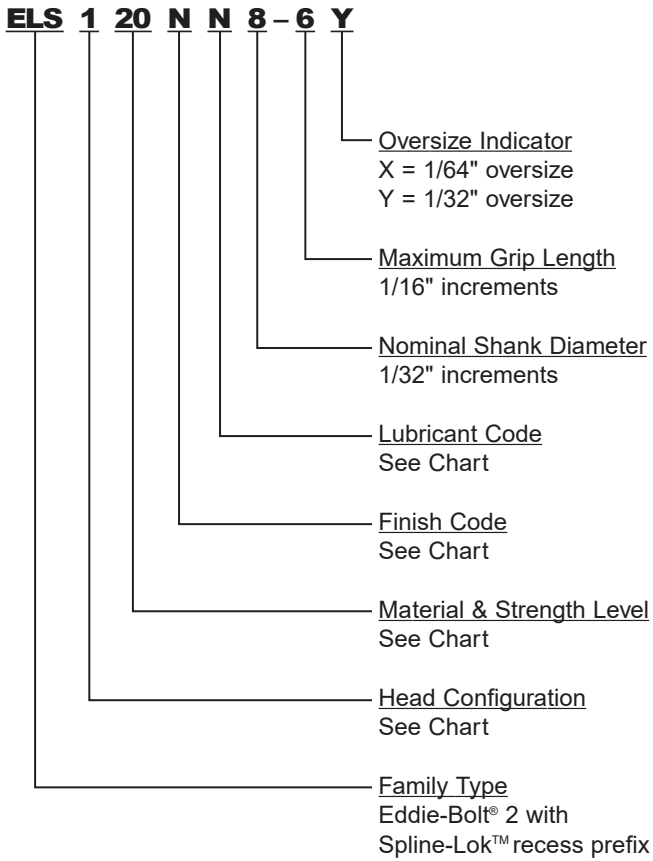
PART NUMBER SYSTEM

Eddie-Pin™ Part Number Code Example
(Spline-Lok™ Recess):



PART NUMBER SYSTEM

Eddie-Pin™ Part Number Code Example
(Spline-Lok™ Recess)(New Numbering System):



PART NUMBER SYSTEM

Eddie-Pin™ Part Number Code Designations:

HEAD CONFIGURATIONS	
1	100º Reduced Flush Shear Head
2	Protruding Shear Head
3	100º Flush Tension Head
31	100º Flush Tension Head, .007 Oversize Head
32	100º Flush Tension Head, .014 Oversize Head
33	100º Flush Tension Head, 6-Lobe Recess
4	Protruding Tension Head
5	Flush MS20426 Head
6	100º Reduced Crown Shear Head
7	100º Crown Tension Head
8	Crown MS20426 Head
9	Self-Sealing Head
90	130º Flush Shear Head
91	120º Flush Shear Head
92	100º Flush Shear Head
93	130º Crown Shear Head

MATERIAL & STRENGTH LEVEL		
10	Alloy Steel	95 KSI Shear
20	6Al-4V Titanium	95 KSI Shear
30	A-286 CRES	95 KSI Shear
35	Inconel 718	108 KSI Shear
38	Inconel 718	125 KSI Shear
40	Ph13-8Mo	125 KSI Shear

PART NUMBER SYSTEM

Eddie-Pin™ Part Number Code Designations:

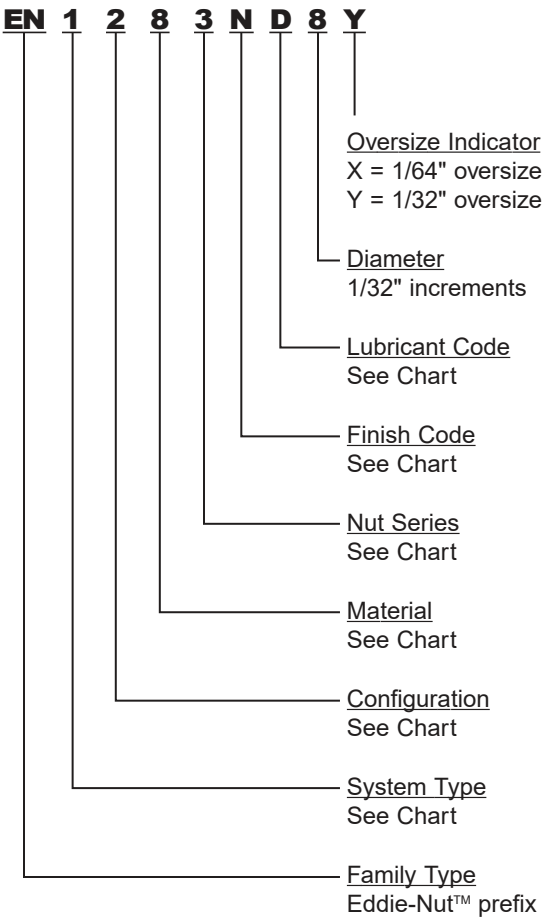
	PIN SERIES
3	Generic (Unlubricated Pin System)
5	Generic (Lubricated Pin System)

	FINISH CODES
A	Anodize per ISO 8080
E	Phosphate Fluoride Treat Per AMS 2486
H	8G (Incotec Corp.) Aluminum Coat per AFS Spec PS103
N	Titanium: No Finish CRES & Inconel: Passivate per AMS-QQ-P-35
P	Cadmium Plate, Type II, Class 2 per AMS-QQ-P-416
V	IVD Aluminum Coat, Type II, Class 3 per MIL-DTL-83488
W	IVD Aluminum Coat, Type I, Class 3 per MIL-DTL-83488

	LUBRICANT CODES
C	Cetyl Alcohol Lube per Mil-L-87132, Type III
D	Titanium: Pretreat with ANN-RO #1012 per Kalgard Spec. A-R 1012 and Dry Film Lube per AS5272, Type I CRES & Inconel: Dry Film Lube per AS5272, Type I
F	Dry Film Lube per AS5272, Type I (shank and head only) and Cetyl Alcohol Lube per Mil-L-87132, Type III, Grade B
G	Dry Film Lube per AS5272, Type I and Cetyl Alcohol Lube per Mil-L-87132, Type III, Grade B
N	No Lube

PART NUMBER SYSTEM

Eddie-Nut™ Part Number Code Example:



PART NUMBER SYSTEM

Eddie-Nut™ Part Number Code Designations:

	SYSTEM TYPE
1	Shear Application
2	Tension Application

	CONFIGURATION
1	Standard Base
2	Captive Washer
3	Self-Aligning
4	Self-Sealing

	MATERIAL
0	7175-T73 or 7075-T73 Aluminum Alloy
3	A-286 CRES
8	3Al-2.5V Titanium

	NUT SERIES
3	Generic (Unlubricated Pin System)
5	Generic (Lubricated Pin System)

PART NUMBER SYSTEM

Eddie-Nut™ Part Number Code Designations:

	FINISH CODES
C	Chemical Conversion Coating per MIL-C-5541, Type 1A
N	Titanium: No Finish CRES: Passivate per AMS-QQ-P-35

	LUBRICANT CODES
C	Cetyl Alcohol Lube per Mil-L-87132, Type I or Type III
D	Titanium: Dry Film Lube per AS5272, Type I CRES: Dry Film Lube per AS5272, Type I
R	Dry Film Lube per MIL-L-23398 (EM Permaslik “G” only)

NOTE: Unless otherwise specified on the applicable standard, specification, or other controlling document (such as the customer's P.O.), all Eddie-Nuts™ may be lubricated, at manufacturer's option, with cetyl alcohol per MIL-L-87132, Type I or Type III.

RECOMMENDED HOLE DIAMETERS

Hole Diameters for Nominal Diameter Fasteners					
Nominal Fastener Dash No.	Nominal Diameter	Clearance Fit	Close Ream	Transition Fit	Interference Fit
-5	5/32	0.167 0.164	0.1645 0.1635	0.164 0.161	0.1615 0.1595
-6	3/16	0.193 0.190	0.1905 0.1895	0.190 0.187	0.1875 0.1855
-8	1/4	0.253 0.250	0.2505 0.2495	0.250 0.247	0.2475 0.2455
-10	5/16	0.315 0.312	0.3130 0.3120	0.313 0.309	0.3100 0.3080
-12	3/8	0.378 0.375	0.3755 0.3745	0.375 0.371	0.3725 0.3705

Hole Diameters for First Oversize (1/64") Diameter Fasteners					
Nominal Fastener Dash No.	Nominal Diameter	Clearance Fit	Close Ream	Transition Fit	Interference Fit
-6	13/64	0.206 0.203	0.2036 0.2026	0.203 0.200	0.2006 0.1986
-8	17/64	0.269 0.266	0.2661 0.2651	0.266 0.263	0.2631 0.2611
-10	21/64	0.331 0.328	0.3286 0.3276	0.328 0.325	0.3256 0.3236
-12	25/64	0.394 0.391	0.3911 0.3901	0.391 0.388	0.3881 0.3861

Hole Diameters for Second Oversize (1/32") Diameter Fasteners					
Nominal Fastener Dash No.	Nominal Diameter	Clearance Fit	Close Ream	Transition Fit	Interference Fit
-6	7/32	0.222 0.219	0.2192 0.2182	0.219 0.216	0.2162 0.2142
-8	9/32	0.284 0.281	0.2817 0.2807	0.281 0.278	0.2787 0.2767
-10	11/32	0.347 0.344	0.3442 0.3432	0.344 0.341	0.3412 0.3392
-12	13/32	0.409 0.406	0.4067 0.4057	0.406 0.403	0.4037 0.4017

Note: **Clearance fit** hole diameters are recommended whenever steel, titanium or composites are present in the material stack-up.

Close ream hole diameters are recommended for net to minimal clearance conditions.

Transition fit hole diameters are recommended in aluminum structure where a close to slight interference fit is needed.

Interference fit hole diameters are recommended in aluminum structure, to provide improved load transfer and improved fatigue performance.

HOLE PREPARATION

Clean, round holes within tolerance and with minimal burrs are fundamental for good joint performance and durability. Below are a few suggestions for hole preparation to achieve good installation:

- Eddie-Pins™ are installed in a variety of hole diameters (see table on previous page).
- Drill/ream sizes should be chosen to generate holes within the diameter ranges shown on drawings, installation specifications, or standards.
- Clamping of the structure with temporary devices is very helpful in avoiding sheet separation, burrs, or chips between the sheets, and hole misalignment.
- Drills should be sharp. Optimized drill point geometry has benefits for hole quality, productivity, and minimizing operator fatigue.
- Drill speeds are critical to achieve hole quality and productivity, while minimizing operator fatigue.
    - For aluminum structure, drill speeds of 4,000 to 6,000 RPM are recommended.
    - For stainless or titanium structure, drill speeds of 300 to 1,000 RPM are recommended.
    - For composite structure, carbide drills and countersink cutters are recommended.
- Lubrication of drills is very helpful in reducing flank wear, burrs, and effort.

HOLE PREPARATION

- Excessive “push” on the drill motor (dull drill) can create sheet separation, burrs, or chips between the sheets and should be avoided.
- Hole normality is important. Angularity beyond 2º should be avoided.
- Countersink concentricity is critical. Generally, countersinks are normal to the structural surface. Angularity problems are caused by hole angularity beyond the 2º limit. Undersize countersink pilots are the most common cause of eccentricity problems and resulting cosmetics issues.
- The countersink included angle for flush head fasteners shall be the nominal fastener angle +/-1 degree.
- Deburr all hole edges in the stack-up.
- Provide head-to-shank fillet relief per table below.

Nominal Diameter No.	Fillet Relief Radius (inch)	
	Protruding Head	Flush Head
-5	.025/.035	.025/.035
-6	.025/.035	.030/.040
-8	.025/.035	.030/.040
-10	.030/.040	.040/.050
-12	.030/.040	.040/.050

GRIP GAGING

Recommended Grip Ranges		
Nominal Fastener Grip Dash No.	Grip Design Range (inch)	
	Minimum	Maximum
3	.126	.188
4	.189	.250
5	.251	.312
6	.313	.375
7	.376	.438
8	.439	.500
9	.501	.562
10	.563	.625
11	.626	.688
12	.689	.750

The grip gage for the Eddie-Pin™ shows both inch and metric scale. The tapered probe of the grip gage is inserted through the prepared hole and hooked on the backside of the material. The scale is read to the nearest 1/16" grip increment at the work surface. If sheet line falls between values on grip gage, round up to the next grip.

GRIP GAGING

P/N EB2G1400

Use the grip scale as shown below for protruding head pins, or use the notched scale to read countersunk head pin grip length.

(reads -10 grip)

(reads -10 grip)

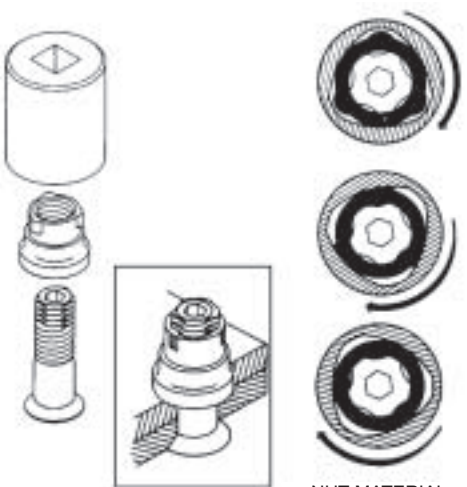
INSTALLATION SEQUENCE

GENERAL NOTES

The Eddie-Pin™ shall not be pulled into the hole with the Eddie-Nut™.

Excess sealant on the threads of the pin can contaminate installation tooling and should be wiped off prior to engaging the tool. Excessive amounts of sealant may also interfere with proper installation of the nut. Small traces of sealant remaining in the root of the threads after wiping will not affect the installation of the nut and need not be removed.

Hand start the nut onto the pin at least 3/4 of a turn. The nut may be spun down until it is seated on the structure.



NUT MATERIAL DEFORMED INTO AND ACROSS PIN FLUTES

FINISHED INSTALLATION

INSTALLATION SEQUENCE

Tools with a center Spline-Lok™ key, or a hex key, shall be used to keep the pin from rotating when installed in clearance fit, close ream, or transition fit holes. Place the Delta-Rad™ installation tool firmly down over the nut ensuring that the key is engaged in the recess of the pin. The installation tool must be engaged over the lobes of the nut and bottomed out on the base of the nut.

Maintain perpendicularity between the drive tool and the fastener.

When the installation tool becomes free running on the nut, the lobes have been swaged into and across the flutes of the pin and the installation is complete.

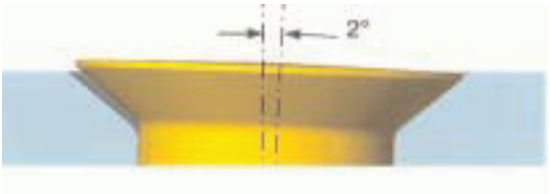
Remove and replace the pin and nut if the pin spins during the nut installation.

If swaging of the nut is incomplete, re-swaging is not permitted. If a nut is found incompletely swaged, remove and replace both the nut and pin.

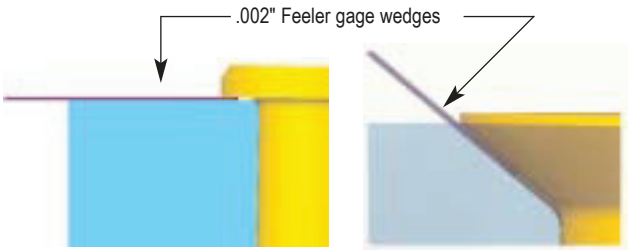
It is not required to have the chamfer of the pin protruding through the nut. The end of the pin may be flush with the top of the nut provided pin protrusion is acceptable.

INSPECTION INFORMATION

Countersink to hole concentricity and angularity are critical. An Eddie-Pin™ can typically absorb up to 2º of angular misalignment.



Ideally, the head should contact the countersink to prevent a .002" feeler gage from entering. The limiting condition is that the feeler gage must wedge before contacting the shank of the Eddie-Pin™.



NOTE: Shaving of the head of flush head pins to meet aerodynamic flushness requirements is not permissible.

INSPECTION INFORMATION

To inspect for proper pin protrusion:

1. Place the base of gage on work surface with the “MAX” / “MIN” side of the gage against the installed fastener. Maintain gage perpendicular to the pin.

2. The pin protrusion must be less than the “MAX” cutout on the gage and greater than the “MIN” cutout of the gage.

3. If the pin does not touch the gage at the “MIN” cutout, it is too short and must be replaced with the next longer grip length pin.

4. If the pin touches the gage at the “MAX” cutout, it is too long and must be replaced with the next shorter grip length pin.

- EB2G1309 pin protrusion gage

(pin too short)

(acceptable)

(pin too long)

NOTE: All pin protrusion inspections must be completed with no gaps between the assembled structure components or under the head of the pin. Gaps in the structure can result in an improper grip condition that will require removal and replacement of both the pin and nut. Pin protrusion should be checked after nut installation.

INSPECTION GAGE INFORMATION

To inspect for proper nut installation:

Visual inspection can be confirmed by appropriate gages. All lobes of an installed Eddie-Nut™ must be sufficiently deformed or swaged equally for their full length to allow the installation gage to pass completely over the lobe area.

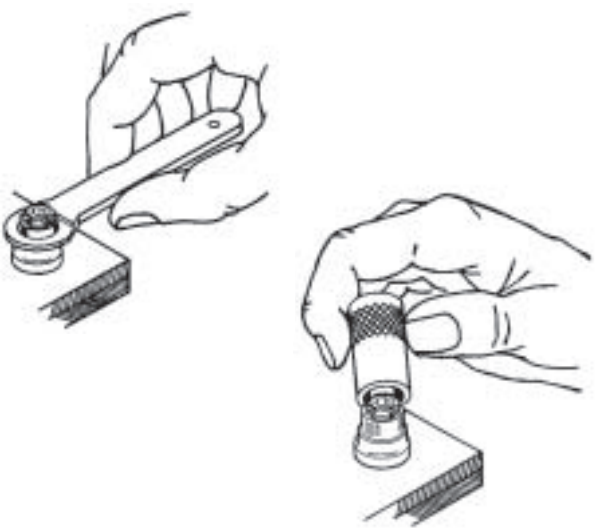
Paddle or Thimble type Eddie-Bolt® 2 gage determines correct nut profile and conformity after installation.

- EB2G1000

- EB2G1100

INSPECTION GAGE INFORMATION

- EB2G1200



NOTE: If a Paddle or Thimble gage is used, it must pass over the deformed Eddie-Nut™ lobes to confirm the installation is satisfactory.

REMOVAL PROCEDURES

The Eddie-Nut™ may be removed by using an Arconic hand or power removal tool designed for use in open or difficult access conditions. For Eddie-Nut™ removal from clearance fit holes, a hex or Spline-Lok™ key is necessary to prevent the Eddie-Pin™ from rotating.

- EBRT100

- EBRT100-( )CF

- EBRTO100-( )

REMOVAL PROCEDURES

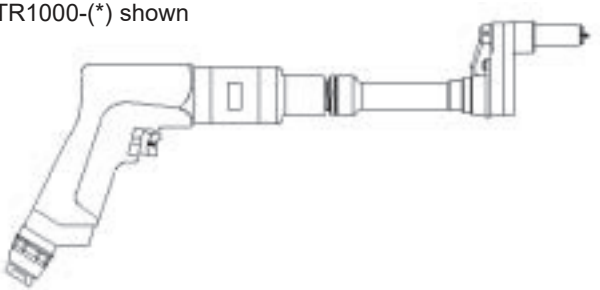
- EBRT100-( ) Shown

NOTES:
Removed Eddie-Nuts™ shall not be reused and Eddie-Pins™ must be replaced before installing a new Eddie-Nut™.

Conventional hex or similar nuts cannot be used on Eddie-Pins™.

A power removal tool with a collet-type action provides trouble-free, high speed removal of Eddie-Nuts™.

- ETR1000-(*) shown



NOTE: If sealant is used on installation, once the sealant sets, removal of the Eddie-Nut™ cannot be accomplished with a power tool.

INSTALLATION TOOLING

Installation tooling includes a choice of hand or power equipment. Common to all tooling options is an internal three-sided shape (Delta-Rad™ driver) for engagement on the three lobes of the Eddie-Nut™.

Hand tool options include:

- Standard non-ratchet wrench
- Delta-Rad™ drive socket
- Roller Wrench which applies torque in limited or large arc sweeps

- EB2T7100

- EB2T7210

INSTALLATION TOOLING

- EB2T4020

- RWB100-( )

- RWEB40-( )
- RWEB80-( )

INSTALLATION TOOLING

Power tool options include:

- Straight Pistol Grip Tool
- Offset Pistol Grip Tool
- 17º Offset Ratchet Tool with Indexing Head
- 20º Offset Ratchet Tool
- Automatic Nut Tool, ANT™, provides a built-in feed mechanism specially designed for Eddie-Nuts™

- ETL2000B Straight Pistol Grip Tool

- ETL1109C Offset Pistol Grip Tool

- ET3109A 17º Offset Ratchet Tool with Indexing Head

- ET4201 20º Offset Ratchet Tool

Lightweight, increased power tools with new pistol grip motors are available in the following models for all -5, -6, and -8 diameters:

- ETL1108 (shown)
- ETL1109
- ETL1110
- ETL1111

ETL1109 Offset Pistol Grip Tool

For clearance-fit applications, Arconic power tools are equipped with assembly to prevent the Eddie-Pin™ from spinning during installation. The assembly holds either the Spline-Lok™ or Hex bits. For interference-fit applications, power tools without the holder are preferred. Power tools with the bit holder in the driver are identified with the same basic number, but with an “SPK” added to designate Spline-Lok™, or the letter “E” added after the hex key size for hex bits.

The tool wear gage is used to determine whether or not the driving surface of the socket has worn to the point where it should be replaced. Insert the end of the gage all the way into the driver. As the gage is slowly pulled out of the driver, rotate the gage in both directions to ensure the full length of driver socket is inspected. If the gage can be rotated within the driving radius more than 90º, replace the worn driver with a new Delta-Rad™ driver.

- EB2G2000-( ) (shown)
- EB2G2100-( )

TROUBLE SHOOTING GUIDE

PROBLEM	TROUBLESHOOTING STEP	REMEDY
Paddle gage or Thimble gage does not pass over Eddie-Nut™ lobes.	Check selected inspection gage to ensure it is the correct Eddie-Bolt® 2 gage to use.	Replace incorrect gage with correct Eddie-Bolt® 2 gage and re-inspect.
	Check to be sure the correct Eddie-Bolt® 2 tool or Delta-Rad™ driver socket is used.	Replace incorrect driver with correct Delta-Rad™ driver. Install new Eddie-Nut™ and Eddie-Pin™ and re-inspect.
	Check selected Delta-Rad™ driver socket for excessive tool wear with correct tool wear gage.	Replace worn driver with correct Delta-Rad™ driver. Install new Eddie-Nut™ and Eddie-Pin™ and re-inspect.
Eddie-Pin™ out of grip.	Check pin protrusion using the Eddie-Bolt® 2 gage.	If pin is too short, replace with correct grip length Eddie-Pin™ and re-inspect prior to installation of Eddie-Nut™. If pin is too long, either replace with correct grip length Eddie-Pin™ or use a washer (installation specification permitting) and re-inspect prior to installation of Eddie-Nut™.

TROUBLE SHOOTING GUIDE

PROBLEM	TROUBLESHOOTING STEP	REMEDY
During installation, the Eddie-Pin™ rotates in a clearance-fit hole.	Check to ensure the hex or Spline-Lok™ key is engaged in Eddie-Pin™ recess.	Repeat installation procedure with new Eddie-Nut™ and Eddie-Pin™.
	Check to ensure the hex or Spline-Lok™ key is the correct size.	Replace incorrect hex or Spline-Lok™ key with correct key and repeat installation procedure with new Eddie-Nut™ and Eddie-Pin™.
	Check to ensure the hex or Spline-Lok™ key is not damaged or worn.	Replace damaged or worn hex or Spline-Lok™ key with new key and repeat installation procedure with new Eddie-Nut™ and Eddie-Pin™.
	Check to ensure the hex or Spline-Lok™ recess is not damaged.	Install new Eddie-Nut™ and Eddie-Pin™ and re-inspect.
Power installation tool stalls.	Check line air pressure to ensure 90-100 psi.	If air pressure is low, adjust air valve to 90-100 psi.
	Check air line to ensure adequate volume of air is reaching the installation tool.	If air volume is too low, replace air line with one having an inner diameter large enough to enable adequate air flow.

TROUBLE SHOOTING GUIDE

PROBLEM	TROUBLESHOOTING STEP	REMEDY
Power installation tool stalls.	Check the tool RPM, if it seems to be running slow, (less than 250 RPM) the motor may need lubrication.	Lubricate air motor with light weight oil through the air input fitting every 30 days.
Removal tool does not grasp Eddie-Nut™.	Check removal tool to ensure it is the correct size for Eddie-Nut™ being removed. Inspect removal tool teeth for damage and/or foreign debris. Captive washer may be interfering with removal.	Replace incorrect diameter removal tool with correct tool. Be sure teeth are grasping the base of the Eddie-Nut™. Clean all foreign debris out of teeth. If any teeth are worn or broken, replace with new tool. Use a smaller diameter removal tool and grip above the washer.
Internal components of attachment gear head damaged or worn.		Using tool maintenance guidelines, check and replace any worn or broken gears or bearings.

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