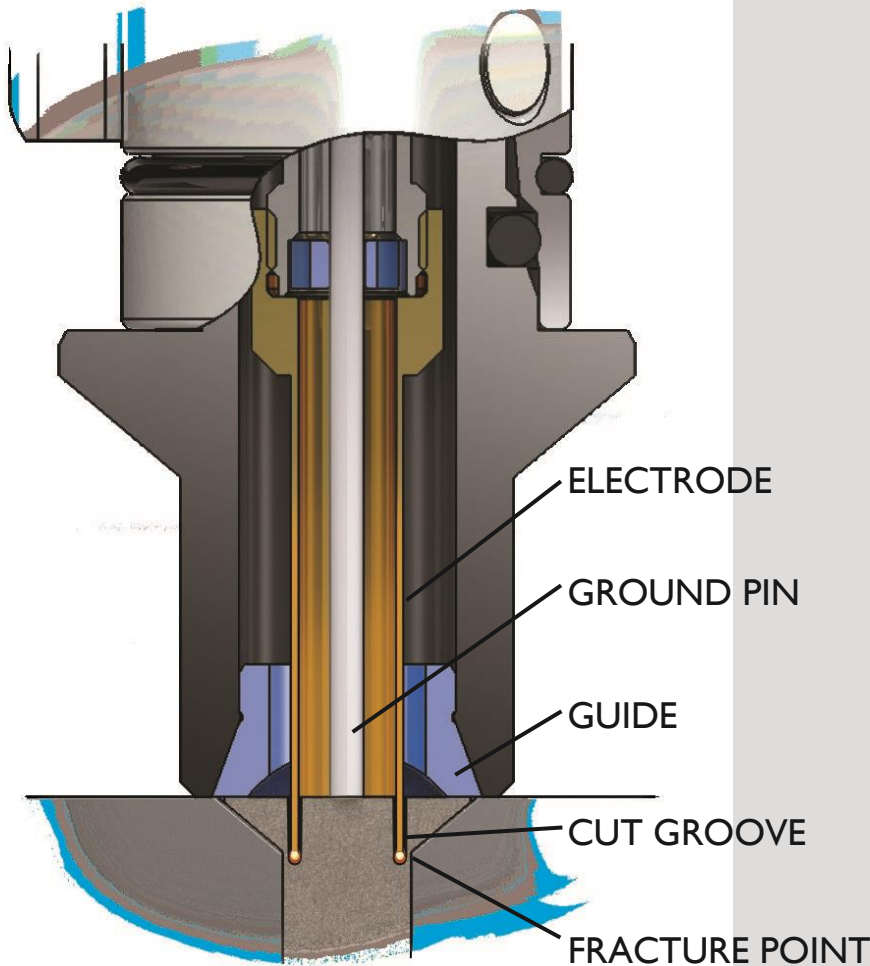


# Perfect Point

## *E-drill Fastener Removal Instructions*



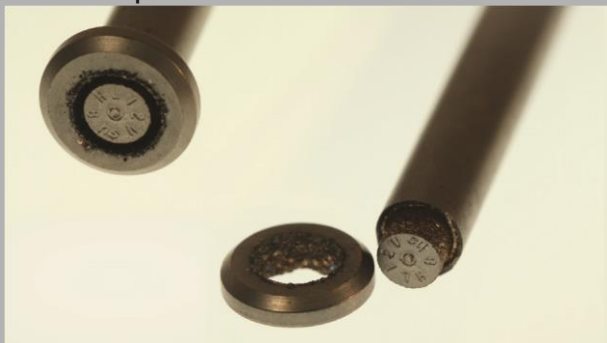
# TECHNOLOGY



Perfect Point's patented handheld electro discharge machining (EDM) technology removes the hardest fasteners quickly and easily. The precision sized electrode cuts a circular groove of material from the fastener head leaving a very thin fracture point between the electrode and the airframe. The exact sizing of the electrode coupled with precision depth control greatly decreases the risk of airframe damage when compared to conventional removal methods. A closed-loop fluid system, consisting of filtered water, flushes the area and removes cut debris. Aggressive flushing during the cut means no heat is transferred to the surrounding area. The forceless cut process significantly reduces the risk of damage to the airframe and repetitive motion injury to the operator. Adaptable to flush head, protruding head and collar side applications. Reduced damage, fast cycle times, and elimination of debris result in efficiencies that mean a very quick return on investment.

## PROCESS

A precision cut results in low punch out force, eliminating stress on the airframe structure. Drill shards are not created and all cut debris is captured, leaving only the severed fastener for cleanup.



- FORCELESS EDM CUTTING
- REDUCES AIRFRAME DAMAGE
- QUICK CYCLE TIMES
- CLOSED LOOP SYSTEM
- CAPTURES CUT DEBRIS
- LOW PUNCH OUT FORCE
- ERGONOMICALLY SUPERIOR
- WORKS ON ALL FASTENERS

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
		Date:	6/25/2019



## WARNINGS:

The E-drill system is designed, built and calibrated to work with factory genuine parts and accessories. The use of non-authorized components, electrodes, or accessories can result in airframe damage, tool damage, personal injury, or death. Lethal high voltages are present throughout the Power Supply Cabinet. Follow all Warning and Caution statements outlined in this User Guide and all equipment Warning placards. Do not proceed with any periodic maintenance until factory trained and authorized, and this document has been thoroughly reviewed and understood. Only trained, authorized technicians should attempt tool use, tool selection, adjustments, dielectric system replenishment, and periodic maintenance. This unit is not field repairable, if any malfunctions are encountered please contact Perfect Point™ EDM Corporation immediately for service.

The Perfect Point E-drill system should be protected from freezing cold conditions that can crack or burst de-ionized water connections and plumbing. If the system is subjected to freezing temperatures, it should be thoroughly inspected by a trained technician for damage or leaks prior to use. If the system is to be stored or transported in low temperature conditions, then it should be fully drained first (see System Maintenance - section 4.1).

The Perfect Point E-drill system should not be operated in the rain or snow. If aircraft repairs necessitate outdoor operation in severe weather conditions, it is recommended the Mobile Service Unit be positioned under a protective awning or positioned in a protected area under or in the airframe. Cable connections should not be left in pooled water and should be kept elevated.

Product specifications are subject to change, and photographs in this document may not match the current E- Drill product combinations exactly.



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<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

## Limited Warranty Statement

Perfect Point EDM Corp. warrants to the end user that its products will be free from defects in material and workmanship for a period of twelve (12) months from the date of delivery, but not more than eighteen (18) months after date of shipment, and the successful completion of operator equipment use and maintenance training. This warranty extends only to the original purchaser, is expressly in lieu of all other warranties, expressed or implied, and is further in lieu of all other liabilities or obligations for any consequential damages or losses incurred by the buyer in connection with the purchase or use of the product.

This warranty applies to systems subjected to normal operating conditions established by PPedm and explicitly excludes equipment subjected to:

- User alteration.
- Accident or damage caused by the end-user.
- Improper handling, installation, maintenance, application, or contamination as established by PPedm equipment operating instructions and preventative maintenance.
- Use with improper voltage.
- Use contrary to the operation instructions, and failure to properly service and maintain per PPedm instructions.
- The use of non-authorized components, electrodes, or accessories.

**Use of counterfeit electrodes will result in eccentric cuts (which will cause airframe damage) incorrect cut depths, cutting times and electrode life. Use of counterfeit electrodes will also invalidate the warranty. PPEDM will not repair systems or components damaged by the use of counterfeit electrodes.**

- Unauthorized disassembly, repair, or alteration by anyone other than PPedm Corp. No allowances will be made for repairs or alterations effected without specific written authorization from PPedm.

This warranty does not cover:

- Normal wear and tear of soft goods (seals, hoses, cables etc.), E-drill Adapters, Guides, Locators, Punch Pins or Punch Guides and other fixtures or tools.

Credit will NOT be allowed nor shipment accepted on any machine or component thereof without Perfect Point's prior written consent and issuance of a PPedm Return Material Authorization (RMA).

PPedm will at its option, repair or replace any defective machine or component thereof for the specified warranty period. PPedm reserves the right to substitute new equipment and/or improve the part(s) on any machine or part thereof judged defective without further liability. Machines or components thereof will be repaired and the warranty time continued.

All machines or components thereof returned for warranty consideration MUST NOT HAVE BEEN TAMPERED WITH and all anti-tamper seals and/or striping must be intact. Removed or destroyed anti-tamper seals and/or striping will be cause to VOID these warranty terms and conditions.

**Liability Limitations:** Under no circumstances shall PPedm have any liability for liquidated damages or collateral, consequential, or special damages loss of production or progress of production, whether resulting from delays in delivery or performance, breach of warranty, negligent manufacture or otherwise. Purchaser agrees to indemnify and hold harmless PPedm from all claims by third parties in excess of these limitations.

THIS WARRANTY IS THE SOLE WARRANTY OF PPedm AND ANY OTHER WARRANTIES EXPRESSED OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE, ARE HEREBY SPECIFICALLY EXCLUDED.



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<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

**WARNING**

**WARNING**

**WARNING**

**The USE of Counterfeit Electrodes Can Cause Damage to the E-drill, Aircraft, Aircraft Components, and Aircraft Structures. THIS IS A SERIOUS SAFETY ISSUE!**

**Perfect Point electrodes are manufactured to exacting standards and are certified for use with E-drill systems. Performance and control are matched to specific alloys. Concentricity, Depth Control, Cut Diameter and Electrode Life will not be maintained outside of these specifications.**

**The USE of Counterfeit Electrodes Will Violate the E-drill System warranty and Perfect Point WILL NOT Service E-drill Systems that USE Counterfeit Electrodes**

**For the Protection of Your E-drill System and the safety of the Application for Which You Are Using the E-drill**

**DO NOT USE COUNTERFEIT ELECTRODES!**

**Only genuine electrodes supplied in original Perfect Point packaging should be used in your system! If you suspect you have received COUNTERFEIT ELECTRODES, please contact the Perfect Point Support Hotline to Report.**

**1-714-891-6533**

**WARNING**

**WARNING**

**WARNING**



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<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

### Perfect Point EDM Software End-User License Agreement (EULA)

IMPORTANT- READ CAREFULLY: This End-User License Agreement (“EULA”) is a legal agreement between the user (either an individual or a single entity) and Perfect Point EDM Corp. (“PERFECT POINT”), the manufacturer of the E-drill you have acquired, that includes certain Perfect Point software product(s) installed on the E-drill system and equipment (“PPEDM SOFTWARE”). The PPEDM SOFTWARE includes computer software, the associated media, any printed materials, any “on-line” or electronic documentation, upgrades and recovery media. By using the PPEDM SOFTWARE, you agree to be bound by the terms of this EULA. If you do not agree to the terms of this EULA, Perfect Point declines to license the PPEDM SOFTWARE to you. In such event, you may not use the PPEDM SOFTWARE, and you should promptly contact PERFECT POINT for instructions on return of the entire product.

#### PERFECT POINT SOFTWARE LICENSE

The PPEDM SOFTWARE is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The PPEDM SOFTWARE is licensed, not sold.

**GRANT OF LICENSE.** This EULA grants you the following rights:

- **Software.** You may use the PPEDM SOFTWARE as installed on the E-drill.

#### OTHER RIGHTS AND LIMITATIONS.

- **Limitations on reverse engineering, Decompilation and Disassembly.** You may not reverse engineer, decompile, or disassemble the PPEDM SOFTWARE.
- **Single E-drill.** The PPEDM SOFTWARE is licensed with the E- E-drill as a single integrated product. The PPEDM SOFTWARE may only be used with the E-drill.
- **Rental.** You may not rent or lease the PPEDM SOFTWARE without prior written approval from PERFECT POINT.
- **Software transfer.** You may permanently transfer all your rights under the EULA only as part of a sale or transfer of the E-drill, provided you retain no copies, b) transfer all of the PPEDM SOFTWARE (including all component parts, the media, any upgrades, and this EULA, c) you notify PERFECT POINT of the new user, and d) the recipient agrees to the terms of this EULA.
- **Termination.** Without prejudice to any other rights, PERFECT POINT may terminate the EULA if you fail to comply with its terms and conditions. In such event, you must return the entire product to PERFECT POINT, and all its component parts.

**COPYRIGHT.** All title and copyrights in and to the PPEDM SOFTWARE (including but not limited to any images, photographs, animations, video, audio, music, text and “applets,” incorporated into the PPEDM SOFTWARE), and the accompanying printed material, are owned by PERFECT POINT. You may not copy the printed materials accompanying the PPEDM SOFTWARE, without prior written approval from PERFECT POINT. All rights not specifically granted under this EULA are reserved by PERFECT POINT.

**This Software Agreement and Limited Warranty are governed by the laws of the State of California, U.S.A.**



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<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

## Contents

WARNINGS:	2
Limited Warranty Statement	3
Perfect Point EDM Software End-User License Agreement (EULA)	5
1 Introduction	8
2 E-drill System Components	8
2.1 E-drill Hand Tools .....	8
2.2 Center-Grounded (CG) Hand Tool.....	8
2.3 External Ground (EG) E-drill Hand Tool .....	9
2.4 E-drill Hand Tool General Features and Controls .....	10
2.4.1 Interchangeable Adapters.....	10
2.4.2 Trigger .....	10
2.4.3 Retract Button.....	11
2.4.4 Status Light.....	11
3 Mobile Service Unit (MSU)	12
3.1 MSU Connection Panel .....	12
3.2 Touch-Screen Display.....	13
4 Electrodes	13
5 Locator Tools	14
5.1 Locator Adapters.....	14
5.1.1 Button Head Adapter .....	14
5.1.2 Vacuum Series Adapters .....	14
5.1.3 Flush Head Adapters .....	14
5.1.4 Special Purpose Adapters and Fastener Specific Kits.....	15
5.2 Electrode Guides .....	16
5.3 Button Head Locators (BHL).....	17
5.4 Vacuum Flush Head Locator (VFHL) System: .....	19
5.5 Offset Vacuum Flush Head Locator (OVL).....	20
5.6 Visual and Mechanical Bombsights.....	21
5.7 Universal Flush Head Locator (FHL) System .....	22



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E-drill Fastener Removal Instructions			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

6	General Best Practices	24
6.1	Fastener Preparation.....	24
6.2	Fastener Identification.....	24
6.3	Terminal Programing.....	25
6.4	Part Number Selection.....	25
6.5	Visual Selector.....	26
6.6	Ground Pin Adjustment (CG Hand Tool).....	27
6.7	Electrode Installation.....	29
6.8	Hand Tool Operation.....	32
6.8.1	General Hand Tool Use.....	32
6.8.2	CG Hand Tool Use.....	33
6.8.3	EG Hand Tool Use.....	33
7	Fastener Removal Best Practices	34
7.1	Raised Head Fastener Cutting.....	34
7.2	Flush Head Fastener Cutting.....	36
7.2.1	Vacuum Flush Locator (VFHL).....	36
7.2.2	Offset Vacuum Locator (OVL).....	38
7.2.3	Flush Head Locator (FHL).....	40
7.3	Fastener Extraction.....	42
7.3.1	Perfect Point Punch-Buddy.....	42
7.3.2	Perfect Point Air Punch.....	43
8	Quality Control	44
8.1	Authorized Users.....	44
8.2	Damage Inspection.....	44
8.3	Rectification.....	44
9	Appendix 1 – Solid Shank Rivet Removal Instructions	45
10	Appendix 2 – Blind Rivet Removal Instructions	48
11	Appendix 3 – Blind-Bolt Removal Instructions	52
12	Appendix 4 – Straight-Shank Pin Removal Instructions	55
13	Appendix 5 – Cutting Electrode Sizes and Adapter Color Matching	58



<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

## I Introduction

Conventionally fasteners are removed by drilling out the head of the fastener with a hand drill and twist drill bit. This process is slow, requires significant strength from the operator, requires skill and precision, generates Foreign Object Debris (FOD), and frequently results in damage to the airframe.

The Perfect Point E-drill system is a hand-held Electrical Discharge Machining (EDM) tool designed to aid in the removal of hard airframe fasteners. The E-drill device weakens the fastener by electrically eroding a circular groove through the fastener head and a short distance into the stem (or pin) of the aircraft fastener. During cutting, a closed loop de-ionized water system is used as a Dielectric Fluid and circulated throughout the head of the device, in such a manner that the fastener and surrounding airframe do not heat up and are cold to the touch immediately after cutting.

The depth of cutting is controlled automatically, such that a thin wall remains holding the fastener head in place. The fastener head may then easily be severed by a sharp tap with a hammer and hand punch. When the device is positioned correctly the airframe is not damaged in any way, and the temperature rise in the airframe around the hole is insignificant.

This document's purpose is to provide the user with information on the E-drill system's component and accessories and provide detailed general instructions for use of the E-drill on airframe and engine structure.

- For upkeep, regular/scheduled maintenance, and troubleshooting of the E-drill system refer to the E-drill system owner's Maintenance and Troubleshooting guide.
- For specific fastener applications refer to the fastener specific appendixes attached to this document.

## 2 E-drill System Components

### 2.1 E-drill Hand Tools

E-drill Hand Tools are currently provided in two models that cover a wide range of fastener sizes. Each Hand Tool has specific fastener size capabilities and features. This User Guide covers the use of both standard types of E-drill hand tools.

### 2.2 Center-Grounded (CG) Hand Tool

CG hand tool can remove fasteners with a diameter of 5/32" through 3/8". For fasteners smaller than these sizes the External Ground (EG) E-drill Hand Tool shall be used.

CG hand tool is Center-Grounded by means of a Ground Pin that protrudes through the center of the cutting electrode. Hand tool visual identification can be quickly made by inspecting the nose of the hand tool. If the Ground Pin is visible protruding from the center of the electrode, then this is a CG or Center Ground Hand Tool.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
		Date:	6/25/2019



**CAUTION:**



The CG hand tool *shall NOT be used* with an electrode smaller than 5/32". Damage to hand tool will result if smaller electrode is used.



Profile view of CG Hand Tool- note protruding ground pin on nose of tool



Profile view of EG Hand Tool- note external grounding wire extending from umbilical cable

### 2.3 External Ground (EG) E-drill Hand Tool

This hand tool configuration can remove fasteners from 3/32" Nominal Stem Size (-3) through 3/8", including oversizes. For fasteners larger than these sizes, the Center Ground (CG) E-drill Hand Tool should be used.

The EG E-drill Hand Tool is externally grounded by means of an External Ground lead and clamp. The Hand Tool Ground Lead and Grounding Clamp Assembly have a "break away" safety connector feature for operator safety and to prevent accidental cable breakage.

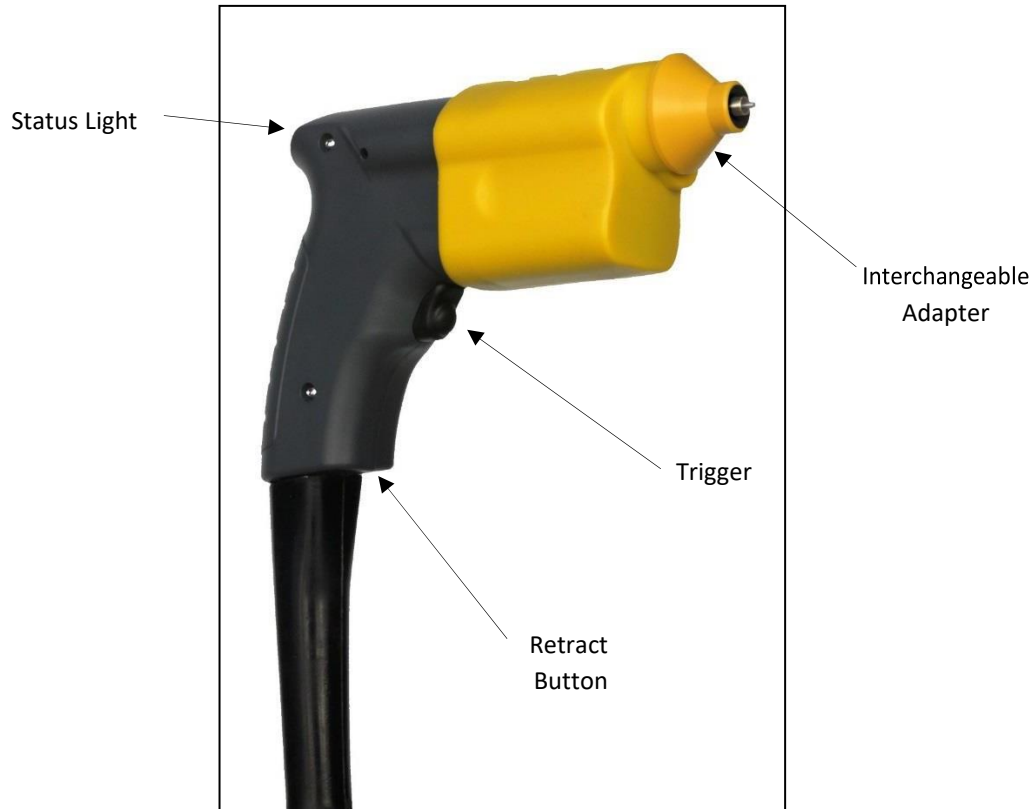


**CAUTION**

The External Ground (EG) Hand Tool will NOT operate without the system properly grounded by the Ground Clamp Assembly. Check for electrical ground prior to further system trouble shooting.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 2.4 E-drill Hand Tool General Features and Controls



### 2.4.1 Interchangeable Adapters

The E-drill includes a kit of Interchangeable Adapters suitable for different fastener types and removal processes.

Adapters and locators are intentionally manufactured in plastic using brighter colors, so they may be easier to find if dropped or mislaid. This is helpful in all shop environments, but especially in FOD-controlled situations. The plastic also reduces the chance of marring the airframe surface.

### 2.4.2 Trigger

The trigger is depressed to initiate the cutting process and is held depressed until the cut automatically completes. As a safety feature, should the trigger be released, the cutting process will be aborted immediately. Keeping the trigger depressed after the cut is finished will assist in cleanup of any excess water which may remain after cutting.

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

### 2.4.3 Retract Button

The Retract Button recessed in the handle is used when necessary to retract the cutting electrode. The retract button is actuated for one of the following conditions:

- A new electrode has been installed and needs to be retracted
- The trigger has been operated accidentally when not placed on a fastener and the electrode has moved forward as a result
- The E-drill has been applied to a non-conductive surface and the electrode has extended in search of a conductive material.

The electrode retracts continuously while the button is held down. Retraction stops when the button is released, or the device reaches the retract limit.

### 2.4.4 Status Light

The Status Light communicates various conditions during operation as follows:

**Solid Green** light upon cut completion – Cut was successfully completed.

**Solid Green** while operating the retract button – Electrode is fully retracted.

**Flashing Green** upon cut completion – Cut was completed successfully but the electrode needs replacement before next cut. **The system is disabled until electrode has been replaced and fully retracted.**

**Solid Red** upon cut completion – Cut was completed with errors. Either the trigger was released before reaching depth, or the cut took excessively long. Which condition occurred will be reported by the Touch-Screen Display. Likely issues causing slow cutting include:

- The head of fastener was not de-painted adequately
- Wrong fastener type was programmed on the terminal
- The electrode is loose

**Flashing Red** (at any time) – An error has been identified, system is disabled. System error will be displayed on the Touch-Screen Display. Typically, the flashing red indicates a low water level, and a Top-Off needs to be performed. **The system is disabled until the water level is restored.**

*Note: Solid lights are informational - The unit is still operational.*

*Flashing Lights require user intervention - Unit is disabled until the condition is resolved.*

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

### 3 Mobile Service Unit (MSU)

#### 3.1 MSU Connection Panel

Vacuum (upper) Connection  
 Pressure (lower) Connection  
 E-drill Hand-Tool  
 Electrical Connection  
 Power Switch  
 Single-Phase  
 Electrical Connection



**Mobile Service Unit- Rear Connection Panel**

The hand-tool connector installs in one vertical orientation, with the blue Vacuum dielectric connector at the top, and the black Pressure dielectric connector at the bottom (matching the cabinet connections). The black electrical connector locking bezel must be twisted until a click is felt.

When removing the hand-tool, the bezels around the Push-To-Connect™ fluid fittings on the Mobile Service Unit and Umbilical Cable must be pushed in to release the tubes.

When installing the hand-tool, the tubes should be pushed into the push-to- connect fittings and then lightly pulled such that they are “set”.

After installing or re-installing a hand-tool or installing the umbilical extension, it is good practice to bleed the pressure line to the hand-tool.

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		



### Warning

**Under no circumstances should the electrical connectors be forced. If aligned correctly, minimal force is required. Excessive force will Damage the connectors and will not be covered under warranty.**

## 3.2 Touch-Screen Display

The Touch-Screen Display (TSD) provides an interface through which the user can select different fastener types to remove (as described in Section 6) and carry out maintenance functions. The TSD also displays status information including:

- Current fastener setting
- Electrode required display
- Cut time for last cut
- Current system status or error messages TSD operation is listed in more detail in Section 5.

## 4 Electrodes

Cutting of the fastener is achieved using a precision tubular electrode. Electrodes are available in a range of sizes depending on the fastener size and type to be removed. Once a fastener type is selected from the Touch-Screen display, the system will indicate which electrode to be used for that fastener.

Electrodes are consumable, and wear slightly every cut. A flashing green light on the back of the hand tool, and accompanying message on the display will indicate when an electrode should be replaced. Throughout its life, electrode performance is unchanged, until the point when the system will advise it be replaced.

Selection, installation and use of electrodes is covered in section 6.6. Appendix 5 provides a complete list of all electrode sizes, color codes and diameters.

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

## 5 Locator Tools

### 5.1 Locator Adapters

E-drill locator tools use 3 types of adapters which correspond to the 3 most common series of locator tools. These adapters ensure a mating surface between the E-drill hand tool and the locator tool. Each type adapter has the following features:

- Mating (tri-wing) base for installation to E-drill hand tool
- Removable electrode guide for precision electrode alignment
- Beveled feature for intimate connection with corresponding locator tool

#### 5.1.1 Button Head Adapter

The BHL Adapter and Guide Assembly is installed on the end of the E-drill for the selected fastener removal application. BHL Adapters are configured for both EG and CG E-drill use.



#### 5.1.2 Vacuum Series Adapters

Vacuum Flush Head Adapter has a unique shape specific for use on the vacuum assisted locator tools. This unique shape also has It is shaped differently than the FHL adapter and with an O-Ring located on the end of the electrode guide to seal the water during the cut. Use of the VFHL locator tool is required for applications where the work surface is not dispositioned as scrap.



#### 5.1.3 Flush Head Adapters

The FHL Adapter and Guide Assembly is installed on the end of the E-drill for the selected fastener removal application. It is shaped differently than the VFHL adapter and there is no O-Ring to seal the water during the cut. The watertight seal is achieved via the locator itself.



**Warning: The FHL should not be used on skins which are to be re-used, unless the holes will be oversized. Use the FHL on skins that are to be replaced.**

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

### 5.1.4 Special Purpose Adapters and Fastener Specific Kits

A range of special purpose adapters is available, for use in confined areas, cavities, or special fasteners. The range includes:

- Slimline Button Head Locators/Adapters, for fasteners close to structure (such as stringers or ribs).
- Extended Adapters and Electrode Extensions, for deep cavities.
- Collar adapters (for collar or nut splitting).
- Threaded insert adapters and kits.



Most special purpose adapters are available in Fastener Specific Kits (FSK's) including all the parts and electrodes necessary to address a particular removal situation.

Contact PPedm for application specific solutions and available FSK's.



<b>E-drill Fastener Removal Instructions</b>					
<b>Document No.:</b>	61-340	<b>Revision:</b>	E	<b>Date:</b>	6/25/2019



Above photo shows an example FSK for Fastener Removal in Confined Spaces.

## 5.2 Electrode Guides

Electrode guides are inserted into the Adapters installed on the E-drill to steady and center the Electrode during the cutting process. Each Guide is sized to a specific electrode size and color coded for easy visual identification.

The same Electrode Guides are used in both the Flush Head Locator (FHL) and Button Head Locator (BHL) systems, while the Vacuum Series Locator Guides are of a different design. Electrode guides are color coded used with their respective Electrode applications as depicted in the chart below.

*Note: Guides should be regularly inspected for damage or wear. Guides with heavy usage should be replaced when the electrode does not feel secured in the guide.*



*To check for Electrode Guide wear, attempt to insert the next OS electrode and observe if it enters the guide. If the next OS electrode passes into the guide then the guide is out of tolerance and should be replaced.*



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E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

Fractional Fastener Size	Dash Size	Adapter Electrode Guide	Electrode Packaging
3/32 Nominal	3	GREEN Electrode Guide	GREEN Cutout
3/32 Plus	3+	WHITE Electrode Guide	GREEN Cutout
1/8 Nominal	4	ORANGE Electrode Guide	ORANGE Cutout
1/8 Plus	4+	WHITE Electrode Guide	ORANGE Cutout
5/32 Nominal	5	BLUE Electrode Guide	BLUE Cutout
5/32 Plus	5+	BROWN Electrode Guide	BLUE Cutout
5/32 1 <sup>st</sup> Oversize (X)	5-X	WHITE Electrode Guide	BLUE Cutout
3/16 Nominal	6	YELLOW Electrode Guide	YELLOW Cutout
3/16 Plus	6+	BROWN Electrode Guide	YELLOW Cutout
3/16 1 <sup>st</sup> Oversize (X)	6-X	WHITE Electrode Guide	YELLOW Cutout
3/16 2 <sup>nd</sup> Oversize (Y)	6-Y	TURQUOISE Electrode Guide	YELLOW Cutout
1/4 Nominal	8	BLACK Electrode Guide	BLACK Cutout
1/4 Plus	8+	BROWN Electrode Guide	BLACK Cutout
1/4 1 <sup>st</sup> Oversize (X)	8-X	WHITE Electrode Guide	BLACK Cutout
1/4 2 <sup>nd</sup> Oversize (Y)	8-Y	TURQUOISE Electrode Guide	BLACK Cutout
5/16 Nominal	10	RED Electrode Guide	RED Cutout
5/16 1 <sup>st</sup> Oversize (X)	10-X	WHITE Electrode Guide	RED Cutout
5/16 2 <sup>nd</sup> Oversize (Y)	10-Y	TURQUOISE Electrode Guide	RED Cutout
3/8 Nominal	12	GRAY Electrode Guide	GRAY Cutout
3/8 1 <sup>st</sup> Oversize (X)	12-X	WHITE Electrode Guide	GRAY Cutout
3/8 2 <sup>nd</sup> Oversize (Y)	12-Y	TURQUOISE Electrode Guide	GRAY Cutout

### 5.3 Button Head Locators (BHL)

The BHL system is comprised of 3 basic components, the Button Head Locator, the E-drill Adapter Assembly, and the required Electrode Guide. The BHL Locator is placed over the Button Head fastener on the work surface. The Button Head Adapter is affixed to the nose of the E-drill hand tool.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

The Button Head Locator comprises a white plastic housing, metal insert, and three O-rings for sealing. The BHL assembly is available in two different sizes; EDB0033 for fastener heads up to 0.5” and EDB0034 for fastener heads greater than 0.5”.



**Close view of the BHL Assembly**

The metal inserts are removable, and each is intended to be pre-bored to suit a specific fastener head diameter. The inserts may be supplied pre-bored to a specific size upon request, or the customer may purchase piloted blanks either individually or pre-assembled, which they can bore themselves per their requirements. Hexagonal inserts are also available for specific hex-head blind fasteners, and removal of seized nuts and bolts.

*Hint: Typically inserts are bored 0.003” larger than the nominal fastener head diameter. For best precision it is recommended to bore inserts on a lathe or mill to precisely the diameter required, since drilling is limited to only discrete drill sizes and there may not be a suitable size available.*

The outside diameter and sealing surface of BHL assemblies is optimized to fit between fastener heads spaced per industry standard (typically greater than 4 to 1, spacing to diameter), while maximizing the footprint to enhance perpendicularity. Detailed instructions for use will follow in Section 6.

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

## 5.4 Vacuum Flush Head Locator (VFHL) System:

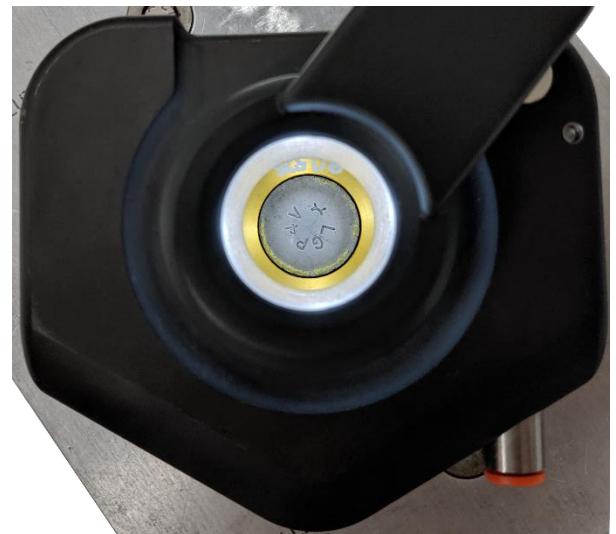
The VFHL System is used when removing flush head fasteners. The VFHL system and its sister OVL system are the only tools recommended for use to remove flush fasteners from composite structures.



The VFHL System is a completely self-contained system that operates on standard 100 to 150 psi regulated shop air pressure. The system comes with a 3-suction cup Locator, an LED illuminated bombsight, and special set of VFHL E-drill Adapters and Locators that uses standard Electrode Guides for centering the Electrodes.

E-drill Fastener Removal Instructions					
Document No.:	61-340	Revision:	E	Date:	6/25/2019

The Vacuum Flush Head Locator will operate on both convex and concave curved surfaces down to a radius of approximately 4 ft, and on fasteners greater than 2” from the edge of a panel. In situations with radius less than that (wing leading edge or lip seal leading edge as examples) or where fasteners are located on the edge of a panel, an alternative means of location might be more suitable.



Alignment of the fixture over the fastener is accomplished with the assistance of the illuminated “bombsite” which provides visual magnification and illumination of the work-area. The bombsite has a set of targeting rings which allow for precise alignment over the fastener head. Detailed instructions for use may be found in Section 7.

A family of mechanical and illuminated bombsight locators is available, detailed further in section 5.6

## 5.5 Offset Vacuum Flush Head Locator (OVL)

The OVL is used on highly curved surfaces where accuracy is necessary. It has a smaller footprint than the VFHL and can be articulated, which allows the OVL to align in areas that the VFHL would typically not be able. It can also operate on fasteners which are on the edge of a panel, such as wing leading or trailing edges. The OVL can also affix to more complex curvatures (up to 8” radius concave and 11” radius convex).



**OVL System**

The OVL tool uses the vacuum pump from the VFHL system to provide the required suction for mating to a work-surface. The OVL is also available as its own kit.

The head of the OVL articulates 270° axial and has the ability to tilt to a 24” radius. This makes the OVL the necessary tool for removing fasteners on highly curved surfaces.

Care must be used to set the OVL up to align perpendicular to the surface in the proximity of the fastener. This is best achieved by installing the adapter and ensuring that it seals against the surrounding surface, before tightening the screw-knob to lock the OVL’s orientation.

Concentric alignment of the OVL to the fastener head is accomplished with the assistance of an illuminated “bombsite” which provides visual magnification and illumination of the work-area. The

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

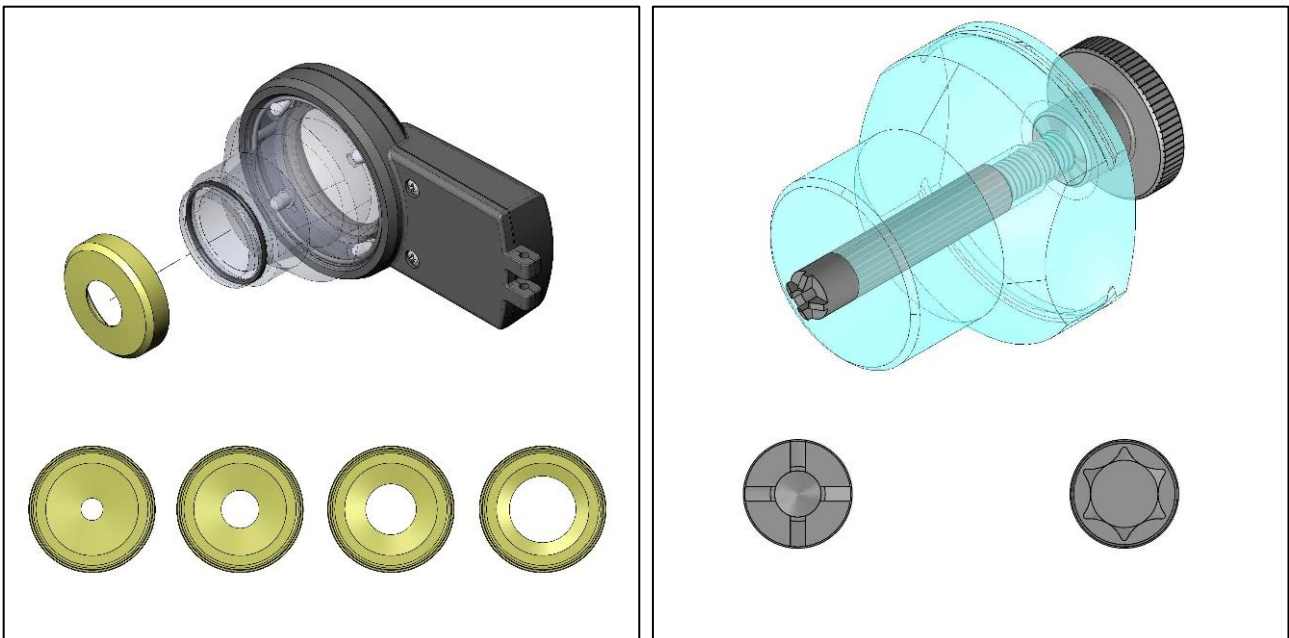
bombsite has a set of targeting rings which allow for precise alignment over the fastener head. Detailed instructions for use will follow in Section 6.

A family of mechanical and illuminated bombsight locators is available, detailed further in section 5.6

## 5.6 Visual and Mechanical Bombsights

The visual bombsight which assists in precision location of the VFHL and OVL locators is available with a set of different sized apertures which may be installed on the front of the sight lens body.

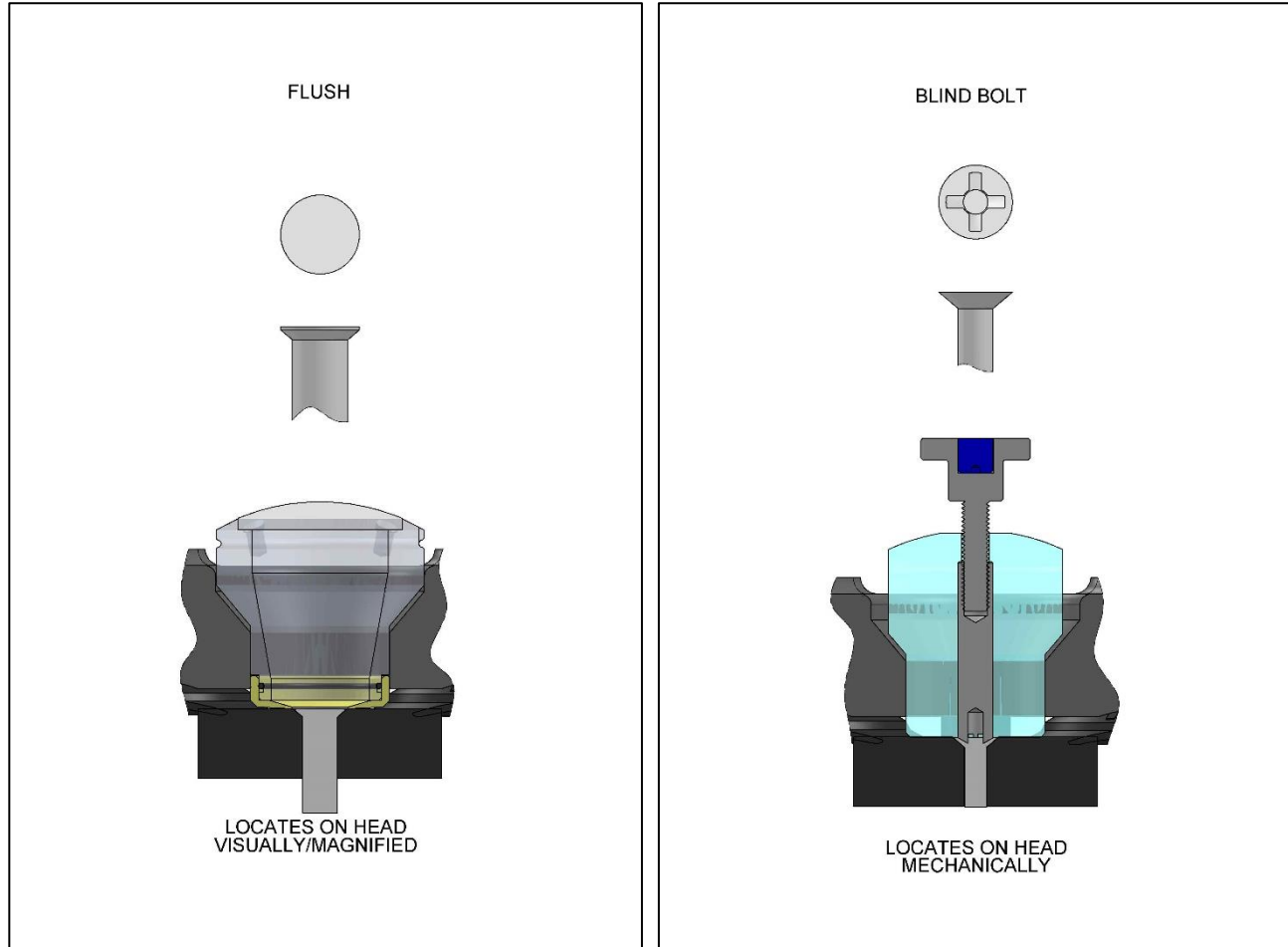
Mechanical Sights are also available which engage in the recess of screw-type fasteners (Hex, Torx, Tri-wing, Hi-torque, ComposiLok, Philips etc.)



**Above: Visual bombsight interchangeable apertures – Mechanical bombsights in various styles**

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

**Below: Visual and Mechanical Bombsights shown in position on fasteners. Note the selection of visual sight aperture diameter slightly larger than the fastener head.**



### 5.7 Universal Flush Head Locator (FHL) System

The Universal Flush Head Locator (FHL) is intended for skin removal where the skin is to be replaced. The FHL locator is a standard size part used across the entire FHL system. The base has a large diameter foot to improve perpendicularity during cutting and is recessed to accept the selected size Aperture Seal.

The FHL system is comprised of 4 basic components:

- The Locator Cup (FHL Body)



<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

- Aperture seal installed in the FHL.
- Flush Head Adapter with removable electrode guide

Aperture Seals are installed in the FHL and selected to most closely match the OD of the fastener to be removed. The aperture seal is the locating mechanism for this tool and comes in several sizes to aid in locating correctly. The aperture seal then acts as a fluid barrier and contains the dielectric pressure during a cut.

### Warning



*The FHL system of locators should only be used on skin dispositioned as scrap. This locator does not have a locking feature and is prone to slippage during a cut. Risk of airframe damage exists if this tool is used on non-scrap parts.*



E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 6 General Best Practices

### 6.1 Fastener Preparation

To obtain acceptable grounding contact, surface paint must be removed from the fastener head before fastener removal is initiated.

Coating may also be removed with 180-grit or finer emery cloth or a small spoon file, or scraper. Care should be taken not to abrade or damage the surrounding structure. Typically, an area comparable in size to the fastener stem diameter is enough (see example below).



*Note: Aluminum fasteners can be deformed by sanding/grinding operations, which makes mechanical or visual alignment difficult. S-Blaster is the Preferred Method of Coating Removal.*

### 6.2 Fastener Identification

Identifying the fastener to be removed is a critical parameter of proper E-drill use. While it is outside the scope of this document to identify every type of fastener installed on aerostructures, typically airframe fasteners fall into 4 general categories:

- Solid Rivet
- Blind Rivet
- Straight Shank Pin
- Blind Bolts

*Note: Each of these fasteners are defined with instructions on proper identification and removal processes in APPENDICES 1-4*

These fasteners can then be sorted into 2 additional categories: Flush and Protruding Head. E-drill can remove any of the above types and configurations from diameters 3/32"-7/16. The fastener's diameter drives the use of different E-drill hand tools and is accounted for in the sizes of Perfect Point Electrodes. Proper fastener identification allows the user to program the Touch Screen Display with the correct command for that specific application.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

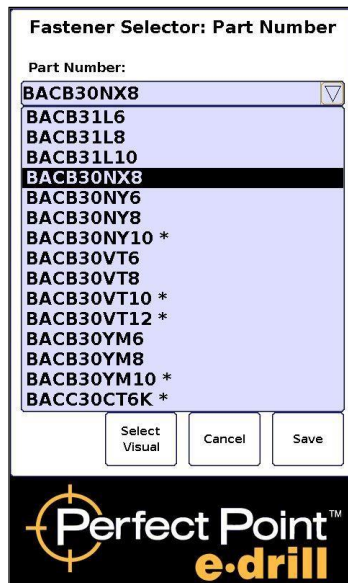
### 6.3 Terminal Programming

E-drill’s Touch Screen Display allows operators to select commands for use in two methods: Part Number Selection and Visual Selection.

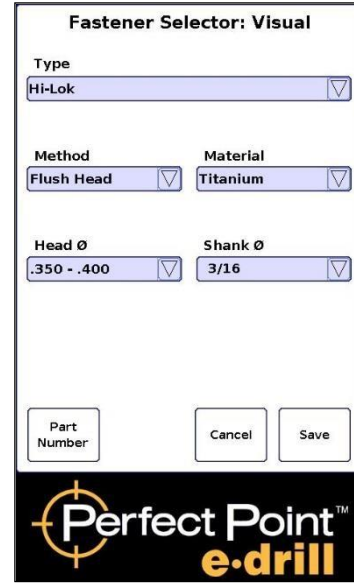
Touch Screen Display Status (Home) Page



Part Number Select Page



Select Visual Page



*Note: In all cases the pre-programmed “Part Number Library” (PNL) is preferable to the “Visual Selection” (VS) Function. VS is specifically designed for emergent/non-standard work. Users who need additional commands loaded into their PNL should contact Perfect Point Customer Service and an adjusted library will be sent to the user.*

### 6.4 Part Number Selection

Part numbers can/are permanently installed on the terminal library and are programmed based off the fastener manufacturer’s datasheet for the part. Perfect Point Field Service typically writes a comprehensive library, based off user input, upon system setup and initial training. These programs are specialized to the individual user’s requirements and are extremely accurate.

To use the Part Number Selector:

- Press Part Number on the home screen.
- Highlight the Part Number window, scroll down to the correct part number and select it by pressing it.
- Select Save to select that part number and load parameters from the library.

E-drill Fastener Removal Instructions					
Document No.:	61-340	Revision:	E	Date:	6/25/2019

Upon successful loading of the command the home screen will display the cut parameters and identify the correct electrode cutter for that command.

*Note: As requirements change, fasteners may be added to or removed from the Part Number Library as needed. Please contact PPedm Hotline (714) 891-6533 for assistance in changing your site-specific PNL.*

## 6.5 Visual Selector

The Visual Selection Function was designed for use when the operator is presented with a fastener not commonly removed. The Visual Selector prompts the user to input 5 criteria parameters and uses this data to retrieve a fastener command from its database. This process cannot be error-proofed and relies on the operator providing the correct information to system, and that correct parameter being in the database.

Press Select Visual on the home screen.

- Progressing down the screen from top to bottom and left to right, in order highlight and select Type, Method, Material, Head (or collar) Diameter range, and Stem Size. The system will automatically offer a default Stem Size, but the default selection should always be checked before Saving.
- To determine head size Use Ground Pin Setting/Dressing Tool, (GO, NO GO gauge) to select the correct head diameter. Slide the gauge over the head of the fastener, if it does not travel freely, go to the next range. If it travels freely over the head of the fastener at that point, that will be the range selected.
- Select Save to accept the selection and load parameters from library.



<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

**CAUTION**



Once the other 4 parameters are selected, the system will automatically suggest the Stem Size. It is critical that the user check that the suggestion is correct, since for certain shear head fasteners the suggestion may be incorrect.

**CAUTION**



It is not possible combinations may be in the fastener library, it is possible to pick a combination for which there is not a library entry. If that occurs, a Red panel will appear indicating that a library entry has not been found, and the user should re-select. When this occurs, the user should check the default values to ensure they will work or recheck their selection.

Upon successful loading of the command the home screen will display the cut parameters and identify the correct electrode cutter for that command.

## 6.6 Ground Pin Adjustment (CG Hand Tool)

Ground Pin adjustment is a critical parameter in efficient operation of the device (much like the electrode in a TIG welder). As described in the Weekly Maintenance Schedule (Section 3.8), the Ground Pin should be regularly checked for excessive burning or damage and correct protrusion from the front of the E-drill. The procedure for checking and adjusting, and if necessary, replacing the ground pin is as follows:

1. Prior to Ground Pin inspection, advance Electrode to the full forward position; remove any installed Adapter and the Electrode from the E-drill and inspect the Ground Pin for excessive burning and/or damage.
2. Place the Ground Pin Setting Tool over the end of the hand-tool and across the Ground Pin tip. There should be no gap visible between the Gauge and the tip of the Ground Pin.
3. If there is a gap the Ground Pin may be adjusted by loosening the internal Ground Pin Clamp Screw.

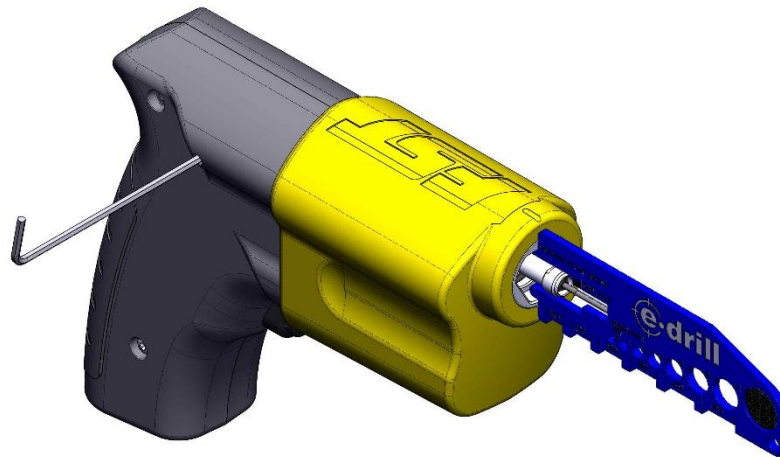
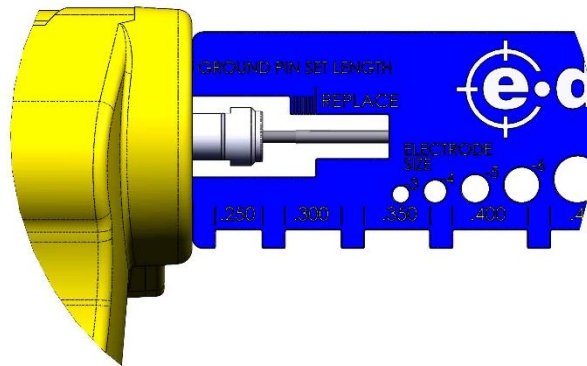
**CAUTION**



**DO NOT COMPLETELY REMOVE THE CLAMP SCREW.** Completely removing the screw will allow internal components to drop into the E-drill housing. Simply loosen the screw sufficiently to relieve the clamping force on the pin shaft.

E-drill Fastener Removal Instructions					
Document No.:	61-340	Revision:	E	Date:	6/25/2019

- Carefully pull the Ground Pin out incrementally (do not use any tools for this – if properly loosened, the Ground Pin should slide out relatively easily), recheck Pin length with the Pin Gauge allowing the Gauge to push the Pin back to the correct protrusion.



- To replace the Ground Pin, grip Ground Pin Assembly firmly and pull it straight out of the nose of the E-drill taking care not to bend it during extraction. Make sure there is no remaining clamping force on the Ground Pin if removal is difficult. As the Ground Pin Assembly is extracted, the Ground Pin Centering Guide will come out with the Ground Pin. Discard Ground Pin and Centering Guide once removed.
- Lightly coat the shaft of the new Ground Pin Assembly with a light coating of O- Ring Lube (do not over lubricate). Insert the prepared Ground Pin Assembly into the nose of the E-drill pressing it through the E-drill's internal seals. Use care not to bend the Ground Pin during insertion. Use Ground Pin Gauge to set the proper pin length and secure the Ground Pin

E-drill Fastener Removal Instructions			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

Clamp Screw (do not use excessive torque).

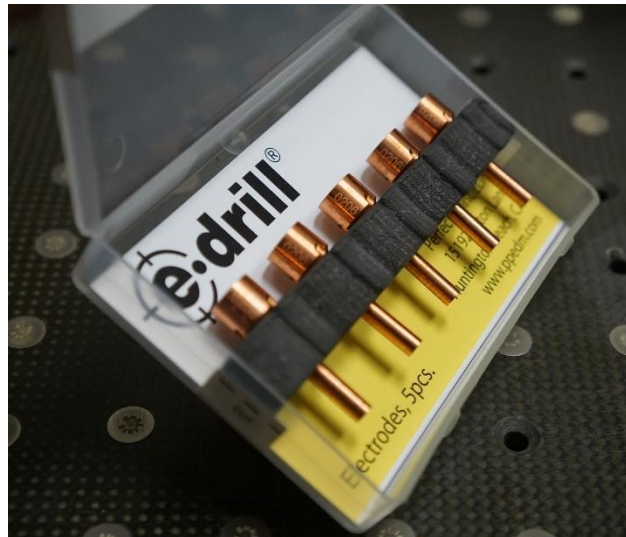
Press the Ground Pin Centering Guide on the Ground Pin Assembly into its seat in the Electrode Conducting Tube Bore using the tip of an Electrode. Install the required Electrode and Adapter and resume E-drill operation.

## 6.7 Electrode Installation

There are 14 standard Cutting Electrode O.D sizes available to which covers fasteners from 3/32” to 3/8”. Electrodes are designed to remove nominal, 1st oversize, and 2nd oversize fasteners.

Cutting Electrodes are packaged with color coded inserts and provided in kits of 5 each to match their sizes. The E-drill Electrode Guides to be used in the E-drill Adapters are color-coded to match. For convenience, each electrode is engraved with its Electrode Part Number.

Electrodes come in a range of standard, first, and second, oversize. Each size is identified by a color and a “dash” size. The complete electrode size range may be found in Appendix 5. Refer to the Operator Touch Screen Display Terminal for recommended Electrode use.



### CAUTION

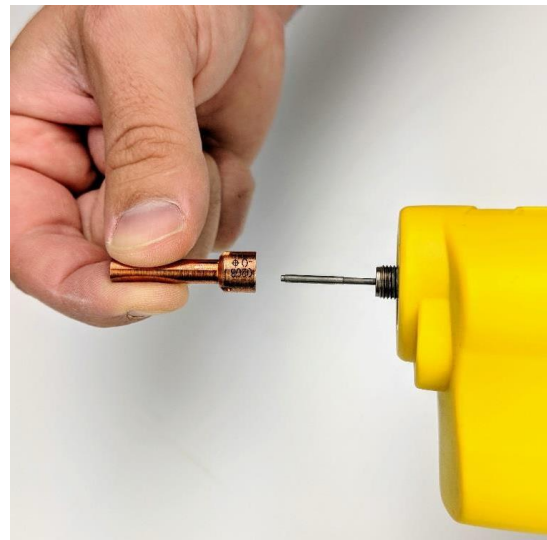


**Each FASTENER SIZE and diameter, and oversize fastener has a matching electrode SIZE. When changing to a different stem diameter or oversize type Fastener, the proper corresponding ELECTRODE MUST BE INSTALLED FOR SUCCESSFUL SYSTEM OPERATION.**

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

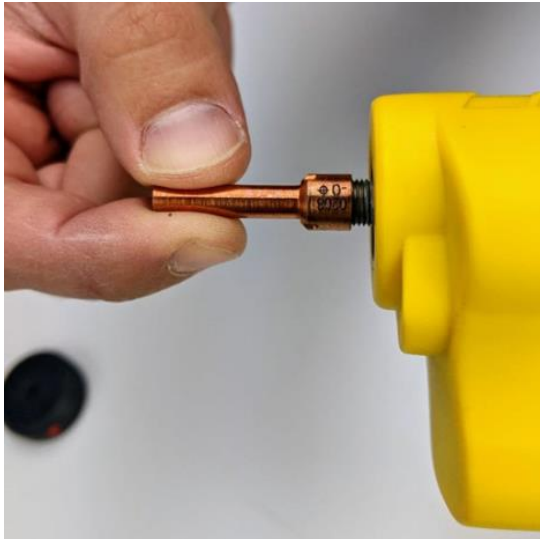
To install or replace an electrode:

- Unlock the E-drill Adapter by twisting in a counter-clockwise direction (when viewed from the front of the E-drill), then pull the adapter straight off.
- Unthread the existing electrode using the provided electrode wrench.



- Occasionally, when the electrode is depleted (flashing green light) the electrode may still not be advanced to the forward limit. In this case the retract button should be pressed momentarily, then the trigger may be depressed, and the electrode will advance completely.
- If the cutting electrode is being changed because of a change of fastener type, then it may be saved and used again later. If the electrode is indicated as needing replacement, then it should be discarded. Attempts to keep using a worn-out electrode could damage the mechanism.
- Check that the threads are clean on the front of the hand-tool and screw the replacement electrode hand-tight but firmly on to the conducting tube.
- Push and engage the electrode wrench over the electrode and tighten. The torque-ring will “skip” when the required torque is reached. Remove the wrench and replace the E-drill Adapter on the front of the hand-tool.

E-drill Fastener Removal Instructions					
<b>Document No.:</b>	61-340	<b>Revision:</b>	E	<b>Date:</b>	6/25/2019



- Retract the cutting electrode by pressing and holding down the green retract button in the base of the grip until the green light illuminates indicating the electrode is fully retracted.

*Note: If the replacement electrode is used/worn then it only needs to be retracted just inside the E-drill Adapter. Then during the first cut it will reach its correct cutting position faster.*

*Note: Electrode Wrench torque value is factory set and identified as calibrated with locking compound. Do not attempt adjustment of the Wrench detent setting screws.*



E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 6.8 Hand Tool Operation

### 6.8.1 General Hand Tool Use

The following instructions are applicable to both the CG and EG hand tools. CG and EG hand tools operate on the same principles, and only differ in their method of achieving electrical connection and by the size range each is designed for.

To remove a fastener with the hand tool:

- Select the right fastener setting on the Touch-Screen Display.
- Ensure the correct E-drill Adapter and Electrode for the fastener are used.
- Using thumb and forefinger press the E-drill lightly down over the fastener to minimize any water leaks which may occur during cutting.
- Allow the E-drill to reach its own perpendicularity to the fastener as influenced by the E-drill Adapter and its seal, and then wrap the fingers around the grip to hold securely during cutting.
- Depress the trigger on the E-drill and keep the trigger depressed until the process is completed. This is indicated by the status light on the back of the hand-tool illuminating.
- Hold the hand-tool as steady as possible during the cutting process.
- Following a successful cut, hold the E-drill over the fastener for a 1-2 seconds with the trigger depressed allowing the vacuum system to evacuate any excess water left behind by the process. The vacuum will continue to operate for as long as the trigger is depressed.



**Correct Grip of E-drill Hand Tool**

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

### 6.8.2 CG Hand Tool Use

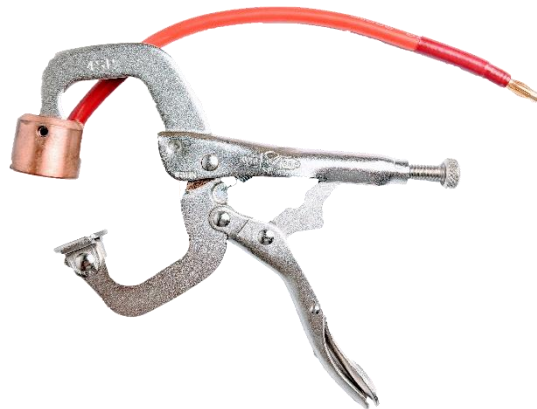
The CG hand tool can remove fastener diameters ranging from 5/32” (0.156”) and above. During CG hand tool operation, the user will feel slight resistance when the grounding pin contacts the fastener head. This is a normal function of CG hand tool and is caused by the ground pin opening a water valve inside the hand tool. During use depress the tool into the locator allowing the ground pin intimate electrical connection to the fastener.



**Failure to establish electrical ground with the CG Hand Tool Ground Pin on the fastener head (will result in a failed cut cycle. If cutting does not occur, re-clean the fastener head and attempt to re-establish a proper system ground between the E-drill Grounding Pin and the Fastener Head. Avoid, striking, grinding, or scraping the E-drill CG Ground Pin on the fastener head. Misuse will result in damage and misalignment of the E-drill Ground Pin and system failure.**

### 6.8.3 EG Hand Tool Use

EG hand tool can remove fastener diameters ranging from 3/32” (0.093”) and above. The EG hand tool requires the use of an electrical clamp to achieve connection to the work area. This clamp can be installed at a grounding point, providing that grounding point is electrically conducting to the fastener being removed and is generally within 18” from that fastener. If no grounding point is available near the fastener a drawing cleco can be used. Insert the cleco into the structure near the fastener and attach the clamp to the cleco.



Should the user be unsure if there is a conductive point near the work area, check continuity with a voltmeter. Attach one lead of the meter to the fastener and the other to potential grounding points. Once the meter confirms continuity attach the clamp and begin use.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 7 Fastener Removal Best Practices

The following is a series of detailed general instructions designed to instruct the user on generic fastener removal procedures. For specific applications by fastener type refer the APPENDICES I-4.

### 7.1 Raised Head Fastener Cutting

Select the correct fastener in either the Part Number or Visual Selector libraries (Section 6). Once the correct fastener has been selected on the Touch-Screen Display, the Home Screen will indicate the electrode size to use. Configure the E-drill hand tool with the correct electrode, button-head adapter, and electrode guide (Section 5). Select the correct Button Head Locator which fits tightly around the fastener head to be removed.

For tight-access fastener situations the Button-head adapter and locator may be one piece (Slimline style). After the heads of the fasteners are prepared (Section 6) the operator may proceed with the cutting process.

Grip the E-drill lightly, nestling the tool between thumb and forefinger as shown below. Position your second finger to depress the trigger when ready.

Place the selected button-head locator over the fastener and press down to ensure it is secure, flat to the surface and forms a good water seal. The Locator should fit snugly concentric around the fastener head with minimal play. If there is excessive play, then select a locator with a smaller metal insert or replace the insert.



***Correct Grip of Button Head Locator***

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

Guide the adapter installed on the E-drill into the Button Head Locator and press firmly but lightly down onto the fastener, (compressing the central E-drill Ground Pin if using a CG hand tool) and sealing the adapter around the head of the fastener. Ensure the E-drill is held perpendicular to the surface.

The adapter should be located concentrically around and over the fastener, sealing to the surrounding airframe. If in doubt about E-drill placement and concentricity go back to step A and try again.

While holding the E-drill firmly but lightly against the fastener, wrap fingers around the E-drill grip and squeeze the trigger with your second finger. The device will then automatically go through the following sequence:

- The vacuum pump will turn on to purge the area.
- The cutting electrode will advance until it detects the electrically conductive head of the fastener and calibrates itself.
- The cutting electrode will retract slightly, the system water pump will start and cutting will be initiated. Cutting will proceed until the prescribed depth is achieved (as defined by the fastener selection on the Touch-Screen Display)
- The power will be shut off, the system water pump will stop, and the light on the back of the hand-tool will illuminate.
- The system vacuum pump will continue to operate until 2 seconds after the trigger is released.



Remove the E-drill from the fastener, revealing the circular groove cut in the fastener head.

If the light on the back of the E-drill does not show green at the completion of the cut, then the cut may not have completed successfully to depth. If the light is showing a solid red then the likely cause is either a) bad electrical continuity resulting from paint or other coating, or b) the fastener material is different from what was selected from the library. Ensure all paint or other coatings are removed, place the E-drill over the fastener and try again.

A flashing green light indicates the cutting electrode must be replaced. A flashing red light indicates a system error – see the Touch-Screen Display for details.

Upon completion of the cut, select a proper size hand punch and center the punch in the fastener head. Sever the fastener head with a sharp blow on the punch with a hammer. It may be necessary to strike the punch more than once. If the fastener head does not separate, the fastener is most likely an oversize stem. Select an oversize cutting electrode and setting. Re-cut the fastener and attempt to sever the fastener head again with a punch and hammer.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 7.2 Flush Head Fastener Cutting

There are 3 standard series of flushing locating systems. The following is general instruction for use of each of these systems. Vacuum assisted locating tools are the preferred method of flush fastener removal. Vacuum Assisted locating ensures the process remains stationary during the cut and prevents damage to the airframe.

There is also a broad range of bombsight devices available to ensure very precise location of the vacuum devices concentric with the fastener to be removed. Please review section 5.6 to ensure you are using the best locator for your particular fastener types.

### 7.2.1 Vacuum Flush Locator (VFHL)

VFHL use is the preferred method for flush fastener removal on a non-contoured surface.

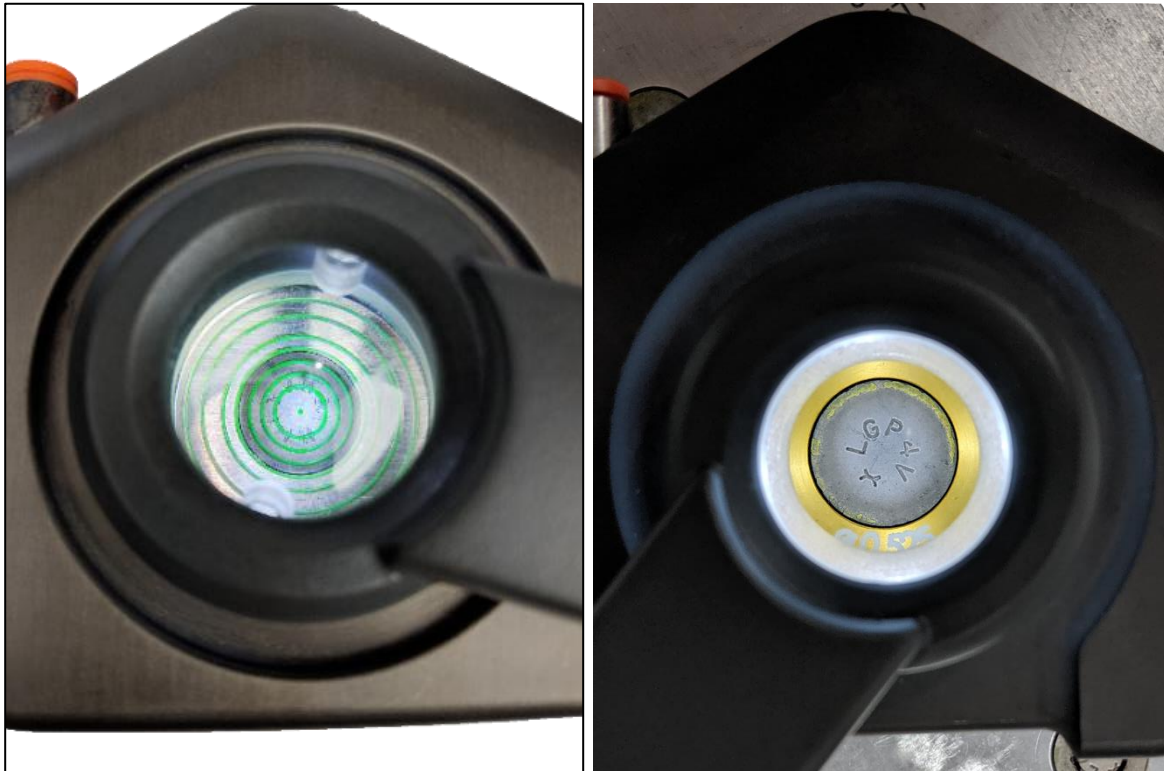
Select the correct fastener in either the Part Number or Visual Selector libraries (Section 6). Once the correct fastener has been selected on the Touch-Screen Display, the Home Screen will indicate the correct electrode size. Configure the E-drill hand tool with the correct electrode, vacuum adapter, and electrode guide (Section 5). To use VFHL perform the following steps:

- Turn on VFHL kit using the “on” switch inside the kit. This will begin the vacuum process keeping the locator in its place.
- Move locator over the fastener head to be removed.
- To move the locator, depress the float valve button on the right-hand side of the locator. This will release vacuum to the suction cups and allow free movement of the locator. Release the float valve to “lock” the locator back into place.
- The LED Bombsite illuminates by placing the long end of the bombsite over the small silver magnet located on top of the VFHL. (Note: mechanical locators do not illuminate.)
- Use the concentric rings or aperture locator ring to achieve concentricity over the head of the countersunk fastener to be removed. If using a mechanical locator (lock bolts, Torx, Hex, Tri-wing etc.) ensure the locator is snug in the recess before locking down the vacuum device.
- Once concentricity is achieved, release float valve, remove bombsite, insert hand tool (with VFHL adapter) and begin cutting sequence.



***Moving VFHL into position***

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		



***Concentric positioning on head of fastener***

Keeping constant and consistent pressure on the hand tool, and ensuring proper perpendicularity, gently squeeze trigger using middle finger. The light on the back of the gun will go out, and the cut will begin. During the cutting process, the following occurs:

- The Vacuum Pump will turn on to purge the area.
- The cutting electrode will advance until it detects the electrically conductive head of the fastener, whereupon it will automatically calibrate itself.
- The cutting electrode will retract slightly, the system Water Pump will start and cutting will be initiated.
- Cutting will proceed until the prescribed depth is achieved (as defined by the fastener selection on the Touch Screen Display)
- Power to the electrode will cease, the system Water Pump will stop, and the light on the back of the hand-tool will illuminate green.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

Once the light turns green on the back of the hand tool, the cut is done. After the cutting cycle is complete the vacuum pump will continue to run for 2 seconds. During this time, release the trigger and pull up slightly to vacuum up any residual water.

### 7.2.2 Offset Vacuum Locator (OVL)

Offset Vacuum Locator is the preferred method for flush fastener removal on a contoured surface. OVL is powered by the vacuum pump from the VFHL kit, operation for turning on vacuum and moving locator is the same as VFHL. OVL is also available as a complete standalone kit.

Select the correct fastener in either the Part Number or Visual Selector libraries (SECTION 5). Once the correct fastener has been selected on the Touch-Screen Display, the Home Screen will indicate the correct electrode size. Configure the E-drill hand tool with the correct electrode, vacuum adapter, and electrode guide (SECTION 5).

The OVL needs to be set to the correct perpendicularity for the structure. The receiver can be inclined to match the surface then locked in-place with the large twist-knob (see diagram below).



**E-drill Fastener Removal Instructions**

<b>Document No.:</b>	61-340	<b>Revision:</b>	E	<b>Date:</b>	6/25/2019
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If using the OVL on flat surfaces, the upper spherical washer pair can be inverted to lock the receiver and disable tilt (see diagram upper right). To use OVL on tilted surfaces ensure the upper washer pair are as in the lower diagram, and perform the following steps:

- Locate OVL over the desired fastener
- Insert a spare vacuum adapter into the receiver
- With one hand, loosen the nut on top of the OVL that holds the spherical washer stack-up
- With the other hand, push down in the center of the inserted VHFL adapter
- lift slightly on the “loose” end surrounding the receiver to achieve perpendicularity
- Once perpendicularity is achieved, tighten the nut on top of the OVL.
- Insert the bombsite to achieve final location over the fastener.
- Use the concentric rings or aperture locator ring to achieve concentricity over the head of the countersunk fastener to be removed. If using a mechanical locator (lock bolts, Torx, Hex, Tri-wing etc.) ensure the locator is snug in the recess before locking down the vacuum device.
- Once concentricity is achieved, release float valve, remove bombsite, insert hand tool (with VHFL adapter) and begin cutting sequence.

*Note: Once contour matching has been achieved with the OVL’s receiver do not adjust the contour when aligning over a fastener. Maneuver the body of the tool to achieve final centering.*



***OVL located correctly on a contoured surface***



E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

Keeping constant and consistent pressure on the hand tool, and ensuring proper perpendicularity, gently squeeze trigger using middle finger. The light on the back of the gun will go out, and the cut will begin. During the cutting process, the following occurs:

- The vacuum pump will turn on to purge the area.
- The cutting electrode will advance until it detects the electrically conductive head of the fastener, whereupon it will automatically calibrate itself.
- The cutting electrode will retract slightly, the system Water Pump will start and cutting will be initiated.
- Cutting will proceed until the prescribed depth is achieved (as defined by the fastener selection on the Touch-Screen Display)
- Power to the electrode will cease, the system Water Pump will stop, and the light on the back of the hand-tool will illuminate green.

Once the light turns green on the back of the hand tool, the cut is done. After the cutting cycle is complete the vacuum pump will continue to run for 2 seconds. During this time, release the trigger and pull up slightly to vacuum up any residual water.

### 7.2.3 Flush Head Locator (FHL)

FHL location is not to be attempted on articles that are dispositioned for reuse. FHL does not have a stationary locking feature and must be aligned visually and held stationary by the user. FHL is only designed for use on non-contoured surfaces. Do not attempt to use FHL on contoured surfaces as this could result in significant water leakage and potentially damage the airframe.

Select the correct fastener in either the Part Number or Visual Selector libraries (SECTION 5). Once the correct fastener has been selected on the Touch-Screen Display, the Home Screen will indicate the correct electrode size. Configure the E-drill hand tool with the correct electrode, vacuum adapter, and electrode guide (SECTION 4). To use VFHL perform the following steps:

- Place FHL over the fastener
- Depress FHL to form a watertight seal
- The locator aperture should be visibly concentric around the fastener head with minimal space between the fastener head and FHL aperture
- If excessive space exists around the aperture select an aperture select a different aperture that closer matches the fastener



**Correct FHL Alignment**

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

- Once concentricity is achieved physically hold the FHL in position and insert hand tool (with FHL adapter) and begin cutting sequence



**CAUTION:**



***While pressing the FHL firmly onto the airframe so that it does not move, insert the E-drill completely into the FHL. Concentricity and perpendicularity are critical to eliminating airframe damage; if in doubt remove the E-drill, check and adjust the FHL and re-insert the E-drill.***



**Adapter fit into FHL**



**Concentric E-drill Alignment**

Keeping constant and consistent pressure on the hand tool, and ensuring proper perpendicularity, gently squeeze trigger using middle finger. The light on the back of the gun will go out, and the cut will begin. During the cutting process, the following occurs:

- The vacuum pump will turn on to purge the area.
- The cutting electrode will advance until it detects the electrically conductive head of the fastener, whereupon it will automatically calibrate itself.
- The cutting electrode will retract slightly, the system Water Pump will start and cutting will be initiated.
- Cutting will proceed until the prescribed depth is achieved (as defined by the fastener selection on the Touch-Screen Display)

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

- Power to the electrode will cease, the system Water Pump will stop, and the light on the back of the hand-tool will illuminate green.

Once the light turns green on the back of the hand tool, the cut is done. After the cutting cycle is complete the vacuum pump will continue to run for 2 seconds. During this time, release the trigger and pull up slightly to vacuum up any residual water.

### 7.3 Fastener Extraction

Upon successfully cutting a fastener with E-drill, the user will still be required to manually sever the head of the fastener from its stem/shank. This may be achieved with a conventional punch and hammer, but there is less risk of damage to airframe or personnel if the Perfect Point Punch-Buddy or Air Punch products are used, since both are guided but the cut-ring in the fastener head

#### 7.3.1 Perfect Point Punch-Buddy

Perfect Point has designed and manufactured a non-skid punch (Punch-Buddy) that can easily sever fastener heads from diameters 5/32" (0.156") to 5/16" (0.312"). In some applications the Punch-Buddy is not capable of successfully severing the fastener head from shank. For fastener-specific means of extraction refer to APPENDICES I-4.

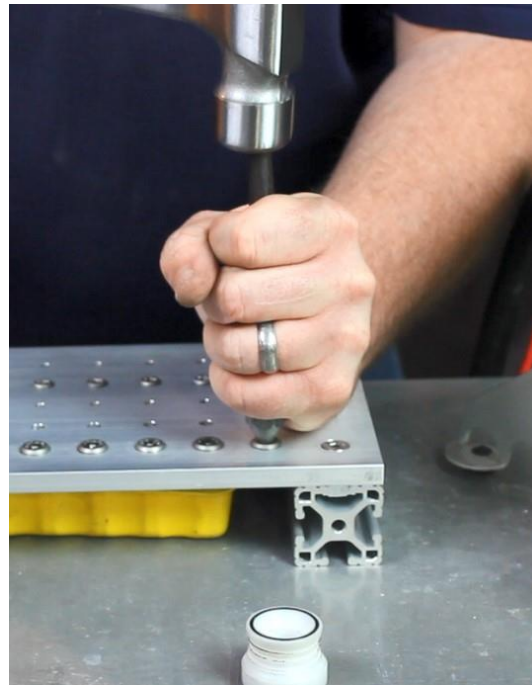
Typically, most fasteners can be extracted by using a Punch-Buddy of the same size as the electrode used to cut the fastener. Perform the following to extract the fastener:

- Align the punch into the Cut Ring on the fastener
- Once aligned strike punch with moderate force using a 12-16 oz ball-peen hammer or equivalent
- The fastener should fail after 1-2 blows with the hammer
- If the fastener does not fail after several blows, reperform the specific cut method used on that fastener.

<b>E-drill Fastener Removal Instructions</b>					
<b>Document No.:</b>	61-340	<b>Revision:</b>	E	<b>Date:</b>	6/25/2019



**Locating Punch-Buddy into cut ring**



**Correct holding of Punch-Buddy during extraction**

### 7.3.2 Perfect Point Air Punch

The Perfect Point Air Punch (p/n EDTI300) is a single shot air-driven punch customized for use with E-drill. It includes a range of nose adapters and is designed to locate in the cut ring left in the fastener head, and strike the flat platform left on the fastener stem after cutting.

The Air Punch is particularly valuable for high-interference fasteners, and fasteners located in tight areas or underside of structure where use of a hammer may be difficult.

Operation is similar to Punch Buddy.



<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

## 8 Quality Control

### 8.1 Authorized Users

Only trained operators shall remove fasteners using this process. Perfect Point Customer Service provides in-depth training courses as part of the initial purchase of an E-drill System. Should a customer require additional training or assistance with a project, contact Perfect Point Customer Service.

### 8.2 Damage Inspection

Holes shall be inspected after fastener removal for evidence of off-center burn, as indicated by a black erosion mark, and in accordance with the applicable fastener installation specification for the replacement fastener to be used.

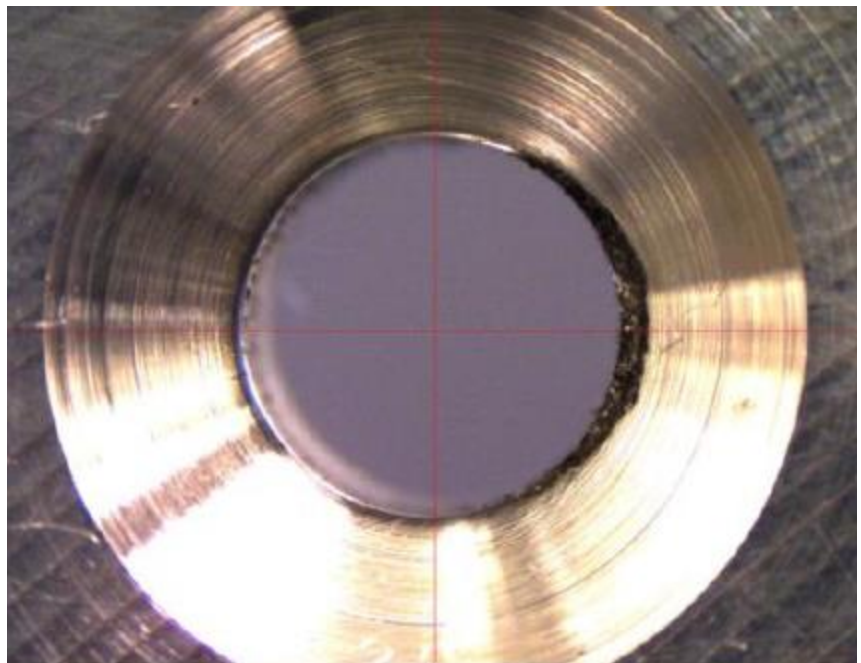
An off-center burn condition after a flush fastener removal is illustrated in the photograph to the right side of the hole. The damage occurs right at the top of the parallel portion of the hole.

This damage must be rectified in-accordance-with the users local engineering procedures.

### 8.3 Rectification

It is outside Perfect Point's scope of authority to directly disposition damaged holes, however Perfect Point has performed exhaustive studies on the effects of EDM damage to typical aerostructures.

As a general disposition, a user must measure the length of the visibly damaged area. This can be performed by best shop practices depending on the user. Once the dimension on maximum damage has been measured, an additional 0.005" must be added to that measurement. This is to account for the non-visible damage in the Heat Affected Zone.



Once the final measurement is derived, typically the engineering disposition will be the same as that of a traditionally drilled hole with that degree of offset. Clean ream the damaged hole in-accordance-with local procedures to the dispositioned size, and the structure will retain its original structural properties.

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 9 Appendix I – Solid Shank Rivet Removal Instructions

### Introduction

Solid Shank Rivets are one of the most prolific fasteners in the aerospace market. These fasteners have applications on almost every single aircraft in existence. Nomenclature changes among users and OEM's; typically these fasteners are called out as AN, MS or NAS series rivets.

Solid Shank Rivets are malleable pins with a shaped head (Raised, Flush or Dome) and a straight shank. The Rivet installed through a joining hole in the structure, and then compressed by an air-hammer and bucking bar. This produces a deformation known as the "bucktail" or "shoptail" which holds the manufactured head of the rivet firmly to the attaching structure.



Fig-1: Typical Example of Solid Rivets Installation

Solid Shank Rivets are constructed of many different alloys such as: Aluminum, CRES, Alloy Steel, Monel, and Titanium. Differentiation on alloys is determined by the stress and heat requirements of the area in which the rivet is installed. General Best Practice is to identify the alloy of the fastener being removed, which dictates which command is used for the E-drill. This ensures the correct power settings are applied for the application.

*Note: This Instruction guide is intended to familiarize the user with best practices required to remove this specific fastener.*

### I. Identification

#### I.1. Head Marking

I.1.1. Read Markings on a solid rivet consist of a series of dots, dashes, triangles, and rectangles, each identifying the fastener's metallurgy and configuration. See Examples below:








MATERIAL	HEAD MARKING	MS MATERIAL CODE
1100	PLAIN 	A
2117	DIMPLED 	AD
2017	RAISED TEAT 	D
2024	RAISED DOUBLE DASH 	DD
5056	RAISED CROSS 	B
CARBON STEEL	RECESSED TRIANGLE 	
CORROSION-RESISTANT STEEL	PLAIN 	F

Fig-2: Typical head markings on solid rivets

E-drill Fastener Removal Instructions			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

## 1.2. Head Configuration

- 1.2.1. Depending on the fastener type, the fastener head configuration will generally be one of the following:
  - 1.2.1.1. Universal Raised Head
  - 1.2.1.2. Universal Flush Head (typically 100° but could also be 85°, 120°, or similar)
  - 1.2.1.3. Double Flush (countersink at both hole ends- often referred to as a repair-rivet or flush-plug  
*Note: Different configurations of countersink degrees do not affect the E-drill Process.*
- 1.2.2. Typically, SRM and Work Instruction Manuals have a legend of different Solid Rivet Configurations which are installed on any given aircraft.

## 2. Setup Procedure

### 2.1. Fastener Preparation

- 2.1.1. To obtain acceptable grounding contact, surface paint must be removed from the fastener head before fastener removal is initiated.
- 2.1.2. Coating may also be removed with 180-grit or finer emery cloth or a small spoon file, or scraper. Care should be taken not to abrade or damage the surrounding structure. Typically, an area comparable in size to the fastener stem diameter is enough (see example below).  
*Note: Aluminum Rivets can be deformed by sanding/grinding operations, which makes mechanical or visual alignment difficult. S-Blaster is the Preferred Method of Coating Removal.*

### 2.2. Hand-Tool Selection

- 2.2.1. Typically, Solid Shank Rivets have a diameter ranging from 3/32" (0.094") to 3/8" (0.375"). This requires the user to select the correct Hand-Tool for the application.
  - 2.2.1.1. Select Center Ground (CG) hand tool for fastener sizes 5/32" – 7/16"
  - 2.2.1.2. Select External Ground (EG) hand tool for fastener sizes 3/32" – 1/8"*Note: EG Handtool is only effective if the stack-up material is comprised of a conductive (metal) material.*

### 2.3. Command Input

- 2.3.1. Select the correct command for the fastener being removed.
  - 2.3.1.1. Select the program for the specific fastener from the Part Number Library
  - 2.3.1.2. Program the parameters into the Visual Selection function. (For instructions on the use of the Visual Selection Function refer to the General E-drill User Instruction Guide)  
*Note: In all cases the pre-programmed "Part Number Library" (PNL) is preferable to the "Visual Selection" (VS) Function. VS is specifically designed for emergent/non-standard work. Should there be a requirement to add commands to the PNL, contact Perfect Point Customer Service and an adjusted library can be sent to the user.*

### 2.4. Tool Configuration

- 2.4.1. Following program load on the display, observe the electrode callout for the specific fastener. Install that electrode on the conducting tube, in-accordance-with the general E-drill User Instruction Guide.
- 2.4.2. Install the correct (either Flush or Button Head) Locator Adapter on the Hand-Tool, depending on the fastener being removed.  
*Note: "Domed" fasteners are to be removed by the flush method only. Do not attempt to align a BHL over the slight dome of these rivets. Risk of airframe damage is significant. For applications on CFRP or on skin to be re-used, use either the VFHL or OVL Locator Tools for precision error-free location. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage.*

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

### 3. Removal Instructions

3.1. Locate the Button Head or Flush Head locator over/around the fastener head. Take care to locate concentric around the fastener.

*Note: Flush applications on CFRP, use either the VFHL or OVL Locator Tools. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage.*

3.2. Firmly insert hand tool and press down with light force, taking care not to move the locator. (If the user suspects the locator may have moved, then extract the Hand-Tool and check/adjust concentricity.

3.3. Squeeze and hold trigger until display light illuminates

3.3.1. Green Light indicates the cut was completed correctly and fastener is ready for extraction.

3.3.2. Red Light indicates the cut was out of parameters (either under or over time prediction).

3.3.2.1. If display indicated under-time warning, attempt to recut the fastener.

3.3.2.2. If the display indicated over-time warning, attempt punchout and note the force required to extract.

3.3.2.2.1. If minimal force is required, no further action is needed.

3.3.2.2.2. If significant force is required or if the fastener does not sever, reattempt the cut.

3.3.2.2.3. If numerous attempts have failed to yield a fracture, check the command settings, electrode size, and recheck the fastener.

3.4. Repeat steps with remaining fasteners to be removed.

### 4. Punch Out

4.1. Solid Rivets can be extracted by using a “Punch Buddy” or Air Punch of the same nominal size as the electrode used to cut the fastener (see section 7.3).

4.2. Align the punch into the Cut Ring on the fastener.

4.3. Once aligned strike punch with moderate force using a 12 oz Ball-Peen Hammer or equivalent.

*Note: Solid Rivets are often installed on very thin skin joints. This may make Punch Out difficult. If there is a notable flexing of the skin-panel or if the rivet will not sever, place a bucking-bar or other solid backing next to the Buck-Tail. Pressing firmly on the bucking-bar, punch fastener until it severs.*



E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## 10 Appendix 2 – Blind Rivet Removal Instructions

### Introduction

Blind Rivets are a very common fastener in the aerospace market. These fasteners have applications on most aircraft and serve in a several key fastening function. Blind Rivets typically are installed in low-stress areas where loading and vibration are not common. Nomenclature changes among users and OEM's; typically, these fasteners are called out as MS, NAS or CR series rivets.

A Blind Rivet is a two-piece fastener that uses a hardened draw-pin to compress a hollow sleeve and secures itself in place by means of a locking-ring. The Blind Rivet is installed through a joining hole in the structure, typically where a bucking bar or other traditional driving tools cannot access. A pulling head is used to move the draw-pin through the hollow sleeve, thus producing a blub-shaped shop-tail, like that of a driven solid rivet. At a predetermined pressure setting the draw-pin fractures from the fastener leaving a lock ring set into the hollow sleeve.

Blind Rivets are constructed of many different alloys such as: Aluminum, CRES, Alloy Steel, Monel, and Titanium. Differentiation on alloys is determined by the stress and heat requirements of the area in which the rivet is installed. General Best Practice is to identify the alloy of the fastener being removed, which dictates which command is used for the E-drill. This ensures the correct power settings are applied for the application.

*Note: This Instruction guide is intended to familiarize the user with best practices required to remove this specific fastener.*

### 1. Identification

#### 1.1. Head Marking

1.1.1. Head Markings on a Blind Rivet consist of a series of trade markings that identify the manufacturer, material, and grip of the Fastener. Some examples below:

1.1.1.1. Marking “+” Indicates CRES Stem.

1.1.1.2. Marking “M” Indicates Monel Sleeve.

1.1.1.3. Marking “X” Indicates Inconel Stem.

### 2. Head Configuration

2.1. Depending on the fastener type, the fastener head configuration will generally be one of the following:

2.1.1. Universal Raised Head

2.1.2. Universal Flush Head (typically 100° but could also be 120°)



Fig. 1- Typical examples of Blind Rivets

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

Note: Different configurations of countersink degrees do not affect the E-drill Process.

2.2. Typically, the SRM and the Work Instruction Manuals have a legend of the different types of Blind Rivet Configurations which are installed on any given aircraft.

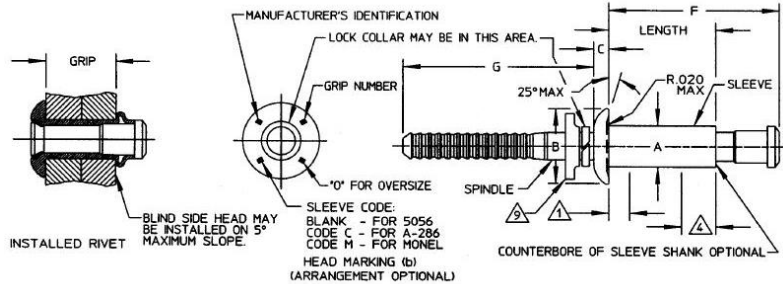


Fig. 2- Diagram of a Blind Rivet

### 3. Setup Procedure

#### 3.1. Fastener Preparation

3.1.1. To obtain acceptable

grounding contact, surface paint must be removed from the fastener head before fastener removal is initiated.

3.1.2. Coating may also be removed with 180-grit or finer emery cloth or a small spoon file, or scraper. Care should be taken not to abrade or damage the surrounding structure. Typically, an area comparable in size to the fastener stem diameter is enough (see example below).



Fig 3- Installed Blind Rivets with Coating Removed

Note: Aluminum Rivets can be deformed by sanding/grinding operations, which makes mechanical or visual alignment difficult. S-Blaster is the Preferred Method of Coating Removal.

#### 3.2. Hand-Tool Selection

3.2.1. Blind Rivets have a diameter ranging from 3/32" (0.094") to 3/8" (0.375"). This requires the user to select the correct Hand-Tool for the application.

3.2.1.1. Select Center Ground (CG) hand tool for fastener sizes 5/32" – 7/16"

3.2.1.2. Select External Ground (EG) hand tool for fastener sizes 3/32" – 1/8"

Note: EG Hand tool is only effective if the stack-up material is comprised of a conductive (metal) material.

#### 3.3. Command Input

3.3.1. Select the correct command for the fastener being removed.

3.3.1.1. Select the program for the specific fastener from the Part Number Library

3.3.1.2. Program the parameters into the Visual Selection function.

E-drill Fastener Removal Instructions			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

*Note: In all cases the pre-programmed “Part Number Library” (PNL) is preferable to the “Visual Selection” (VS) Function. VS is specifically designed for emergent/non-standard work. Should there be a requirement to add commands to the PNL, contact Perfect Point Customer Service and an adjusted library can be sent to the user.*

### 3.4. Tool Configuration

3.4.1. Following program load on the display, observe the electrode callout for the specific fastener. Install that electrode on the conducting tube.

3.4.2. Install the correct (either Flush or Button Head) Locator Adapter on the Hand-Tool, depending on the fastener being removed.

*Note: For applications on CFRP or on skin to be re-used, use either the VFHL or OVL Locator Tools for precision error-free location. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage.*

## 4. Removal Instructions

4.1. Locate the Button Head or Flush Head locator over/around the fastener head. Take care to locate concentric around the fastener.

*Note: Flush applications on CFRP, use either the VFHL or OVL Locator Tools. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage.*

4.2. Firmly insert hand tool and press down with light force, taking care not to move the locator. (If the user suspects the locator may have moved, then extract the Hand-Tool and check/adjust concentricity.

4.3. Squeeze and hold trigger until display light illuminates

4.3.1. Green Light indicates the cut was completed correctly and fastener is ready for extraction.

4.3.2. Red Light indicates the cut was out of parameters (either under or over time prediction).

4.3.2.1. If display indicated under-time warning, attempt to recut the fastener

4.3.2.2. If the display indicated over-time warning, attempt punchout and note the force required to extract.

4.3.2.2.1. If minimal force is required, no further action is needed

4.3.2.2.2. If significant force is required or if the fastener does not sever, reattempt the cut.

4.3.2.2.3. If numerous attempts have failed to yield a fracture, check the command settings, electrode size, and recheck the fastener.

4.4. Repeat steps with remaining fasteners to be removed.

## 5. Punch Out

5.1. Blind Rivets cannot be extracted by using a “Punch Buddy” or Air Punch.

5.2. Use of the Punch Buddy or Air Punch will drive the locking stem out of the fastener, leaving the bulb-shaped sleeve in place.

5.3. Use a Straight Pin Punch of similar diameter as that of the electrode used for the cut.

*Note: If a Straight Pin Punch of correct size cannot be acquired, contact Perfect Point Customer Service*

5.4. Align the Pin-Punch into the Cut Ring on the fastener

<b>E-drill Fastener Removal Instructions</b>			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
<b>Date:</b>	6/25/2019		

5.5. Once aligned strike punch with moderate force using a 12 oz Ball-Peen Hammer or equivalent

*Note: Blind Rivets are often installed on very thin skin joints. This may make Punch Out difficult. If there is a notable flexing of the skin-panel or if the rivet will not sever, place a bucking-bar or other solid backing next to the Buck-Tail. Pressing firmly on the bucking-bar, punch fastener until it severs.*

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

## I I Appendix 3 – Blind-Bolt Removal Instructions

### Introduction

Blind-Bolts are the most difficult fasteners to remove by traditional drilling/grinding techniques, however, it is one of the easiest fastener types to remove using the E-drill. Blind-Bolts are the fastener category containing: Visu-Loks/Jo-Bolts, Composi-Loks, Radial-Loks, and any other fastener that is installed via a stationary threaded core and a driving nut.

Typically, these fasteners are constructed of a hardened Steel Alloys or Titanium Cores making conventional drilling extremely difficult to control and results in higher rates of damage. These fasteners are typically installed on Wing Closeout Skins, High-Stress Aerodynamic Surfaces, Flight Control Surfaces, and on Carbon Reinforced Plastics (CFRP).

Typically Blind-Bolts deviate from standard nominal diameters and require a larger electrode to remove. Specialized removal kits are available for specific applications and can be ordered from the Perfect Point.



Fig. 1- Typical examples of Blind-Bolt Fasteners

*Note: This Instruction guide is intended to familiarize the user with best practices required to remove this specific fastener.*

### 1. Identification

#### 1.1. Head Marking

1.1.1. Head Marking on Blind Bolt Fasteners typically show a VS, PLT, or MBF on the head, followed by a series of numbers.

Examples below:

1.1.1.1. PLT 160

1.1.1.2. MBF 2113

#### 1.2. Head Configuration

1.2.1. Depending on the fastener type, the head configuration will be one of the following

1.2.1.1. Raised-head

1.2.1.2. Flush-head

1.2.1.3. Hex-head

1.2.2. These Fasteners typically have an easily identifiable cross formation known as a cruciform, with a noticeable pin in the center of the head.



Fig. 2- Typical example of Installed Blind-Bolt Fasteners

### 2. Setup Procedure

#### 2.1. Fastener Preparation

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

- 2.1.1. To obtain acceptable grounding contact, surface paint must be removed from the fastener head before fastener removal is initiated.
- 2.1.2. Blind Bolt Fasteners surface finish must be removed by the S-Blaster System. This is due to the cruciform depression in the head of these fasteners. Mechanical sanding and/or chemical coating removal typically will not yield a conductive surface finish quality required for E-drill.



Fig. 3- Typical example of installed Blind-Bolt with coating removed

## 2.2. Hand-Tool Selection

- 2.2.1. Typically, Blind-Bolt have a diameter greater than 5/32" (0.156") which allows for removal with either Hand-Tool.
- 2.2.2. Fasteners with drive stems that are broken relatively flush to the fastener head, CG Hand-Tool is preferable.
- 2.2.3. Fasteners with drive stems broken off high or low relative to the fastener face, users typically require the Externally Grounded (EG) Hand-Tool. This is due to the interference between the stem and the Grounding Pin of the CG Hand-Tool.  
*Note: EG Handtool is only effective if the stack-up material is comprised of a conductive (metal) material.*
- 2.2.4. Should the material be completely comprised of CFRP and the CG Hand-Tool must be used. Adjust the grounding pin to account for the fastener stem height or depth.

## 2.3. Command Input

- 2.3.1. Select the correct command for the fastener being removed.
  - 2.3.1.1. Select the program for the specific fastener from the Part Number Library
  - 2.3.1.2. Program the parameters into the Visual Selection function.

*Note: In all cases the pre-programmed "Part Number Library" (PNL) is preferable to the "Visual Selection" (VS) Function. VS is specifically designed for emergent/non-standard work. Should there be a requirement to add commands to the PNL, contact Perfect Point Customer Service and an adjusted library can be sent to the user.*

## 2.4. Tool Configuration

- 2.4.1. Following program load on the display, observe the electrode callout for the specific fastener. Install that electrode on the conducting tube, in-accordance-with the general E-drill User Instruction Guide.
- 2.4.2. Install the correct (either Flush or Button Head) Locator Adapter on the Hand-Tool, depending on the fastener being removed.



*Caution: Blind Bolt Fastener's do not typically follow nominal diameters for fastener shanks. Check the Electrode Callout Display on the Terminal prior to installing an electrode onto the hand-tool.*

**E-drill Fastener Removal Instructions**

<b>Document No.:</b>	61-340	<b>Revision:</b>	E	<b>Date:</b>	6/25/2019
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### 3. Removal Instructions

3.1. Locate the Button Head or Flush Head locator over/around the fastener head. Take care to locate concentric around the fastener.

*Note: Flush Blind Bolt Applications on CFRP, use either the VFHL or OVL Locator Tools, and the mechanical locator (refer to section 5.6) for precision error-free location. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage. For Blind Bolt fasteners where there is a recess (torx, hex, tri-wing Hi-Torque etc.), the correct mechanical locator (refer to section 5.6) should be used.*

3.2. Firmly insert hand tool and press down with light force, taking care not to move the locator. (If the user suspects the locator may have moved, then extract the Hand-Tool and check/adjust concentricity.

3.3. Squeeze and hold trigger until display light illuminates

3.3.1. Green Light indicates the cut was completed correctly and fastener is ready for extraction.

3.3.2. Red Light indicates the cut was out of parameters (either under or over time prediction)

3.3.2.1. If display indicated under-time warning, attempt to recut the fastener

3.3.2.2. If the display indicated over-time warning, attempt punchout and note the force required to extract.

3.3.2.2.1. If minimal force is required, no further steps are needed

3.3.2.2.2. If significant force is required or if the fastener does not sever, reattempt the cut.

3.3.2.2.3. If numerous attempts have failed to yield a fracture, check the command settings, electrode size, and recheck the fastener.

3.4. Repeat steps with remaining fasteners to be removed.

### 4. Punch Out

4.1. Blind-Bolt Fasteners can typically be extracted by using a "Punch Buddy" or Air Punch of the same nominal size as the electrode used to cut the fastener (see section 7.3).

4.2. Align the punch into the Cut Ring on the fastener.

4.3. Once aligned strike punch with moderate force using a 12 oz Ball-Peen Hammer or equivalent.

*Note: Generally Blind-Bolts are installed in rigid areas of the aircraft and should sever easily with a solid punch impact.*

<b>E-drill Fastener Removal Instructions</b>					
<b>Document No.:</b>	61-340	<b>Revision:</b>	E	<b>Date:</b>	6/25/2019

## I2 Appendix 4 – Straight-Shank Pin Removal Instructions

### Introduction

Straight-Shank Pins are a very common form of structural fastener. Often referred to as: Hi-Loks, Hi-Lites, Hucks, Lock-Bolts, Eddie-Bolts or Pin-Rivets, these fasteners are installed with a collar that is threaded or swaged on depending on type.

Straight-Shank Pins are hardened pins with a shaped head and a threaded or grooved shank. These fasteners are typically constructed of Steel or Titanium alloys, which makes conventional drilling difficult. Straight Shank Pins are installed in high-strength/stress mating joints, frame stations, fairing ribs, and many other places where strength and rigidity are required.



Fig. 1- Typical examples of Straight Shank Pins

*Note: This Instruction guide is intended to familiarize the user with best practices required to remove this specific fastener.*

### I. Identification

#### I.1. Head Marking

I.1.1. Head Marking on Straight-Shank Pin Fasteners typically show a HL, HST, LGPL, or LHPL on the head, followed by a series of numbers. Examples below:

- HL 10
- LGPL2

#### I.2. Head Configuration

I.2.1. Depending on the fastener type, the head configuration will be one of the following

- Raised Head
- Flush Head

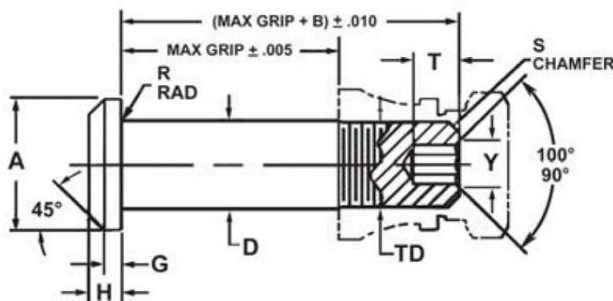


Fig. 2- Diagram of a Straight Shank Pin



E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

### 1.3. Collar Configuration

1.3.1. These Fasteners typically have a flat planed surface and are easily identifiable due to the method of installation (Collared).

## 2. Setup Procedure

### 2.1. Fastener Preparation

2.1.1. To obtain acceptable grounding contact, surface paint must be removed from the fastener head before fastener removal is initiated.

2.1.2. Coating may also be removed with 180-grit or finer emery cloth or a small spoon file, or scraper. Care should be taken not to abrade or damage the surrounding structure. Typically, an area comparable in size to the fastener stem diameter is enough.

### 2.2. Hand-Tool Selection

2.2.1. Straight-Shank Pins have a diameter greater than 5/32" (0.156") which allows the user to select either style hand tool

2.2.1.1. Center Grounded (CG) Hand Tool is preferable on Straight Shank Pins

2.2.1.2. Externally Grounded (EG) Hand Tool can be used on this application, but is of no direct benefit to the user, unless the surface face of the fastener is damaged or deformed.

### 2.3. Command Input

2.3.1. Select the correct command for the fastener being removed.

2.3.1.1. Select the program for the specific fastener from the Part Number Library

2.3.1.2. Program the parameters into the Visual Selection function.

*Note: In all cases the pre-programmed "Part Number Library" (PNL) is preferable to the "Visual Selection" (VS) Function. VS is specifically designed for emergent/non-standard work. Should there be a requirement to add commands to the PNL, contact Perfect Point Customer Service and an adjusted library can be sent to the user.*

### 2.4. Tool Configuration

2.4.1. Following program load on the display, observe the electrode callout for the specific fastener. Install that electrode on the conducting tube, in accordance with the general E-drill User Instructions.

2.4.2. Install the correct (either Flush or Button Head) Locator Adapter on the Hand-Tool, depending on the fastener being removed.

*Note: For flush pin applications on CFRP or on skin to be re-used, use either the VFHL or OVL Locator Tools for precision error-free location. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage. For pin fasteners where there is a recess (torx, hex, tri-wing Hi-Torque etc.), the correct mechanical locator (refer to section 5.6) should be used.*

## 3. Removal Instructions

3.1. Locate the Button Head or Flush Head locator over/around the fastener head. Take care to locate concentric around the fastener.

3.2. Firmly insert hand tool and press down with light force, taking care not to move the locator. (If the user suspects the locator may have moved, then extract the Hand-Tool and

E-drill Fastener Removal Instructions			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

check/adjust concentricity.

- 3.3. Squeeze and hold trigger until display light illuminates
  - 3.3.1. Green Light indicates the cut was completed correctly and fastener is ready for extraction.
  - 3.3.2. Red Light indicates the cut was out of parameters (either under or over time prediction)
    - 3.3.2.1. If display indicated under-time warning, attempt to recut the fastener
    - 3.3.2.2. If the display indicated over-time warning, attempt punchout and note the force required to extract.
      - 3.3.2.2.1. If minimal force is required, no further action is needed
      - 3.3.2.2.2. If significant force is required or if the fastener does not sever, reattempt the cut.
      - 3.3.2.2.3. If numerous attempts have failed to yield a fracture, check the command settings, electrode size, and recheck the fastener.
- 3.4. Repeat steps with remaining fasteners to be removed.

*Note: Flush applications on CFRP, use either the VFHL or OVL Locator Tools. Non-Vacuum Assisted Flush Locators risk damaging the CFRP due to slippage.*

#### 4. Punch Out

- 4.1. Straight-Shank Pins can be extracted by using a “Punch Buddy” or Air Punch of the same nominal size as the electrode used to cut the fastener (see section 7.3).
- 4.2. Align the punch into the Cut Ring on the fastener
- 4.3. Once aligned strike punch with moderate force using a 12 oz Ball-Peen Hammer or equivalent.

*Note: Typically, Straight-Shank Pins are installed in rigid areas of the aircraft and should sever easily with a solid punch impact.*

E-drill Fastener Removal Instructions					
Document No.:	61-340	Revision:	E	Date:	6/25/2019

### 13 Appendix 5 – Cutting Electrode Sizes and Adapter Color Matching

There are 17 different standard Cutting Electrode O.D sizes available to cover 18 different diameter fasteners from 3/32” to 3/8”. Electrodes are designed to remove nominal, X (1<sup>st</sup> Oversize) and Y (2<sup>nd</sup> Oversize) fasteners.

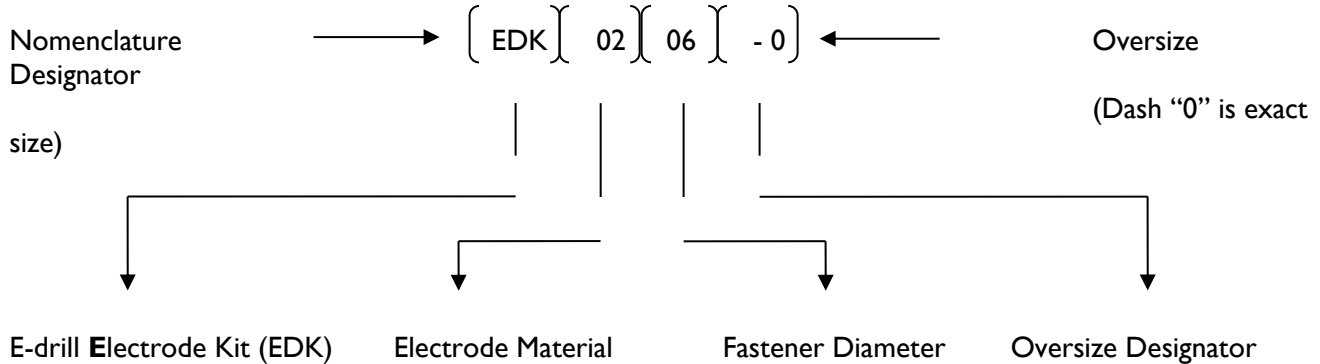
Cutting Electrodes are packaged and color coded and provided in kits of 5 each to match their sizes and the hand-tool Adapters used with that size Electrode. The chart and color legend below illustrates the size color coding. Refer to Perfect Point™ Consumables Order Form (Document No.60-122) provided with the System Documentation Package for Electrode part number and Adaptor Tip ordering information.

Electrode Size	Dash Size	Hand-Tool Adapter Body (Tri-wing)*	Adapter Electrode Guide	Electrode Packaging
3/32 Nominal	3	YELLOW Adaptor Body	GREEN Electrode Guide	GREEN Cutout
3/32 Plus	3+	YELLOW Adaptor Body	WHITE Electrode Guide	GREEN Cutout
1/8 Nominal	4	YELLOW Adaptor Body	ORANGE Electrode Guide	ORANGE Cutout
1/8 Plus	4+	YELLOW Adaptor Body	WHITE Electrode Guide	ORANGE Cutout
5/32 Nominal	5	YELLOW Adaptor Body	BLUE Electrode Guide	BLUE Cutout
5/32 Plus	5+	YELLOW Adaptor Body	BROWN Electrode Guide	BLUE Cutout
5/32 1 <sup>st</sup> Oversize (X)	5-X	YELLOW Adaptor Body	WHITE Electrode Guide	BLUE Cutout
3/16 Nominal	6	YELLOW Adaptor Body	YELLOW Electrode Guide	YELLOW Cutout
3/16 Plus	6+	YELLOW Adaptor Body	BROWN Electrode Guide	YELLOW Cutout
3/16 1 <sup>st</sup> Oversize (X)	6-X	YELLOW Adaptor Body	WHITE Electrode Guide	YELLOW Cutout
3/16 2 <sup>nd</sup> Oversize (Y)	6-Y	YELLOW Adaptor Body	TURQUOISE Electrode Guide	YELLOW Cutout
1/4 Nominal	8	YELLOW Adaptor Body	BLACK Guide	BLACK Cutout
1/4 Plus	8+	YELLOW Adaptor Body	BROWN Electrode Guide	BLACK Cutout
1/4 1 <sup>st</sup> Oversize (X)	8-X	YELLOW Adaptor Body	WHITE Guide	BLACK Cutout
1/4 2 <sup>nd</sup> Oversize (Y)	8-Y	YELLOW Adaptor Body	TURQUOISE Guide	BLACK Cutout
5/16 Nominal	10	YELLOW Adaptor Body	RED Guide	RED Cutout
5/16 1 <sup>st</sup> Oversize (X)	10-X	YELLOW Adaptor Body	WHITE Guide	RED Cutout
5/16 2 <sup>nd</sup> Oversize (Y)	10-Y	YELLOW Adaptor Body	No Guide Required at this size	RED Cutout
3/8 Nominal	12	YELLOW Adaptor Body	No Guide Required at this size	GRAY Cutout
3/8 1 <sup>st</sup> Oversize (X)	12-X	YELLOW Adaptor Body	No Guide Required at this size	GRAY Cutout
3/8 2 <sup>nd</sup> Oversize (Y)	12-Y	YELLOW Adaptor Body	No Guide Required at this size	GRAY Cutout

E-drill Fastener Removal Instructions			
Document No.:	61-340	Revision:	E
Date:	6/25/2019		

**Electrode Part Number Legend:**

**EDK0206-0**



Nomenclature:

- EDK:** = E-drill electrode Kit (5 electrodes)
- Electrode Material:**
  - 01 = Brass Alloy (for Ti fasteners greater than 5/32")
  - 02 = Copper Alloy (for all other fastener metals)
- Fastener Diameter:** 06 = Fastener Stem Size Designator (3/16")
- EXAMPLE:**
  - 03 = 3/32" Fastener
  - 04 = 1/8" Fastener
  - 05 = 5/32" Fastener
  - 06 = 3/16" Fastener
  - 08 = 1/4" Fastener
  - 10 = 5/16" Fastener
  - 12 = 3/8" Fastener

Size Designator:

All Electrode kits carry a dash number indicating a nominal size (-0), a Plus (+), or letter designators (-X or -Y) for each of the three oversize electrode OD's available.

- The Plus "+" size Electrodes are specifically for use on fragile airframe only.
- Plus sizes -5, -6 & -8 are also designed for use with Blind Bolt fasteners such as ComposiLok, VisuaLok, Jo-Bolt etc. where the shank diameter is not true nominal.
- The Letter "X" depicts the first oversize or, *plus 1/64<sup>th</sup> of an inch.*
- The Letter "Y" depicts the second oversize or, *plus 2/64<sup>ths</sup> (or 1/32<sup>nd</sup>) of an inch.*

E-drill Fastener Removal Instructions			
<b>Document No.:</b>	61-340	<b>Revision:</b>	E
		<b>Date:</b>	6/25/2019

**Notes:**

For CherryMax and other blind “pull” fasteners whose “nominal” shank size is dimensionally closer to an oversize, use one oversize above the fastener size. For example, a 3/16” (-6) nominal alloy steel CherryMax should be removed with the 1<sup>st</sup> oversize electrode (0206-X). A 1<sup>st</sup> over CherryMax should be removed with the 2<sup>nd</sup> over electrode (0206-Y).

For ComposiLok and other blind bolt fasteners, use the “Plus” size electrodes for -5, -6 and -8 sizes. For other sizes use the nominal size.

For applications where a metal component is being replaced, such as wing skin replacement, an electrode one oversize may be used in order to ease removal (less or no punch-out required). Damage which will result will be limited to the lip of the hole, and therefore the old skin will still be acceptable for using as a template for a replacement skin.

Electrode Size	Electrode Packaging	Electrode actual diameter
3/32 Nominal	GREEN Label	0.078”
3/32 + size	GREEN Label	0.082”
1/8 Nominal	ORANGE Label	0.105”
1/8 + size	ORANGE Label	0.114”
5/32 Nominal	BLUE Label	0.135”
5/32 Plus	BLUE Label	0.139”
5/32 1 <sup>st</sup> Oversize (X)	BLUE Label	0.15”
3/16 Nominal	YELLOW Label	0.159”
3/16 Plus	YELLOW Label	0.168”
3/16 1 <sup>st</sup> Oversize (X)	YELLOW Label	0.174”
3/16 2 <sup>nd</sup> Oversize (Y)	YELLOW Label	0.189”
1/4 Nominal	BLACK Label	0.22”
1/4 Plus	BLACK Label	0.229”
1/4 1 <sup>st</sup> Oversize (X)	BLACK Label	0.235”
1/4 2 <sup>nd</sup> Oversize (Y)	BLACK Label	0.25”
5/16 Nominal	RED Label	0.282”
5/16 1 <sup>st</sup> Oversize (X)	RED Label	0.297”
5/16 2 <sup>nd</sup> Oversize (Y)	RED Label	0.312”
3/8 Nominal	GRAY Label	0.345”
3/8 1 <sup>st</sup> Oversize (X)	GRAY Label	0.36”
3/8 2 <sup>nd</sup> Oversize (Y)	GRAY Label	0.375”