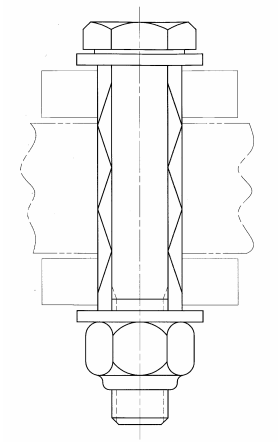
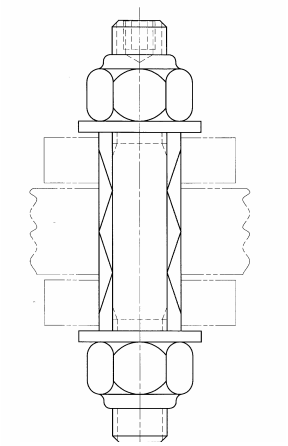
1.0 INTRODUCTION:

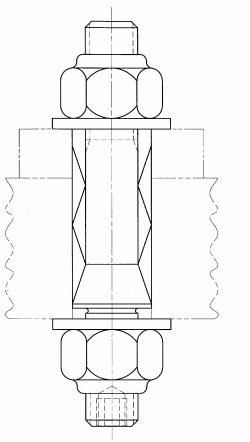
This Technical Sales Bulletin describes some benefits and limitations and the typical installation procedures for the six classification types of EDF. These classification types are shown below.
1.1



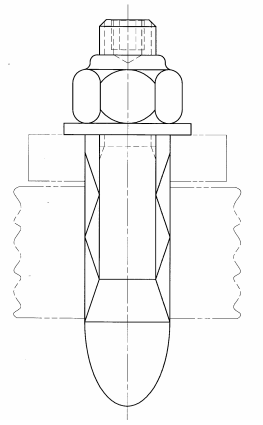
Expandable
Diameter Bolt



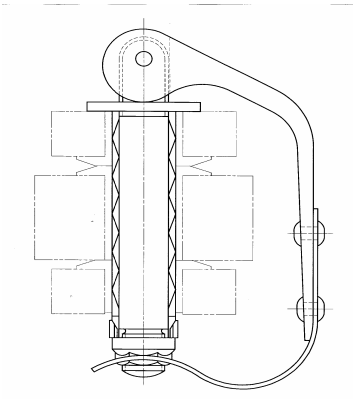
Expandable
Diameter Shaft



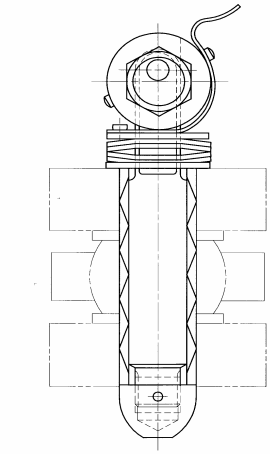
Expandable Diameter
Clamp-up Shaft



Expandable
Diameter Blind Bolt



Expandable Diameter
Wrap-Around Cam
Handle Pin



Expandable Diameter
Handleless Cam
Pin

2.0 BENEFITS, FEATURES AND LIMITATIONS OF EDF'S:

2.1 Benefits that apply to all classification types:

- Elimination of all radial clearance.
- Creates a rigid joint and enhances fatigue life.
- Eliminates wear in the joint
- Provides hole alignment and repeatability

2.2 Features of specific classification types:

- Usable in applications where acceess is limited to one side, or a blind hole is required (blind bolt & handleless cam designs)
- Provides quick installation & removal (blind bolt, wrap-around cam handle and handleless cam designs).
- Designed to provide axial clamp-up of the structure (clamp-up shaft design)
- Factory adjusted to accommodate specific hole size and tolerance. (Handleless cam design***) Note: This design is not readjustable by the customer after factory setting, and requires a closer toleranced design hole than the other configurations.***

2.3 Limitations:

- Limited axial clamp-up capability (applies to all types **except** clamp-up shaft design).
- Reusability limited by thread wear (applies to all types **except** wrap-around cam and handleless cam designs).
- Bushing assembly is tightened up from both ends (applies to expandable diameter shaft).
- Must be adjusted at initial installation and readjusted if used in a different hole. Less mechanical advantage to achieve desired radial tightness than other EDF types (applies to wrap-around cam handle pin design only).

3.0 MATERIAL SELECTION:

Unless otherwise specified by the customer, it is Shur-Lok's recommendation and practice that all EDF designs intended as flight hardware be made from CRES type PH13-8Mo material, Cond H-1000 for the main structural components, such as the core shaft and expandable bushing segments. This is due to the materials superior stress corrosion capability and high fracture toughness. For non flight hardware, other materials may be used.

4.0 IMPORTANT GUIDELINES:

EDF's are designed to be used in a specified hole size and tolerance, as well as a specified structure length and tolerance. The EDF should never be tightened or actuated outside of the intended hole. This could result in permanent set of the expandable bushing segments which may prevent proper removal and/or installation.

5.0 TYPICAL INSTALLATION PROCEDURE:

It is recommended that the EDF be installed as tight as possible without damaging the parent structure or stressing the core pin over 50% of its tensile yield strength (Fty).
See Table I for maximum recommended installation nut torque.

5.1 To help obtain an even load distribution (with the EDF installed in the intended hole) it is recommended to perform a break-in cycle by tightening, then loosening, then re-tightening the EDF. This helps to burnish-in the dry film coating. For nut tightened type assemblies, a free running nut should be used for this procedure.

5.2 After the break-in cycle and with the EDF installed in the intended hole, tighten the nut (for nut tightened type assembly) and observe the nut running torque. Tighten nut to the maximum recommended installation torque per Table I, over and above the nut running torque.

5.2.1 Expandable Diameter Blind Bolt Design. A hex recess is provided for the purpose of holding the EDF stationary while rotating the nut. Do not attempt tightening the EDF using the hex recess. Once the bushing segments are in full contact with the hole, remove the Hex Wrench, and finish torqueing the nut.

5.2.2 Expandable Diameter Shaft Design. This assembly is tightened up from both ends. A hex recess is provided in the core shaft for holding the EDF stationary while tightening the nuts. Tighten both ends evenly observing that the bushing assembly is approximately centered on the core shaft. This design is **not** intended to clamp-up or contact against the structure. If axial clamp-up is desired, use clamp-up shaft design.

5.2.3 Expandable Diameter Clamp-Up Shaft Design. This assembly is intended to provide radial tightness as well as provide an axial load on the structure. A hex recess is provided in the core shaft for holding the EDF stationary while tightening the nuts. First tighten the bushing expansion nut to the desired installation torque. (As reference the bushing expansion nut is the top nut shown on the picture example). Then tighten the clamp-up nut to the desired torque.

5.0 TYPICAL INSTALLATION PROCEDURE: *(Cont'd)*

5.2.4 Expandable Diameter Wrap-Around Cam Handle Design. With the EDF in the relaxed condition and installed into the intended hole, rotate the cam handle to the installed position. Remove the assembly and adjust the nut to provide desired cam handle torque. Typically, this design has a spring-clip which snaps over the adjusting nut. This spring clip acts as a secondary lock of the nut as well as a lock of the handle. Once the assembly is adjusted to the desired cam torque, a final nut adjustment may be necessary in order for the spring clip to snap over the nut.

5.2.5 Expandable Diameter Handleless Cam Design. This type of EDF is typically factory adjusted and permanently set to accommodate a specific hole size and tolerance. No adjustment is required upon installation. With the EDF relaxed, insert it into the intended hole with washer against structure. Using a wrench, rotate the cam until the lock pin engages the spring clip. This locks the cam in the installed position. Typically, the cam is inscribed showing the "tighten" and "loosen" directions.

TABLE I

BASIC HOLE SIZE	BASIC CORE BOLT/SHAFT THREAD SIZE	MAXIMUM SHUR-LOK RECOMMENDED INSTALLATION NUT TORQUE IN-LBS [Newton-Meter] ê	
		For 17-4PH Mat'l. (50% Fty=85 Ksi)	For PH13-8Mo Mat'l (50% Fty=95 Ksi)
∅.1875	.140-32.	11 [1.24]	13 [1.47]
∅.2500	.1900-32	34 [3.84]	38 [4.29]
∅.3125	.2160-28	49 [5.54]	55 [6.21]
∅.3750	.2500-28	80 [9.04]	90 [10.17]
∅.4375	.3125-24	160 [18.08]	179 [20.22]
∅.5000	.3750-24	292 [32.99]	326 [36.83]
∅.5625	.4375-20	459 [51.86]	513 [57.96]
∅.6250			
∅.7500	.5625-18	1010 [114.11]	1129 [127.56]
∅.8750	.6250-18	1417 [160.10]	1583 [178.86]
∅1.0000	.7500-16	2477 [279.86]	2768 [312.74]
∅1.1250	.8750-16	3944 [445.61]	4408 [498.04]
∅1.2500	1.0000-12	5870 [663.22]	6560 [741.18]
∅1.3750	1.1250-12	8530 [963.76]	9533 [1077.09]
∅1.5000	1.2500-12	11875 [1341.70]	13276 [1499.99]

Note: ê *Values indicated are Shur-Lok maximum torque recommendations. The torques are Shur-Lok's recommendations to provide optimum tightness in the joint and it is recommend that the user specify a torque range close to the maximum shown. The design activity is responsible for suitability and/or effect of these torques on the structure material(s) and adjacent surfaces. To obtain calculated loading (PSI) in the structure induced by the EDF and a given torque; contact Shur-Lok engineering.*

5.O TYPICAL INSTALLATION PROCEDURE: *(Cont'd)*

5.2.6 Expandable Diameter Bolt. This assembly is tightened from the nut end and should be centered in the structure as much as possible, leaving equal gaps at the nut end and the bolt end. Centering the assembly is particularly important for torque-tube applications or applications that have a void in the structure. This design is **not** intended to clamp-up against the structure. If axial clamp-up is desired, use clamp-up shaft design.

6.0 OPTIONS:

Many special options are available to enhance the use of expandable diameter fasteners, some of these options are:

- Captive Segments - To prevent removal of the bushing segments from the core bolt when the nut and washer are removed. This eliminates possible loss of the individual segments.
- Lanyards - To secure the removed EDF near its intended hole to prevent loss of the EDF and to provide for ready installation.
- Lock Ring - A special bushing segment which expands outside the hole to enhance the ability of the EDF to resist tensile loads.
- Dual locking features such as Cotter Pins and Spring Clips.

SHUR-LOK CORPORATION ***TECHNICAL SALES BULLETIN***	**TSB 0015**
TITLE: **BENEFITS, LIMITATIONS AND INSTALLATION PROCEDURE FOR EXPANDABLE DIAMETER FASTENERS (EDF)**	**REVISION PAGE**

REVISION RECORD:			**APPROVALS:**		
REV	DATE	REVISION CHANGE	ORIGINATOR	CHECKED	APPROVED
NC	05/11/99	Initial Release	Tino Riveron Lead Engineer	Jim Struble Lead Engineer	Tino Riveron Lead Engineer
A	06/01/99	5.2….Tighten nut to the maximum…. was…Seat nut….	Tino Riveron Lead Engineer	Jim Struble Lead Engineer	Tino Riveron Lead Engineer
B	05/08/02	5.2.6…..Expandable Diameter Bolt…leaving equal gaps at the nut end and the bolt end…..	Tino Riveron Lead Engineer	V. Pineiros Director – Engr.	V. Pineiros Director – Engr.
