

FTI OPERATIONS, MAINTENANCE, AND REPAIR MANUAL

Little Brute Right Angle Puller (LBRA-10)

Part #2720-126, Log #36511

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NO REVISIONS WILL BE ISSUED

This manual should be used in conjunction with the FTI
“Little Brute Puller Unit Operations, Maintenance, and Repair Manual”



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ABOUT FATIGUE TECHNOLOGY

Fatigue Technology (FTI) is a world-leading aerospace engineering and manufacturing company. FTI pioneered cold expansion technology (which provides solutions to fatigue problems associated with holes in metal structures) back in 1969 and has advanced this science to develop innovative bushing and fastener products. These proprietary products and associated tooling may be covered by patents or agreements owned by or exclusively licensed to Fatigue Technology. Use of tooling procured from other than a licensed source may constitute patent infringement.

The detailed tooling information in this manual was compiled and written by FTI. The tooling was designed specifically for use with FTI's Cold Expansion (Cx™) Systems. FTI cannot be held responsible for damage or injury as a result of operating this equipment if it is used for other than the process intended, with any other tooling not provided by FTI, or not used in accordance with the instructions contained in this manual. To avoid personal injury, please observe all safety precautions and instructions. FTI reserves the right to change specifications or configurations of equipment detailed in this manual as part of our ongoing technical and product improvement programs. If you have any questions about the use or serviceability of this equipment, please contact our Sales Department.

FTI's systems and processes are the subject matter of one or more of the following patents: 4,809,420, 4,885,829, 4,934,170, 5,083,363, 5,096,349, 5,103,548, 5,127,254, 5,129,253, 5,218,854, 5,245,743, 5,305,627, 5,341,559, 5,380,136, 5,405,228, 5,433,100, 5,468,104, 6,077,010, 6,183,180, 6,487,767, 6,792,657, 6,990,722, 7,024,908, 7,100,264; 1,061,276, 513,898, 692015124, 581,385, 69310828, 468,598, 69105390, 643,231, 69414946, 696,686, 785,366, 1032769, and other patents pending. These systems and processes are tooling critical and must be performed in accordance with FTI's specifications or controlling documents. To ensure proper results from FTI's cold expansion systems and to be licensed to use FTI's patented processes, it is essential that FTI's complete integrated system of tooling be purchased and utilized. The use of tooling purchased from other than a licensed supplier could jeopardize fatigue life enhancement and may constitute patent infringement.

FTI reserves the right to change the specifications or configurations of tooling detailed in this manual as part of its ongoing technical and product information program. Should inconsistencies occur between your tooling and this manual, please contact our Sales Department.

Fatigue Technology (FTI) has provided innovative solutions to fatigue problems in metal structures since 1969. Complete systems of tooling are used worldwide to enhance the fatigue life of holes in airframes, turbine engines, and other critical structures.

The FTI staff of professionals provides a full range of support services including:

- Application engineering
- Detailed project planning, implementation, and management
- On-site assistance, including training and tool room setup

The Sales Department is always available to assist with special fatigue enhancement requirements. Please contact FTI with questions at any time.

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SECTION 1.0: INTRODUCTORY INFORMATION—LITTLE BRUTE RIGHT ANGLE PULLER

This instruction manual contains information on the operation and maintenance of the Little Brute Right Angle Puller (LBRA-10) designed by Fatigue Technology Inc. (FTI) for use with the patented Split Sleeve Cold Expansion™ (SsCx™) process. To obtain optimum performance and many years of trouble-free service, carefully follow maintenance procedures and operate the LBRA properly.

Read this manual before operating the LBRA, and retain the manual for future reference. If requested, FTI will provide this manual in the language of the end-user.

The Little Brute Right Angle Puller is a compact, durable tool that enables coldworking in restricted access areas that are difficult or impossible to get to with conventional tools.

- Is capable of cold expanding holes in restricted access areas up to 0.50-inch (12.7mm) in diameter in aluminum and mild steel, or 0.375-inch (9.5mm) in diameter in titanium and high strength steel.
- Attaches to the Little Brute (LB) series of puller units. See the Little Brute Puller Unit Operations, Maintenance, and Repair Manual for additional safety information.
- The Right Angle Puller alone weighs approximately 2.6 pounds (1.18 kg); with the Little Brute Puller Unit, it weighs approximately 12.6 pounds (5.72 kg).
- Requires only 0.375-inch (9.53mm) lateral clearance (see Figure 3.0-1).
- Head can rotate 360 degrees on the puller unit.
- Has a maximum pull force of 8,000 pounds (maximum generated by the Little Brute Puller Unit).
- The LBRA-10 is capable of much more pull force than the LBRA-7 and is physically larger. For low-force applications an LBRA-7 may be better suited. This manual only covers the LBRA-10 and does NOT apply to the LBRA-7.

SECTION 2.0: SAFETY

Safe operation of the LBRA is of paramount concern. Along with standard shop safety practices (eye protection, safe handling of high-pressure equipment, etc.), the following items are peculiar to the LBRA/puller unit assembly:

1. Wear eye protection when operating the puller unit.
2. Disconnect the air supply when:
 - Maintenance is to be performed
 - Hydraulic hose is disconnected
 - PowerPak is not in use
3. Disconnect the LB Puller Unit from the PowerPak before attaching the LBRA.
4. In the event of a ruptured or leaking hydraulic hose, IMMEDIATELY RELEASE THE TRIGGER AND DISCONNECT THE AIR LINE at the air coupler from the PowerPak. Never use your hands to grasp a leaking hose under pressure. The force of escaping hydraulic fluid could cause serious injury.
5. Keep hands away from the nosecap assembly while holding the nosecap against the workpiece.
6. Release the puller unit trigger when the mandrel clears the workpiece or becomes stuck.
7. The Little Brute end cap must always be in place while in use. Injury may occur if the end cap is removed during operation.
8. Before operating the pump, tighten all hose connections using the proper tools. Do not over-tighten the connections. Connections need only be tightened securely and leak-free. Over-tightening may cause premature thread failure or high-pressure fittings to split at pressures lower than their rated capacities.
9. Operators must read this manual in its entirety before using the Little Brute Right Angle Puller. Eye and ear protection must be worn while operating the Little Brute. Three safety stickers on the Little Brute Puller Unit series act as a reminder to these instructions. The symbols are shown in Figure 2.0-1.
10. Do not use in potentially explosive atmospheres.

Read manual before using



Always wear eye protection



Always wear ear protection



**Figure 2.0-1
Safety Stickers**

Hydraulic Hose Safety

1. Inspect the hydraulic hose for signs of wear (cuts, abrasions, or kinks) to the outer shell material. Pump clean oil through the entire length. Pressurize the hose and check for leaks at the crimped connectors, between the hose material and the fitting, and between the fitting and the coupler.
2. DO NOT attempt to disconnect the hydraulic hose while it is under pressure.

DO NOT expose hoses to potential hazards, such as extreme heat or cold, sharp surfaces, or heavy impact.

DO NOT allow hoses to kink, twist, curl, or bend so tightly that the oil flow within the hose is blocked or reduced. Periodically inspect the hose for wear or damage that could cause premature failure of the hose and possibly result in injury. Damaged hoses must be replaced immediately.

DO NOT use the hose to move attached equipment.

DO NOT remove the strain reliever from hoses.

3. Hose strain relievers must be placed around hose fittings during use. Hoses with damaged strain relievers must be replaced immediately.
4. Hose material and coupler seals must be compatible with hydraulic fluid that meets the requirements of MIL-PRF-5606.
5. Hoses must not come in contact with toxic materials, such as creosote-impregnated objects and some paints. Keep couplers and hoses clean and free of paint. Hose deterioration due to chemical degradation may cause the hose to fail under pressure. Damaged hoses must be replaced immediately.
6. Before operating the PowerPak, make sure all hose connections are tightened securely. DO NOT over-tighten.
7. If hoses require replacement, contact the FTI Sales Department.

IMPORTANT: FTI completed a risk assessment on this unit at our factory. Any modifications done by a third party or the final user are excluded from that risk assessment.

SECTION 3.0: LBRA-10 SPECIFICATIONS AND DIMENSIONS

Model Number	LBRA-10
Weight	2.6 Pounds
Stroke	1.92"
Mandrel Attachment	3/8"-24 Thread
Nosecap Attachment	11/16"-24 Thread
Maximum Pull Force	8,000 Pounds
Minimum Edge Distance	0.375"

Table 3.0-1
LBRA-10 Specifications

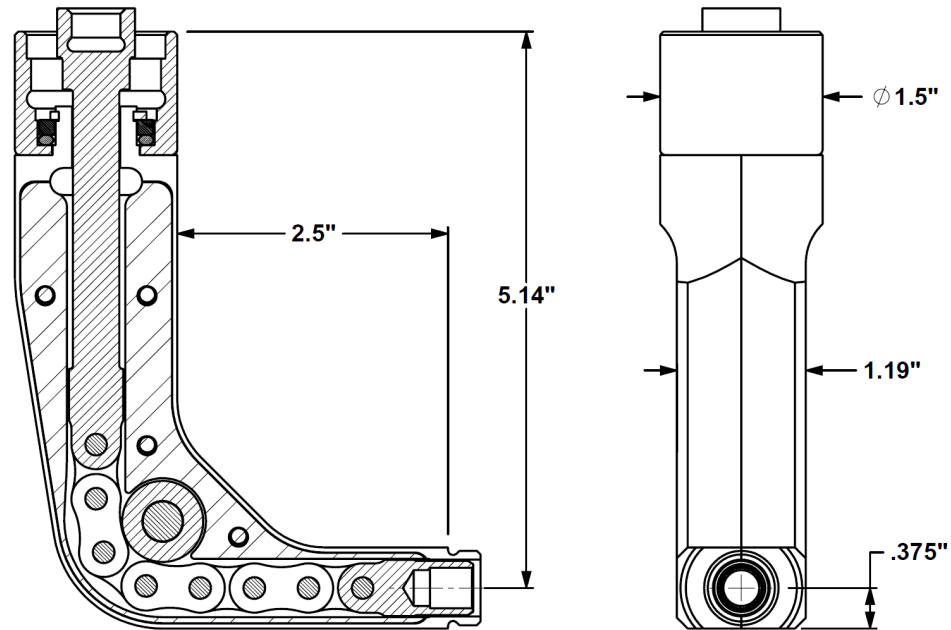


Figure 3.0-1
LBRA-10 Dimensions

SECTION 4.0: TOOLING SELECTION

STDN Size	Maximum Mandrel Length	Maximum Sleeve Length
4-0-N	CBM-4-0-N-10RA-16.4-V1	1.64"
4-1-N	CBM-4-1-N-10RA-16.2-V1	1.62"
4-2-N	CBM-4-2-N-10RA-15.8-V1	1.58"
4-3-N	CBM-4-3-N-10RA-15.8-V1	1.58"
4-4-N	CBM-4-4-N-10RA-15.9-V1	1.59"
6-0-N	CBM-6-0-N-10RA-16-V1	1.60"
6-1-N	CBM-6-1-N-10RA-16-V1	1.60"
6-2-N	CBM-6-2-N-10RA-15.7-V1	1.57"
6-3-N	CBM-6-3-N-10RA-15.7-V1	1.57"
8-0-N	CBM-8-0-N-10RA-15.7-V1	1.57"
8-1-N	CBM-8-1-N-10RA-15.7-V1	1.57"
8-2-N	CBM-8-2-N-10RA-15.4-V1	1.54"
8-3-N	CBM-8-3-N-10RA-15.4-V1	1.54"
10-0-N	CBM-10-0-N-10RA-15.2-V1	1.52"
10-1-N	CBM-10-1-N-10RA-15.2-V1	1.52"
10-2-N	CBM-10-2-N-10RA-15.1-V1	1.51"
10-3-N	CBM-10-3-N-10RA-15.1-V1	1.51"
12-0-N	CBM-12-0-N-10RA-15-V1	1.50"
12-1-N	CBM-12-1-N-10RA-15-V1	1.50"
12-2-N	CBM-12-2-N-10RA-14.8-V1	1.48"
12-3-N	CBM-12-3-N-10RA-14.8-V1	1.48"
14-0-N	CBM-14-0-N-10RA-14.6-V1	1.46"
14-1-N	CBM-14-1-N-10RA-14.7-V1	1.47"
14-2-N	CBM-14-2-N-10RA-14.5-V1	1.45"
14-3-N	CBM-14-3-N-10RA-14.5-V1	1.45"
16-0-N	CBM-16-0-N-10RA-14.4-V1	1.44"
16-1-N	CBM-16-1-N-10RA-14.4-V1	1.44"
16-2-N	CBM-16-2-N-10RA-14.2-V1	1.42"
16-3-N	CBM-16-3-N-10RA-14.2-V1	1.42"

Table 4.0-1
CB Mandrels

STDN Size	Maximum Mandrel Length	Maximum Sleeve Length
20	CAM-20-10RA-16.4-V2	1.64"
21	CAM-21-10RA-16.4-V2	1.64"
22	CAM-22-10RA-16.3-V2	1.63"
23	CAM-23-10RA-16.1-V2	1.61"
30	CAM-30-10RA-16-V2	1.60"
31	CAM-31-10RA-15.9-V2	1.59"
32	CAM-32-10RA-15.9-V2	1.59"
33	CAM-33-10RA-15.7-V2	1.57"
40	CAM-40-10RA-15.2-V2	1.52"
41	CAM-41-10RA-15.1-V2	1.51"
42	CAM-42-10RA-15-V2	1.50"
43	CAM-43-10RA-14.9-V2	1.49"
50	CAM-50-10RA-14.6-V2	1.46"
51	CAM-51-10RA-14.5-V2	1.45"
52	CAM-52-10RA-14.5-V2	1.45"
53	CAM-53-10RA-14.4-V2	1.45"

Table 4.0-2
CA Mandrels

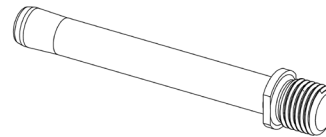


Figure 4.0-1
LBRA-10 Mandrel

The LBRA-10 uses special mandrels and nose caps that are not compatible with other FTI puller units.

CB Nosecaps	
STDN Size	Model Number
4-0-N	CBC-10RA-040F
4-1-N	CBC-10RA-041F
4-2-N	CBC-10RA-042F
4-3-N	CBC-10RA-043F
4-4-N	CBC-10RA-044F
6-0-N	CBC-10RA-060F
6-1-N	CBC-10RA-061F
6-2-N	CBC-10RA-062F
6-3-N	CBC-10RA-063F
8-0-N	CBC-10RA-080F
8-1-N	CBC-10RA-081F
8-2-N	CBC-10RA-082F
8-3-N	CBC-10RA-083F
10-0-N	CBC-10RA-100F
10-1-N	CBC-10RA-101F
10-2-N	CBC-10RA-102F
10-3-N	CBC-10RA-103F
12-0-N	CBC-10RA-120F
12-1-N	CBC-10RA-121F
12-2-N	CBC-10RA-122F
12-3-N	CBC-10RA-123F
14-0-N	CBC-10RA-140F
14-1-N	CBC-10RA-141F
14-2-N	CBC-10RA-142F
14-3-N	CBC-10RA-143F
16-0-N	CBC-10RA-160F
16-1-N	CBC-10RA-161F
16-2-N	CBC-10RA-162F
16-3-N	CBC-10RA-163F

Table 4.0-3
CB Nosecaps

CA Nosecaps	
STDN Size	Model Number
20	CAC-10RA-20F
21	CAC-10RA-21F
22	CAC-10RA-22F
23	CAC-10RA-23F
30	CAC-10RA-30F
31	CAC-10RA-31F
32	CAC-10RA-32F
33	CAC-10RA-33F
40	CAC-10RA-40F
41	CAC-10RA-41F
42	CAC-10RA-42F
43	CAC-10RA-43F
50	CAC-10RA-50F
51	CAC-10RA-51F
52	CAC-10RA-52F
53	CAC-10RA-53F

Table 4.0-4
CA Nosecaps



Figure 4.0-2
LBRA-10 Nosecap

SECTION 5.0: ASSEMBLY OF THE LBRA-10 ONTO A LITTLE BRUTE PULLER

To install the LBRA-10 onto the Little Brute puller:

CAUTION:	Before attempting any maintenance operations on the puller unit, disconnect the PowerPak from the air supply or disconnect the puller from the PowerPak or hand pump.
-----------------	---

1. Remove all tooling from the barrel end of the Little Brute, including the threaded adapter (Figure 5.0-1).



Figure 5.0-1
Little Brute Puller Unit, Tooling Removed

2. Using a spanner wrench, loosen the lock ring on the back of the Little Brute and remove the endcap (Figure 5.0-2). A large flat screwdriver fits into the slot on the back of the piston to keep it from rotating.



Figure 5.0-2
Little Brute Puller Unit, Endcap Removed

3. Extend the inner rod from the back of the LBRA-10 and thread it onto the piston rod (Figure 5.0-3). Tighten securely while using a large flat screwdriver on the back of the Little Brute to keep the piston from rotating.

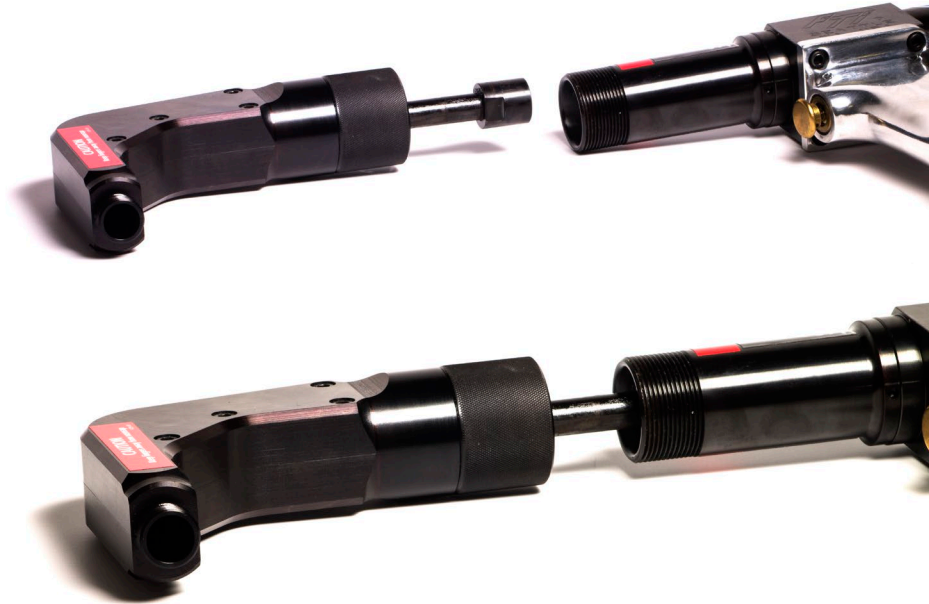


Figure 5.0-3
LBRA-10, Rod Threaded

4. Re-install the Little Brute endcap and tighten the lock ring securely with a pinwrench. THE ENDCAP MUST BE IN PLACE DURING OPERATION. Thread the outer collar of the LBRA-10 onto the barrel of the Little Brute (Figure 5.0-4). The installation is now complete.



Figure 5.0-4
LBRA-10, Installation Completed

SECTION 6.0: OPTIONAL ADAPTERS

Tooling specifically designed for the LBRA-10 is optimized to be as compact as possible. However, adapters may be used to allow the attachment of conventional tools. Note that although all Little Brute tooling will thread onto the adapters shown, some mandrels may be too long for the limited stroke of the LBRA-10.

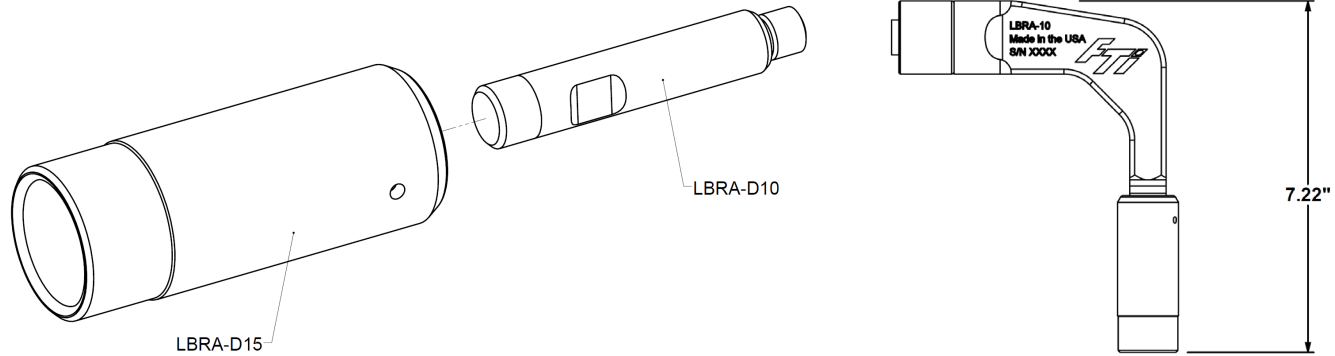


Figure 6.0-1
LBRA-D15 and LBRA-D10 Adapters

SECTION 7.0: ASSEMBLY AND MAINTENANCE

CAUTION:	Before attempting any maintenance operations on the puller unit, disconnect the PowerPak from the air supply or disconnect the puller from the PowerPak or hand pump.
-----------------	---

Refer to Figure 8.0-1 for identification of the components.

7.1 Disassembly

1. To disassemble the LBRA-10, first remove it from the Little Brute. If a nose cap is mounted, take it off as well.
2. Remove the retaining ring (8) using retaining ring pliers (Figure 7.1-1). The knurled collar (6) can now be removed along with the o-ring (10) and washer (9).



Figure 7.1-1
Retaining Ring Removal

3. Remove the four screws in the left half of the housing. The left housing can now be removed and the internal parts accessed for maintenance.

7.2 Cleaning and Lubrication

The puller requires routine checking and periodic preventative maintenance to ensure safe, trouble-free operation. No special maintenance is required. The following maintenance actions are suggested.

1. Periodically clean the outer surfaces of the unit.
2. The internal moving parts should be periodically lubricated with Mobil-HP or equivalent grease to ensure smooth operation and extend the life of the unit (Figure 7.2-1).

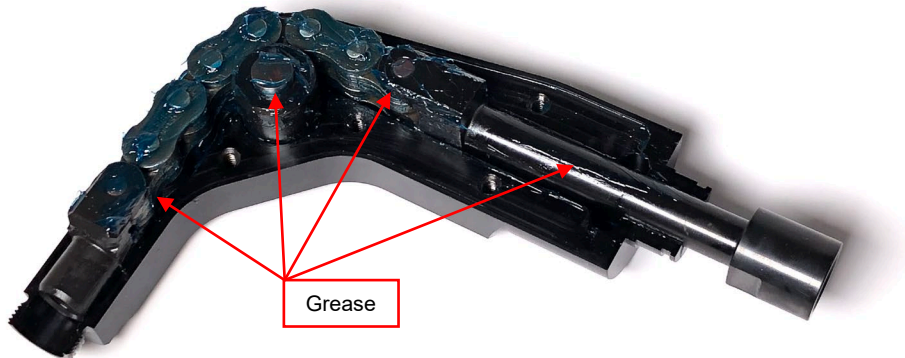


Figure 7.2-1
Greased Internals

3. Whenever the puller unit is to be stored for any length of time, maintain a thin coat of 10-weight oil on the outside surfaces to prevent rusting.

7.3 Replacing Parts/Repair

If parts need replacing or the unit needs repair, please contact FTI's Sales Department. FTI will work with the operator to try to troubleshoot over the phone, but a return of the LBRA unit may be required.

7.4 Reassembly

1. Replace all internal components into the right half housing.
2. Attach the left housing half using the four screws.
3. Install the knurled collar (6), followed by the o-ring (10) and washer (9). Ensure that the o-ring and washer are fully seated all the way down.
4. Install the retaining ring (8) using retaining ring pliers. The o-ring must be compressed to fit the retaining ring on, so it may be necessary to tap the retaining ring with a blunt pin until the ring is fully snapped into the groove.

SECTION 8.0: ILLUSTRATED PARTS BREAKDOWN

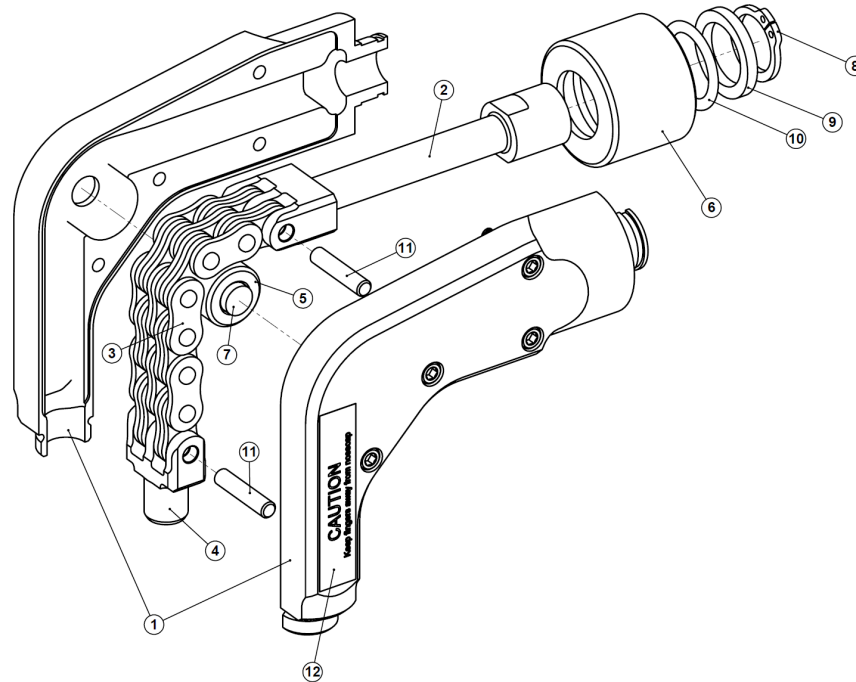


Figure 8.0-1
LBRA-10 Illustrated Parts Breakdown

Item Number	Quantity	Part Number	Description
1	1	6908-001	Housing Sub-Assembly
2	1	6912-001	Puller Clevis
3	1	5305-002	Chain
4	1	6911-001	Mandrel Clevis
5	1	6917-001	Roller
6	1	6918-001	Knurled Collar
7	1	6916-001	Roller Pin
8	1	1199-450	External Retaining Ring
9	1	5301-002	Washer
10	1	1046-120	O-Ring
11	2	6915-001	Clevis Pin
12	1	1009-185	Caution Sticker
13	1	1199-452	Case
14	1	1009-293	FTI Sticker
15	1	1009-294	LBRA Sticker

Table 8.0-1
LBRA-10 Parts List

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