FATIGUE TECHNOLOGY INC.

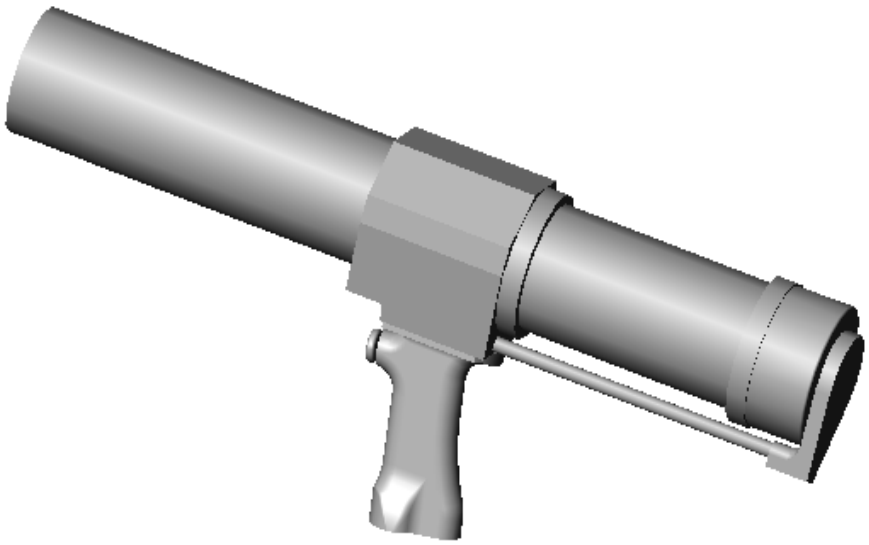
401 Andover Park East
Seattle, Washington 98188-7605
USA (206) 246-2010

FTI OPERATIONS, MAINTENANCE AND REPAIR MANUAL

Big Brute
Puller Unit

FTI Part #2720-008, Log #1206

Published March 2007



Uncontrolled if printed

This page intentionally left blank for two-sided printing.

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

FATIGUE TECHNOLOGY INC.

Seattle, WA • USA

Fatigue Technology Inc. (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 have 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 Inc. 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 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 Technical Sales Department.

FTI's Cold Expansion™ 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; 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 Technical Sales Department.

Uncontrolled if printed

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

ABOUT FATIGUE TECHNOLOGY INC.

Fatigue Technology Inc. (FTI) has provided innovative solutions to the aerospace industry since 1969. Our products are used worldwide to reduce manufacturing and maintenance flow time and costs.

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

Complete inventory allows FTI to respond quickly to customers' requirements.

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

Burke F. Gibson
CEO/Chairman of the Board

Uncontrolled if printed

FATIGUE TECHNOLOGY INC.

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

TABLE OF CONTENTS

SECTION 1 INTRODUCTION 1
1.1 About the Big Brute Puller Unit 1
1.2 General Specifications 1
1.3 General Description 2

SECTION 2 SAFETY 5

SECTION 3 PULLER UNIT OPERATING INSTRUCTIONS 7
3.1 Puller Unit Set-Up and Operation Procedure 7
3.2 Actuation of the Puller 7

SECTION 4 MAINTENANCE 9
4.1 General Cleaning 9
4.2 Lubrication 9
4.3 Inspection 9
4.4 Assembly and Disassembly 9
4.5 Chuck Assembly Cleaning and Jaw Replacement 11

SECTION 5 TROUBLESHOOTING 13
5.1 PowerPak Will Not Build Full Hydraulic Pressure 13
5.2 Puller Retracts on First Trigger Actuation, But Will Not Return to Start Position .. 14
5.3 PowerPak Will Not Generate Constant Pressure (or Hiccups) 15
5.4 PowerPak Will Not Operate or Maintain Sufficient Pressure (6,000 psi) 15
5.5 Mandrel Sticks in Hole When Puller Activated 16

SECTION 6 ILLUSTRATED PARTS BREAKDOWN 17
6.1 Big Brute Rework Kit (BB-CT-RK) 18
6.2 Big Brute Seal Kit (BB-SK) 19
6.3 Previous Trigger Assembly 20
6.4 Big Brute Parts List 21

FIGURES
Figure 1.3-1 Big Brute Puller Unit 2
Figure 1.3-2 Big Brute Puller Unit Specifications 3
Figure 2.0-1 Location of Air Disconnect 5
Figure 4.5-1 Chuck Assembly 11
Figure 5.1-1 FT-200 PowerPak 13
Figure 5.2-1 Location of Hydraulic Quick Coupler (FT-200) 14
Figure 5.3-1 Location of Trigger Response Valve (FT-200) 15
Figure 5.4-1 Pressure Gauge (FT-200) 15
Figure 6.1-1 Diagram of Cartridge Trigger Assembly 18
Figure 6.3-1 Diagram of Previous Trigger Assembly 20
Figure 6.4-1 Assembly Diagram 22

Uncontrolled if printed

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

TABLES

Table 1.3-1	Big Brute Specifications	3
Table 6.0-1	Trigger Assembly Conversion	17
Table 6.1-1	Big Brute Rework Kit (BB-CT-RK)	18
Table 6.2-1	Big Brute Seal Kit (BB-SK)	19
Table 6.3-1	Parts List for Previous Trigger Assembly	20
Table 6.4-1	Big Brute Parts List	21

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

SECTION 1: INTRODUCTION

This instruction manual contains information on the operation and maintenance of the Big Brute (BB) Puller Unit. To obtain optimum performance and many years of trouble-free service, operate the puller unit properly and carefully follow maintenance procedures. Read this manual before operating the puller unit and retain the manual for future reference.

1.1 ABOUT THE BIG BRUTE PULLER UNIT

The Big Brute hydraulic puller unit is a powerful, heavy-duty tool specifically designed for use with FTI's patented Split Sleeve Cold Expansion process. The BB puller unit is designed to pull a mandrel through a hole with the pre-lubricated stainless steel split sleeves used in this process.

The BB pullers have a maximum pull force of 38,000 pounds at 10,000 psi pump pressure. The BB is available in sizes (models) capable of cold expanding holes up to 1-3/4 inches in diameter and 7 inches deep in aluminum, steel and titanium. For hole sizes larger than 1-3/4 inches, please contact the FTI technical support staff for assistance. The Big Brute is available in various models to accommodate multiple material stackups, including "-V" models with high-visibility hose markings.

The Big Brute has a fail-safe air control system that causes the puller retraction cycle to be interrupted whenever the operator releases finger pressure on the trigger or in the event of air or hydraulic hose failure. All puller units operate in conjunction with either of FTI's PowerPak air-hydraulic power units, the standard FT-200 or portable FT-20 (and are compatible with older units IW100MF and IW10MF). The BB has proven to be very reliable, and requires minimal maintenance.

1.2 GENERAL SPECIFICATIONS

Pull Force Capacity	38,000 pounds
Air Line Requirements	3/8 inch to 1/2 inch ID
Air Flow Requirements (via PowerPak)	45 cfm
Weight:	
BB-10.	26 pounds
BB-30.	33 pounds
BB-70.	40 pounds
Stackup Capacity:	
BB-10.	1.3 inches
BB-30.	3.0 inches
BB-70.	7.0 inches
Hole Diameter Capacity:	
Aluminum	>1-3/4 inches diameter
Steel	>1-3/4 inches diameter
Titanium	>1-3/4 inches diameter
Actuation	Pneumatic
Operation	Hydraulic
Air and Hydraulic Hose Length	10 feet
Compatible PowerPaks	FT-200 or FT-20
Fail-Safe	Air logic safety circuit halts mandrel retraction when trigger is released
Replacement Seal Kit	BB Seal Kit (BB-SK)

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

1.3 GENERAL DESCRIPTION

- Air actuated, hydraulic puller is designed to pull a mandrel through a hole using the pre-lubricated stainless steel split sleeves used in the cold expansion process.
- Maximum pull force is 38,000 pounds at 10,000 psi of hydraulic pressure.
- Includes a 10-foot hose assembly, spanner wrench and nosecap pin wrench.
- Capable of cold expanding holes up to 2.5 inches in aluminum and mild steel and 1.25 inches in titanium and high strength steel.
- Up to 7.0 inches material stackup capacity.
- Hydraulic pressure provided by the FT-200 PowerPak.

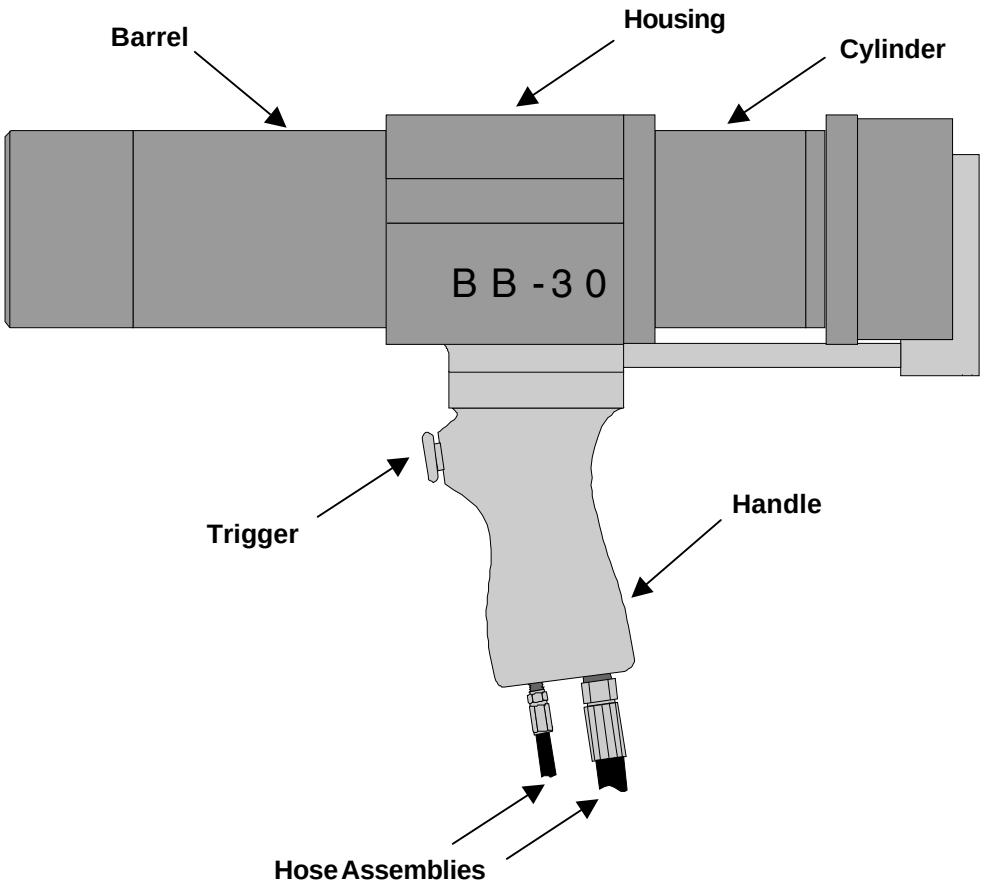


Figure 1.3-1
Big Brute Puller Unit

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

Table 1.3-1
Big Brute Specifications

Model Number	Maximum Material Stackup (inch)	L (Ref Fig 2-4) (inch)	F (Ref Fig 2-4) (inch)	Weight (lb.)	Mandrel Attachment	Stroke (inch)
BB-30	3.0	21.3	10.5	35	.960" tang 7/8-14thd	6.26
BB-30A	3.0	21.3	10.5	35	.960" tang 7/8-14thd	6.26
BB-70	7.0	27.0	13.4	40	.960" tang 7/8-14thd	9.14
BB-70A	7.0	27.0	13.4	40	.960" tang 7/8-14thd	9.14

Note: The **bold** model number is standard.

Nosecap Selection: The BB puller is compatible with the flush nosecaps (Section 2, page 70*) and the extension nosecaps (Section 2, pages 67 to 68*).

Mandrel Selection: The BB puller is directly compatible with threaded or tang mandrels (Section 2, page 57*).

*Refers to FTI Tooling Catalog Revision #3.

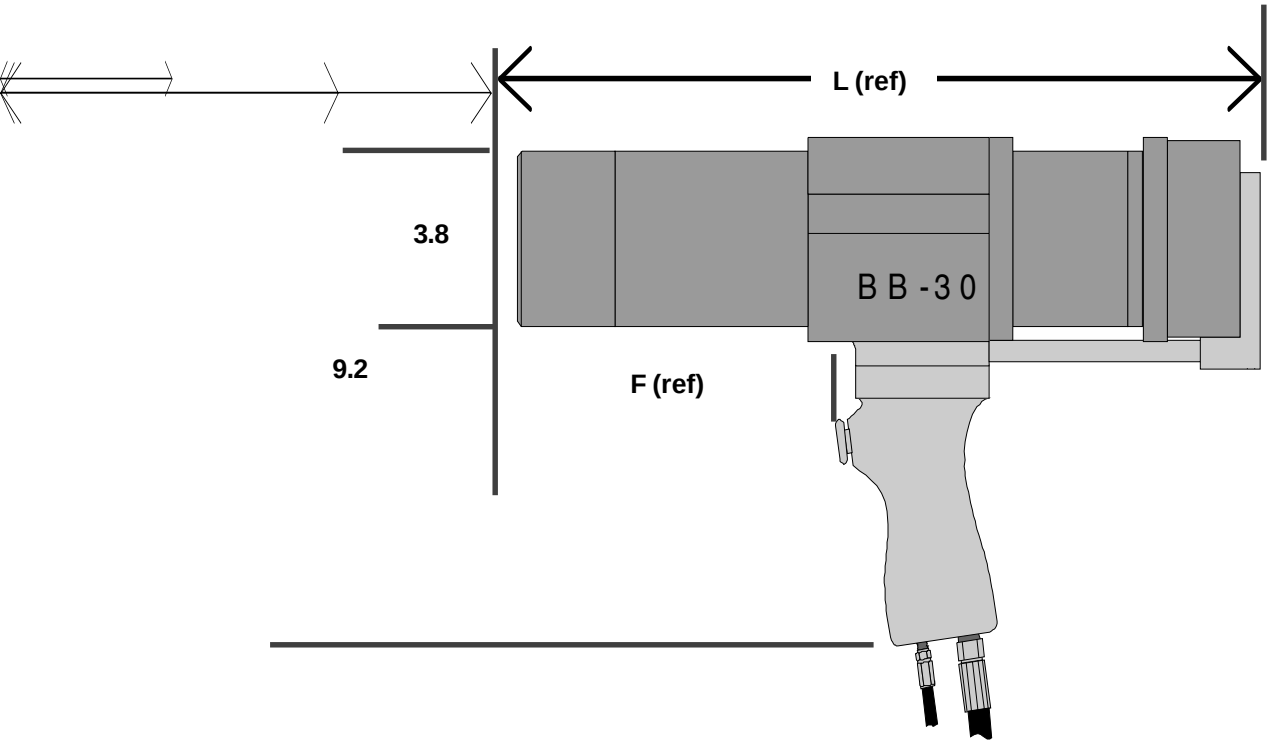


Figure 1.3-2
Big Brute Puller Unit Specifications

Uncontrolled if printed

Fatigue Technology Inc.
Tel: (206)246-2010
401 Andover Park East
www.fatiguetech.com
Seattle, WA 98188-7605 USA
Fax: (206)244-9886

This page intentionally left blank for two-sided printing.

Fatigue Technology Inc.
Tel: (206)246-2010

401 Andover Park East
www.fatiguetech.com

Seattle, WA 98188-7605 USA
Fax: (206)244-9886

SECTION 2: SAFETY

Consult PowerPak manual for safety precautions before connecting the puller unit.

When used in accordance with these instructions, the puller unit is safe and easy to use. All general safety precautions associated with hydraulic and pneumatically operated power tools should be observed. Many of these are noted in this section.

Ultimately, the operator is responsible for his own safety; however, the following general safety precautions should be observed.

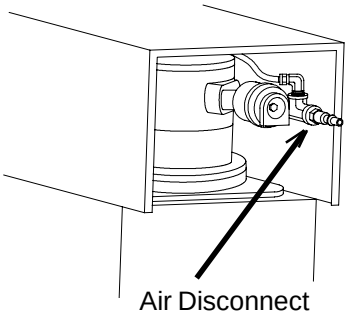


Figure 2.0-1 Location of Air Disconnect

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. 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 (see Figure 2.0-1). Never use your hands to grasp a leaking hose under pressure. The force of escaping hydraulic fluid could cause serious injury.

4. **DO NOT** attempt to disconnect the hydraulic hose while it is under pressure.

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

6. **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 which could cause premature failure of the hose and possibly result in injury.

7. **DO NOT** use the hose to move attached equipment.

8. Hose material and coupler seals must be compatible with hydraulic fluid that meets the requirements of U.S. MIL-SPEC #5606.

9. Hoses must not come in contact with toxic materials such as creosote imprinted objects and some paints. Keep clean and never paint couplers or hoses. Hose deterioration due to chemical degradation may cause the hose to fail under pressure.

10. Release puller unit trigger when mandrel clears the workpiece, or becomes stuck.

11. Before operating pump, make sure all hose connections are tightened securely. **DO NOT** overtighten.

12. Keep hands away from nosecap assembly while holding nosecap against the workpiece.

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

This page intentionally left blank for two-sided printing.

Fatigue Technology Inc.
Tel: (206)246-2010
401 Andover Park East
www.fatiguetech.com
Seattle, WA 98188-7605 USA
Fax: (206)244-9886

SECTION 3: PULLER UNIT OPERATING INSTRUCTIONS

Become familiar with these instructions before operating the puller.

3.1 PULLER UNIT SET-UP AND OPERATION PROCEDURE

Refer to Section 6 (Illustrated Parts Breakdown) for parts identification.

1. Inspect all threads and fittings of PowerPak for signs of wear or damage and replace them if necessary.

2. Uncoil the hose assembly of the puller unit, and inspect all threads, couplings, and hoses for damage and degradation.

3. Remove the thread protectors from the hydraulic fittings and thread the hydraulic hose fitting from puller unit (female) onto the hydraulic fitting of the FTI PowerPak (male). Wipe fittings clean prior to connecting. Make sure to thread couplers completely together. There should be positive contact between the PowerPak coupler and the hose fitting flange. Failure to completely tighten the coupler will prevent the puller from returning to the forward (start) position. See Section 5, Problem 5.2, for more information.

4. Connect the male/female AIR quick-disconnects from puller to FTI PowerPak.

5. Remove the thread protectors from the air inlet on back of PowerPak. Connect the female quick disconnect of a 3/8-inch or 1/2-inch ID shop air line onto the male air inlet of the PowerPak.

6. Test shop air supply to ensure that air is clean, dry, and between 90 and 120 psi at 45 cfm.

3.2 ACTUATION OF THE PULLER

1. The puller can be activated only when connected to an FTI PowerPak.

2. Activate the puller by depressing the trigger on the handle. Hydraulic pressure is transmitted through the hose to the cylinder of the puller which then retracts the hydraulic piston.

3. Releasing the trigger changes pressure at the pilot valve and stops the pull cycle, and returns puller to original position.

4. If the puller fails to operate as detailed above, refer to Section 5 (Troubleshooting).

This page intentionally left blank for two-sided printing.

Fatigue Technology Inc.
Tel: (206)246-2010
401 Andover Park East
www.fatiguetech.com
Seattle, WA 98188-7605 USA
Fax: (206)244-9886

SECTION 4: MAINTENANCE

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.

WARNING

Disconnect the PowerPak from the air supply before performing maintenance or repair procedures.

4.1 GENERAL CLEANING

1. Periodically clean the outer surfaces of the puller unit and PowerPak.
2. When not in use, ensure thread protectors are reinstalled.
3. Keep all hose connections free of dirt and grime.

4.2 LUBRICATION

1. There is no internal lubrication requirement for the puller unit.
2. Whenever the puller is to be stored for any length of time, maintain a thin coat of 10-weight oil on the outside of black oxided surfaces.

4.3 INSPECTION

Periodically inspect the threaded fittings for cracks, leaks or other damage. Repair and replace as necessary.

4.4 ASSEMBLY AND DISASSEMBLY

Normal replacement of seals (refer to the Illustrated Parts Breakdown, Figure 6.4-1).

Disassembly

1. Loosen lock ring (14) and remove nosecap (13).
2. Remove Allen-head bolt (19) and pull out barrel (5).
3. Loosen locknut (9) and unthread chuck or threaded adapter.
4. Remove set screws (27), air adapter (11) and air tube.
5. Remove and replace seals (20) at each end of air tube.
6. Loosen lock rings (14), unthread endcap (29) and cylinder (3).

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

7. Pull cylinder (3) off piston (4), the piston may stick in cylinder. If needed, remove piston from cylinder after cylinder is removed.

8. Remove and replace O-rings (25) on piston (4).

9. Remove handle (16) by removing Allen screws (12).

10. Pull hydraulic adapter (3) out of handle or housing (8) whichever it is stuck in.

11. Remove and replace O-ring (13) and backup ring (11) at each end of hydraulic adapter.

12. Remove sleeve (2).

13. Remove and replace O-ring (24) and backup ring (25).

14. Remove and replace O-ring (22) and backup ring (23).

15. Remove and replace scraper (21).

Reassembly

1. Replace sleeve (2).

2. Install piston (4) in barrel (3).

3. Put sleeve (2) onto piston shaft (3) and slide sleeve down to end of barrel so O-rings (25) are seated down in the end of the cylinder.

4. Thread barrel and sleeve into housing (8).

5. Align sleeve, replace hydraulic adapter (3) in handle (16), replace gasket (14), and install handle.

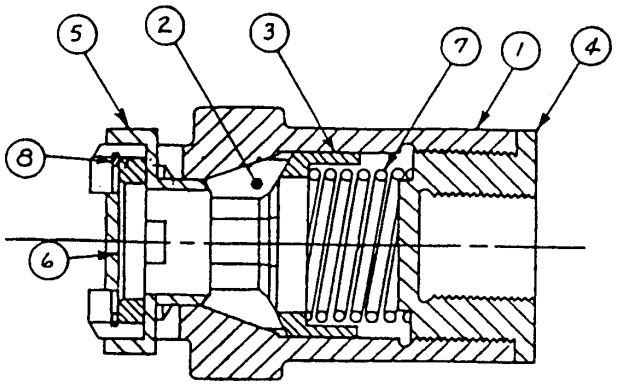
6. Thread endcap (29) onto end of the barrel and tighten lock rings (14).

7. Install locknut (9) and chuck on threaded adapter and tighten locknut.

8. Replace barrel and Allen bolt (19).

9. Install nosecap (13) and lock ring.

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886



Detail No.	Name of Detail	Sheet No.
8	Snap ring	5000-156 TRUARC
7	Spring	22-7
6	Retainer	22-6
5	Jaw release	22-5
4	Chuck adapter	22-4
3	Follower	22-3
2	Jaws	22-2
1	Casing	22-1

Figure 4.5-1
Chuck Assembly

1. Unscrew chuck adapter (4) from casing (1) with a counterclockwise motion. Care should be taken not to lose the spring (7), jaws (2) or follower (3) out of the end of the unit.

2. Remove spring (7), follower (3) and jaws (2).

3. Clean casing (1), jaws (2), release (5) and retainer (6) as a unit in any solvent that leaves little residue.

4. Replace any damaged jaws.

5. Place the chuck assembly in a vertical position with the nose down. In this position, align the jaws around the release (5).

Note: Do not use grease or oil in reassembling the unit. Debris has a tendency to accumulate, preventing proper operation.

This page intentionally left blank for two-sided printing.

Fatigue Technology Inc.
Tel: (206)246-2010

401 Andover Park East
www.fatiguetech.com

Seattle, WA 98188-7605 USA
Fax: (206)244-9886

SECTION 5: TROUBLESHOOTING

This section provides solutions to some basic trouble spots. If you cannot solve your maintenance or operational problems with the information provided in this section, please contact your nearest FTI representative.

NOTE: Should difficulties originate in the PowerPak, consult the specific PowerPak Operations, Maintenance and Repair Manual.

PROBLEM	CAUSE	SOLUTION
5.1 POWERPAK WILL NOT BUILD FULL HYDRAULIC PRESSURE		
	(a) One or more of the key air or hydraulic lines has not been securely connected.	(a) Check the following hose connections: (1) Mail air line quick disconnect fitting from shop air system to PowerPak. (2) Hydraulic quick couplings connecting the hoses to the PowerPak manifold, and the puller to the hydraulic hoses. (3) Two male/female air line quick disconnect fittings connecting the puller to the PowerPak manifold. (4) Check the main air supply has not been interrupted.

CAUTION
Hydraulic oil under extreme pressure may cause serious injuries if not handled carefully. For technical assistance, please contact FTI's Technical Sales Department.

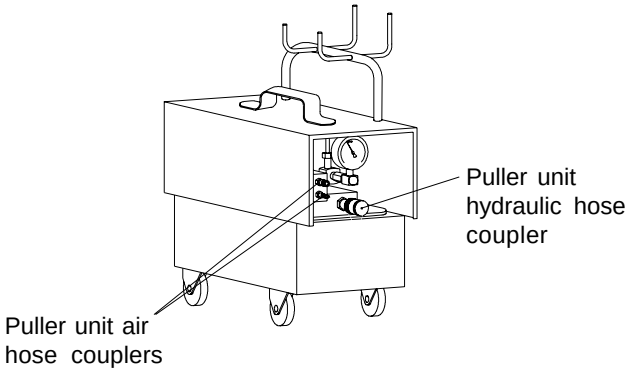


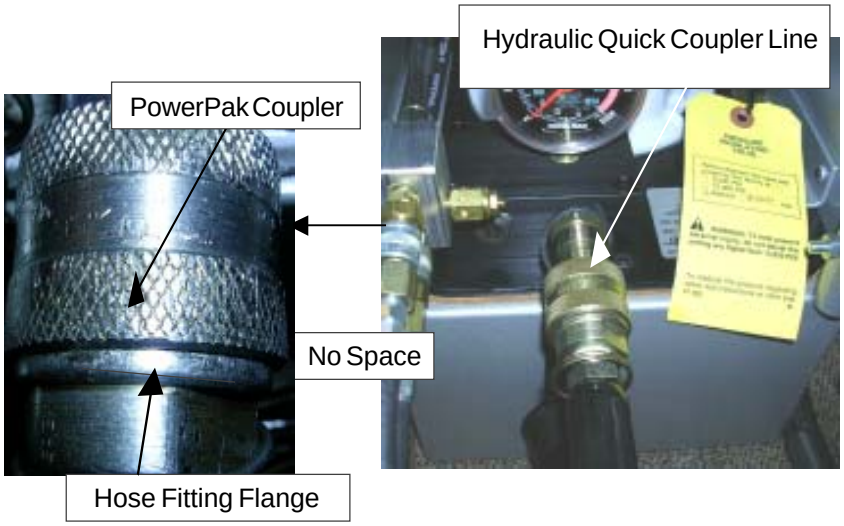
Figure 5.1-1
FT-200 PowerPak*

***Drawings not to scale.**

Uncontrolled if printed

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

PROBLEM	CAUSE	SOLUTION
5.2 PULLER RETRACTS ON FIRST TRIGGER ACTUATION, BUT WILL NOT RETURN TO START POSITION		
	(a) The new puller unit requires lubrication through the piston and cylinder.	(a) Cycle trigger several times to introduce hydraulic fluid into the cylinder.
(b) As above, AND the hydraulic hose is difficult to bend or coil (indicating unrelieved pressure built up in the hose).	(b) The hydraulic quick coupler line has not been completely tightened at the PowerPak manifold (there should be no space between the PowerPak coupler and the hose fitting flange).	(b) Once hydraulic pressure has been introduced to the hydraulic hose, the pressure must be relieved before the coupler can be sufficiently tightened.



Procedure for relieving hydraulic pressure:

(1) Disconnect main air supply.
(2) Disconnect coupler from PowerPak
(3) Wrap the fitting with a rag to absorb the squirting oil and slowly turn the coupler off the hydraulic hose to allow hydraulic oil to bleed out.
(4) Once pressure is relieved, coupler may be tightened and reinstalled onto PowerPak.
(5) Re-attach air lines to get puller to return.

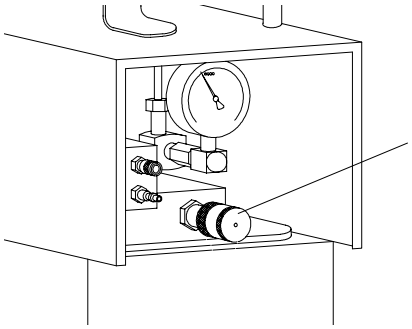


Figure 5.2-1
Location of Hydraulic Quick Coupler
(FT-200)

***Drawings not to scale.**

Uncontrolled if printed

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

PROBLEM	CAUSE	SOLUTION

5.3 POWERPAK WILL NOT GENERATE CONSTANT PRESSURE (OR HICCUPS)

(a) Trigger response valve requires adjustment.

(a) Adjustment procedure:

For puller units with new trigger assembly (see Section 6.1-1), trigger response valve should be closed.

(1) Loosen locknut on trigger response valve.
(2) Using a screwdriver, open screw counterclockwise until PowerPak will not start when puller trigger is depressed.
(3) Turn screw clockwise until:
- PowerPak generates constant pressure when puller trigger is depressed, and

- PowerPak starts instantly when puller trigger is depressed and stops instantly when released. When the puller trigger is depressed, the PowerPak should be run at the pre-set pressure until the trigger is released.

(4) Hold set screw in position and tighten locknut.

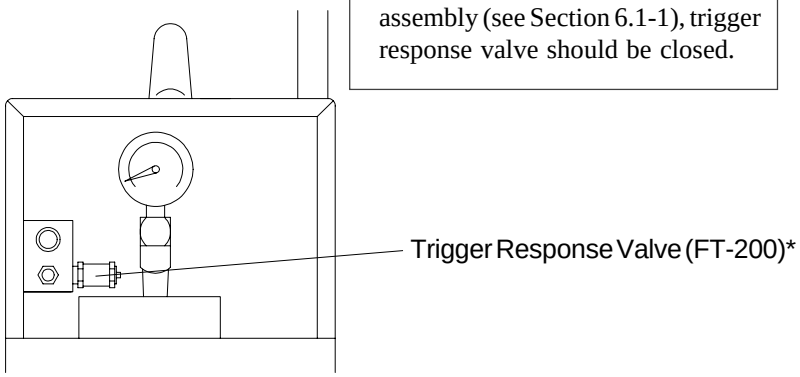


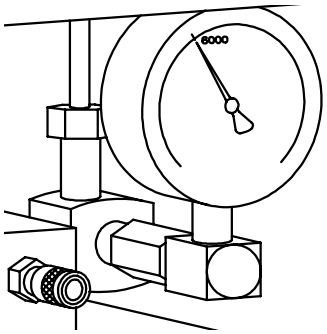
Figure 5.3-1
Location of Trigger Response Valve (FT-200)

5.4 POWERPAK WILL NOT OPERATE OR MAINTAIN SUFFICIENT PRESSURE (6,000 PSI)

(a) Hydraulic pressure requires adjusting (applicable to FT-200 PowerPak only).

(a) Adjust PowerPak pressure valve:

(1) Squeeze trigger on puller unit to activate PowerPak.
(2) If pressure does not reach 6,000 psi, loosen wingnut and turn hydraulic pressure control clockwise until pressure reaches 6,000 psi.
(3) Tighten locknut to secure available shop air.



(b) Inadequate air supply.

(b) Increase pressure or flow of available shop air.

If the PowerPak will not generate or maintain sufficient pressure, the main air line pressure is too low or the PowerPak hydraulic pressure requires adjustment.

Figure 5.4-1
Pressure Gauge (FT-200)

Air pressure requirements:
- 1/2-inch ID air line with 90 to 120 psi for the FT-200

Flow requirements:
- 40 to 50 cfm for the FT-200

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

PROBLEM	CAUSE	SOLUTION
5.5 MANDREL STICKS IN HOLE WHEN PULLER ACTIVATED		
	(a) Not enough pressure used to generate pull forces.	(a) Use the following procedure to analyze the problem: (1) Actuate the puller and observe pressure reading on PowerPak pressure gage (FT-200 PowerPak only). (2) Pressure gage should read 6,000 psi. If an increase in pressure is required, refer to the solution for Problem 5-4 in this section for instructions. (3) Actuate puller again. If mandrel remains stuck, increase pressure to 10,000 psi. (4) If mandrel remains stuck at 10,000 psi immediately disengage the mandrel from the puller. Push the mandrel out using and impact hammer. Contact FTI's Technical Sales Department for additional assistance.

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

FTI has redesigned the puller unit trigger assembly. Puller units with serial numbers equal to or higher than the serial numbers in Table 6.0-1 have the new cartridge trigger assembly design. The new design will reduce the occurrence of trigger air leaks, perform more reliably (better pump actuation), and be easier to maintain. The previous trigger design as detailed in Section 6.3 can be easily replaced with the Cartridge Trigger Assembly Kit (FTI-CT-RK) or the Big Brute Rework Kit (BB-CT-RK) and the Puller Trigger Rework Tool Kit (FTI-CT-RKT). One FTI-CT-RK or BB-CT-RK is required for each puller converted. Only one FTI-CT-RKT is required regardless of the number of pullers converted. The FTI-CT-RKT kit also includes detailed instructions on how to perform the modification.

Table 6.0-1
Trigger Assembly Conversion

FTI Part Number	FTI Serial Number
2318-001 through -012	0555
2866-001 through -002	0337
5330-001	0101

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

6.1 BIG BRUTE REWORK KIT (BB-CT-RK)

This kit is used to repair or refurbish older pullers. Table 6.1-1 is a parts list for the Big Brute Rework Kit and Figure 6.1-1 is a diagram of the cartridge trigger assembly.

Table 6.1-1
Big Brute Rework Kit (BB-CT-RK)

Quantity	Piece Number	Description	FTI Part Number
4		Screw, SHC (10-32 UNFX 3/4)	1035-005
1		BB-H-D16 Hydraulic Adapter	2039-003
1		BBD35 Adapter, Air	2324-001
1		Big Brute Seal Kit (BB-SK) (See Section 6.2)	8000-486
1	2	Push Button, Brass	1187-623
1	3	Retaining Ring, Internal	1187-624
1	4	Sleeve, Puller Handle Trigger	3196-001

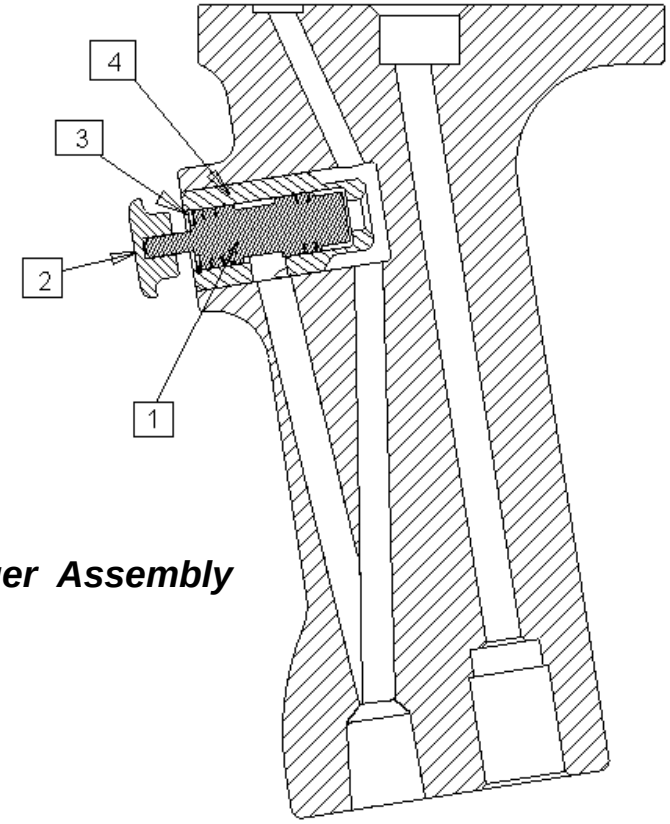


Figure 6.1-1
Diagram of Cartridge Trigger Assembly

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

6.2 BIG BRUTE SEAL KIT (BB-SK)

This kit is used to replace seals. It is included as part of the Big Brute Rework Kit (see Section 6.1). Table 6.2-1 is a parts list for the Big Brute Seal Kit.

Table 6.2-1
Big Brute Seal Kit (BB-SK)

Quantity	Description	FTI Part Number
1	Valve, Cartridge Trigger (See Figure 6.1-1, Piece Number 1)	1187-622
1	Seal, LB Handle (See Table 6.3-1, Piece Item 6)	2040-001
2	Ring, Backup MS28782-9	1046-028
1	A-111-90-BUNA	1046-038
2	AN6227-9	1046-027
1	MS-28782-32	1046-024
1	CP-329	1046-009
1	Scraper (R 2072)	1046-037
1	MS28775-214 O-Ring	1046-059
1	MS28775-224 O-Ring	1046-058
1	AN62278-19	1046-025
1	MS-28782-19	1046-026
1	AN6227B-32	1046-023
1	MS228775-147	1046-035
2	AN6227-5	1046-036

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

6.3 PREVIOUS TRIGGER ASSEMBLY

The previous trigger design (serial number less than those shown in Table 6.0-1) detailed here, can be easily replaced with the improved trigger assembly detailed at the beginning of Section 6. Table 6.3-1 is a parts list for the old-style trigger assembly.

Table 6.3-1
Parts List for Previous Trigger Assembly

Quantity	Piece Item	Description	FTI Part Number
1	1	Trigger, LB Handle	2042-001
1	2	Spring, LB Handle	1005-003
1	3	Retainer, LB Handle	2043-001
1	4	Ball, .250 Diameter stl.	1045-025
1	5	Pin, 1/8 x 3/4 stdl. Spring	1045-026
1	6	Seal, LB Handle	2040-001
1	7	Sleeve, LB Handle	2044-001

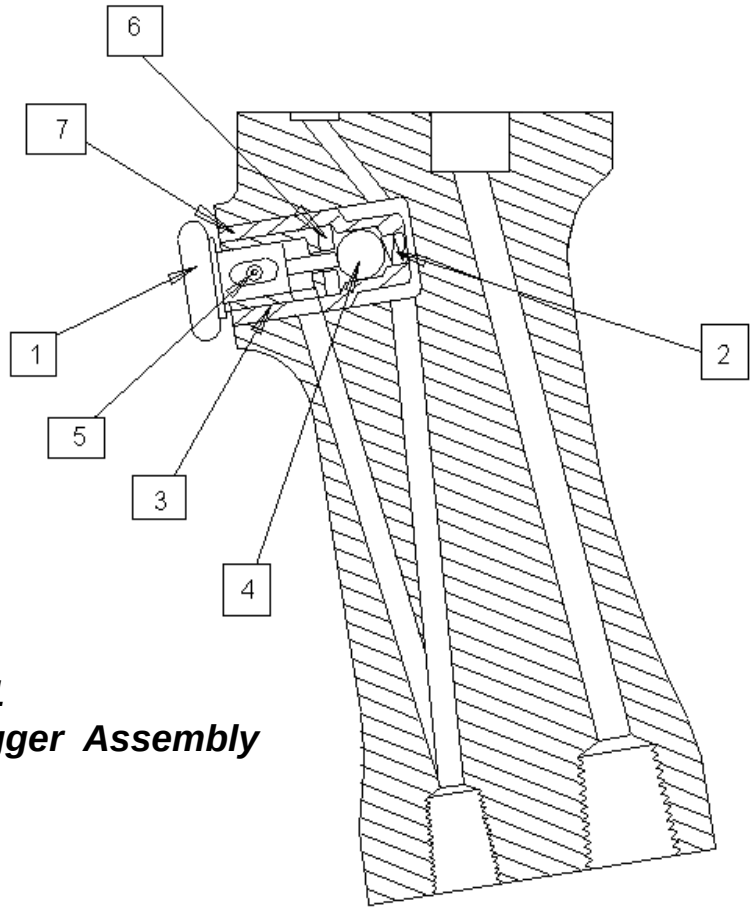
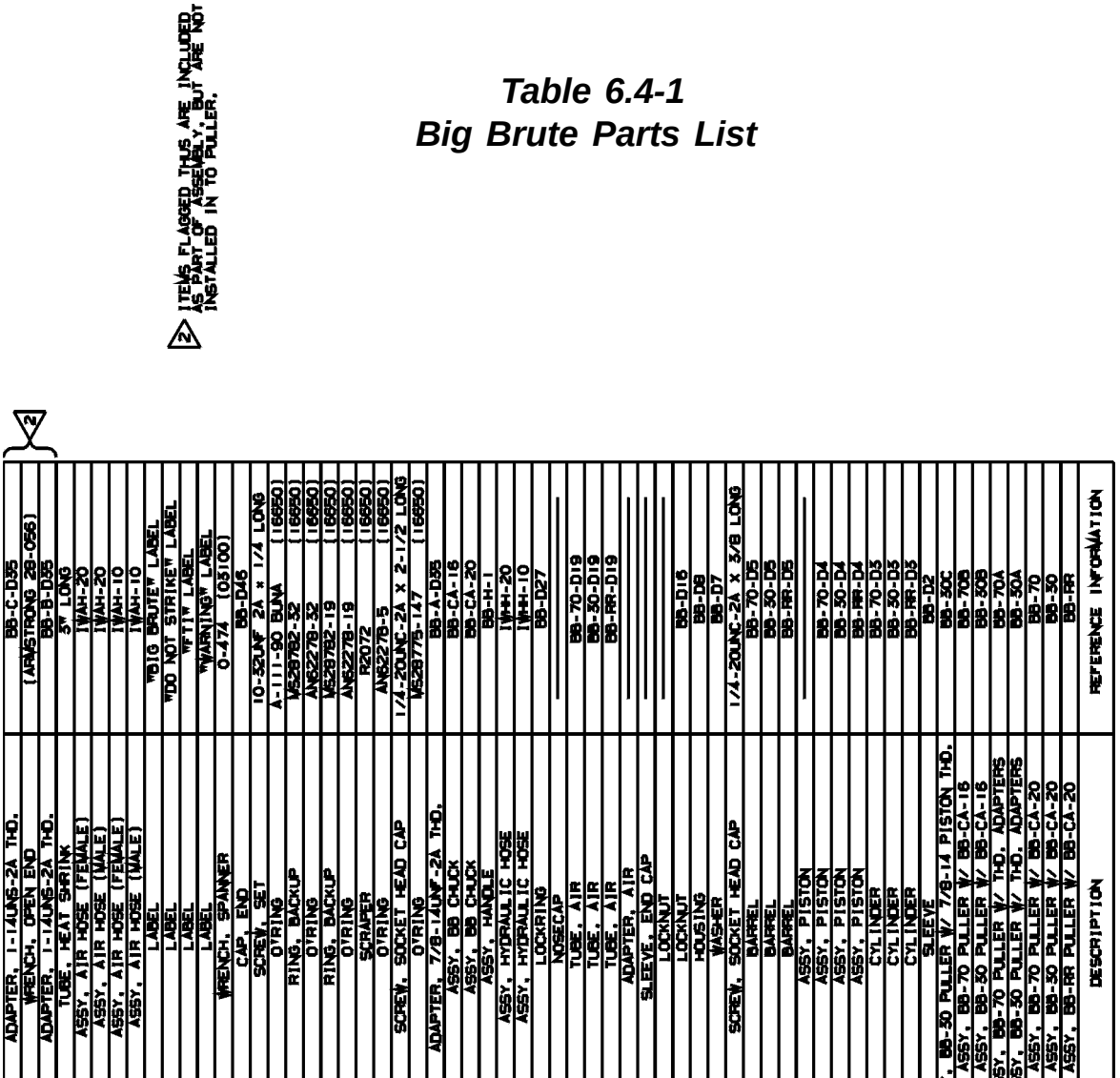


Figure 6.3-1
Diagram of Previous Trigger Assembly

Fatigue Technology Inc. 401 Andover Park East Seattle, WA 98188-7605 USA
Tel: (206)246-2010 www.fatiguetech.com Fax: (206)244-9886

Table 6.4-1
Big Brute Parts List



PART NO. / DASH NO.	PIECE NO.	QUANTITY -004	QUANTITY -005	QUANTITY -006	QUANTITY -007	QUANTITY -008	DESCRIPTION	REFERENCE INFORMATION
2526-003	—	—	—	—	—	—	ADAPTER, 1-14UNS-2A THD.	BB-C-D35
1045-118	—	—	—	—	—	—	WRENCH, OPEN END	(ARMSTRONG 28-056)
2526-002	—	—	—	—	—	—	ADAPTER, 1-14UNS-2A THD.	BB-B-D35
2839-001	37	4	4	4	4	—	TUBE, HEAT SHRINK	3" LONG
2106-004	36	—	—	—	—	—	ASSY, AIR HOSE (FEMALE)	1/4H-20
2106-003	35	—	—	—	—	—	ASSY, AIR HOSE (MALE)	1/4H-20
2106-002	34	—	—	—	—	—	ASSY, AIR HOSE (FEMALE)	1/4H-10
2106-001	33	2	2	2	2	—	ASSY, AIR HOSE (MALE)	1/4H-10
1009-188	32	2	2	2	2	2	LABEL	"BIG BRUTE" LABEL
1009-184	31	—	—	—	—	—	LABEL	"DO NOT STRIKE" LABEL
1009-024	30	—	—	—	/	—	LABEL	"FTI" LABEL
1009-185	29	—	—	—	—	—	LABEL	"WARNING" LABEL
1045-015	28	1	1	1	1	1	WRENCH, SPANNER	0-474 (05100)
2197-001	27	2	2	2	2	2	CAP, END	BB-D46
1045-027	26	2	2	2	2	2	SCREW, SET	10-32UNF 2A x 1/4 LONG
1046-038	25	—	—	—	—	—	O'RING	A-111-90 BUNA (16650)
1046-024	24	2	2	2	2	2	RING, BACKUP	M528782-32 (16650)
1046-023	23	—	—	—	—	—	O'RING	AN6227B-32 (16650)
1046-026	22	2	2	2	2	2	RING, BACKUP	M528782-19 (16650)
1046-037	21	—	—	—	—	—	O'RING	AN6227B-19 (16650)
1046-036	20	2	2	2	2	2	SCRAPER	R2072 (16650)
1035-013	19	2	2	2	2	2	O'RING	AN6227B-5 (16650)
1046-035	18	—	—	—	—	—	SCREW, SOCKET HEAD CAP	1/4-20UNC-2A x 2-1/2 LONG
2526-001	17	—	—	—	—	—	O'RING	M528775-147 (16650)
2513-001	17	2	2	2	2	—	ADAPTER, 7/8-14UNF-2A THD.	BB-A-D35
2513-002	17	—	—	—	—	—	ASSY, BB CHUCK	BB-CA-16
2049-003	16	—	—	—	—	—	ASSY, BB CHUCK	BB-CA-20
2107-002	15	—	—	—	—	—	ASSY, HANDLE	BB-H-1
2107-001	15	—	—	—	—	—	ASSY, HYDRAULIC HOSE	1/4H-20
2120-005	14	3	3	3	3	1	ASSY, HYDRAULIC HOSE	1/4H-10
2074-001	13	—	—	—	—	—	LOCKRING	BB-D27
2328-003	12	—	—	—	—	—	NOSECAP	———
2328-002	12	—	—	—	—	—	TUBE, AIR	BB-70-D19
2328-001	12	—	—	—	—	—	TUBE, AIR	BB-50-D19
2324-001	11	—	—	—	—	—	ADAPTER, AIR	BB-RR-D19
2323-001	10	—	—	—	—	—	SLEEVE, END CAP	———
2201-002	9	—	—	—	—	—	LOCKNUT	———
2201-001	9	—	—	—	—	—	LOCKNUT	BB-D16
2127-001	8	—	—	—	—	—	HOUSING	BB-D8
2007-007	7	—	—	—	—	—	WASHER	BB-D7
1035-002	6	2	2	2	2	—	SCREW, SOCKET HEAD CAP	1/4-20UNC-2A x 3/8 LONG
2187-004	5	—	—	—	—	—	BARREL	BB-70-D5
2187-003	5	—	—	—	—	—	BARREL	BB-50-D5
2187-002	5	—	—	—	—	—	BARREL	BB-RR-D5
2105-005	4	—	—	—	—	—	ASSY, PISTON	———
2105-003	4	—	—	—	—	—	ASSY, PISTON	BB-70-D4
2105-002	4	—	—	—	—	—	ASSY, PISTON	BB-50-D4
2105-001	4	—	—	—	—	—	ASSY, PISTON	BB-RR-D4
2184-004	3	—	—	—	—	—	CYLINDER	BB-70-D3
2184-003	3	—	—	—	—	—	CYLINDER	BB-50-D3
2184-001	3	—	—	—	—	—	CYLINDER	BB-RR-D3
2192-001	2	—	—	—	—	—	SLEEVE	BB-D2
2318-008	—	—	—	—	—	•	ASSY, BB-30 PULLER W/ 7/8-14 PISTON THD.	BB-30C
2318-007	—	—	—	—	•	—	ASSY, BB-70 PULLER W/ BB-CA-16	BB-70B
2318-006	—	—	—	•	—	—	ASSY, BB-50 PULLER W/ BB-CA-16	BB-50B
2318-005	—	—	•	—	—	—	ASSY, BB-70 PULLER W/ THD. ADAPTERS	BB-70A
2318-004	—	•	—	—	—	—	ASSY, BB-50 PULLER W/ THD. ADAPTERS	BB-50A
2318-003	—	•	—	—	—	—	ASSY, BB-70 PULLER W/ BB-CA-20	BB-70
2318-002	—	—	•	—	—	—	ASSY, BB-50 PULLER W/ BB-CA-20	BB-50
2318-001	—	—	—	•	—	—	ASSY, BB-RR PULLER W/ BB-CA-20	BB-RR

⚠2 ITEMS FLAGGED THUS ARE INCLUDED AS PART OF ASSEMBLY, BUT ARE NOT INSTALLED IN TO PULLER.

Fatigue Technology Inc.
Tel: (206)246-2010
401 Andover Park East
www.fatiguetech.com
Seattle, WA 98188-7605 USA
Fax: (206)244-9886

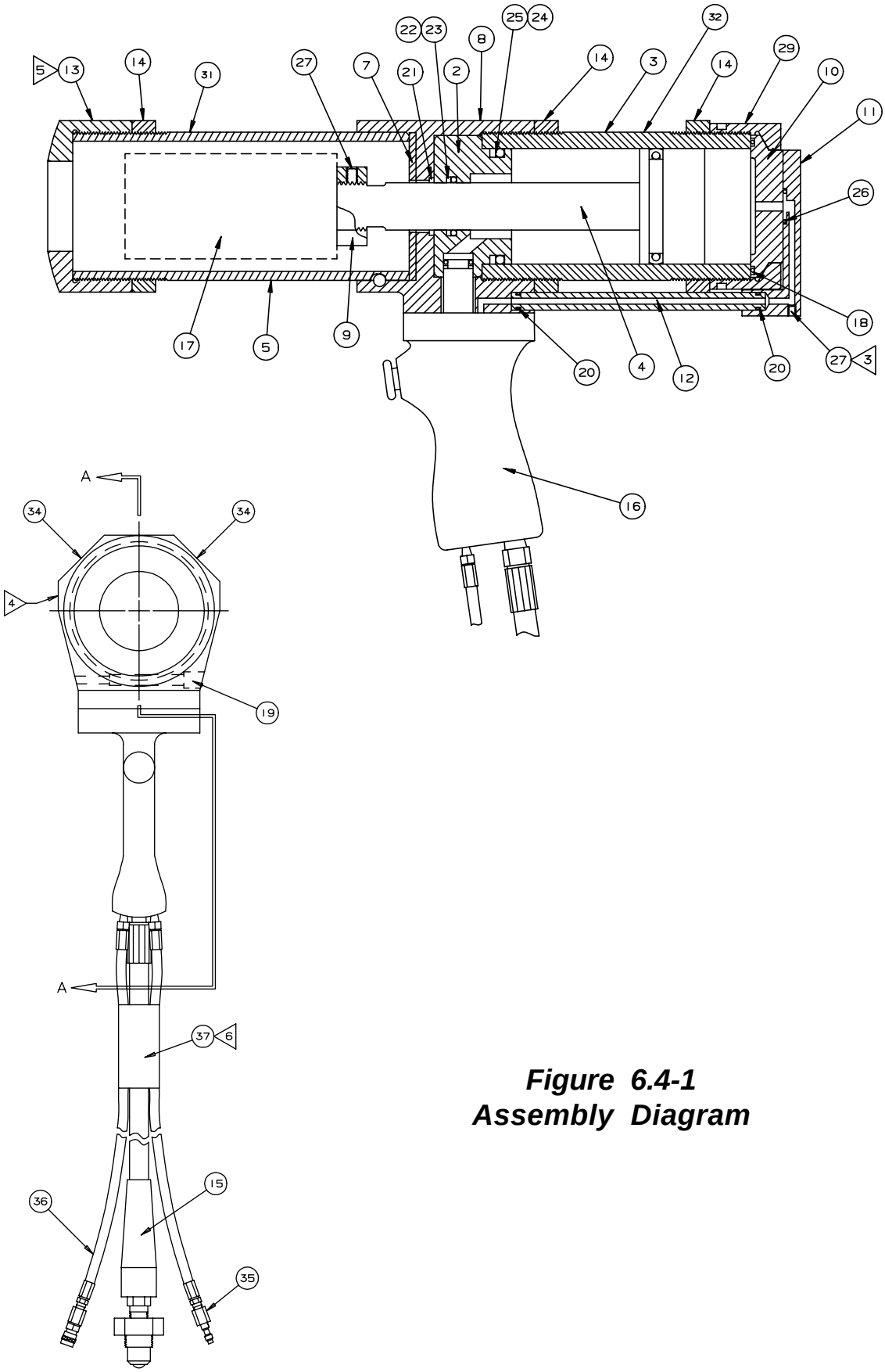


Figure 6.4-1
Assembly Diagram

Uncontrolled if printed

Fatigue Technology Inc.
Tel: (206)246-2010
401 Andover Park East
www.fatiguetech.com
Seattle, WA 98188-7605 USA
Fax: (206)244-9886