

FTI OPERATIONS, MAINTENANCE AND REPAIR MANUAL

HP-20 Hand Puller Operator Manual

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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 (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 Technical Sales Department.

FTI's systems and processes are the subject matter of one or more of the following patents: 4,423,619, 4,425,780, 4,557,033, 4,809,420, 4,885,829, 4,934,170, 5,127,254, 5,083,363, 5,096,349, 5,103,548, 5,245,743, 5,218,854, 5,305,627, 5,405,228, 5,341,559, 5,380,136, 5,433,100, 5,468,104, 0131648, 86,344, 1,792,039, 513,898, 581,385, 69310828, 692015124, 5,129,253, 6,183,180, 6,077,010, 6,487,767; 131,648, 33 82069, 468,598, 69105390, 643,231, 69414946, 696,686, 785,366, 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.

ABOUT FATIGUE TECHNOLOGY

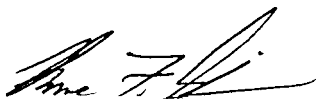
Fatigue Technology Inc. (FTI) has provided innovative solutions to fatigue problems in metal structures since 1969. Complete systems of tooling are used worldwide to enhance the fatigue life of holes in airframes, turbine engines, and other critical structures.

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

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

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



Bruce F. Gibson
President

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SECTION 1: INTRODUCTION

This instruction manual contains information on the operation and maintenance of the HP-20 Hand Puller Unit. To obtain optimum performance and many years of 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 HP-20 HAND PULLER UNIT

The HP-20 Hand Puller Unit is a convenient, small, lightweight tool specifically designed for use with Fatigue Technology Inc. (FTI) patented Cold Expansion (Cx™) installation process. The HP-20 Hand Puller Unit is designed for uses where a limited number of holes need cold expansion to improve fatigue life performance.

The HP-20 Hand Puller adheres to these standards:

- Maximum pull force of 4,000 pounds.
- Material stack-up of 2.0 inches.
- Each rotation of the hex nut provides .050 inch of travel.
- Equals 3.1 inch maximum stroke.
- Up to 3/8 inch diameter in aluminum, up to 1/4 inch diameter in steel and titanium. Larger holes may be possible in smaller material stack-up if pull forces are below 4000 pounds.

Included in the kit with the HP-20 Hand Puller Unit is a standard 5/8 inch x 11/16 inch ratchet box wrench (Figure 4).

1.2 GENERAL SPECIFICATIONS AND ILLUSTRATIONS

Durable Tooling Selection: For applicable nosecap and mandrel sizes see Process Specifications of the application.

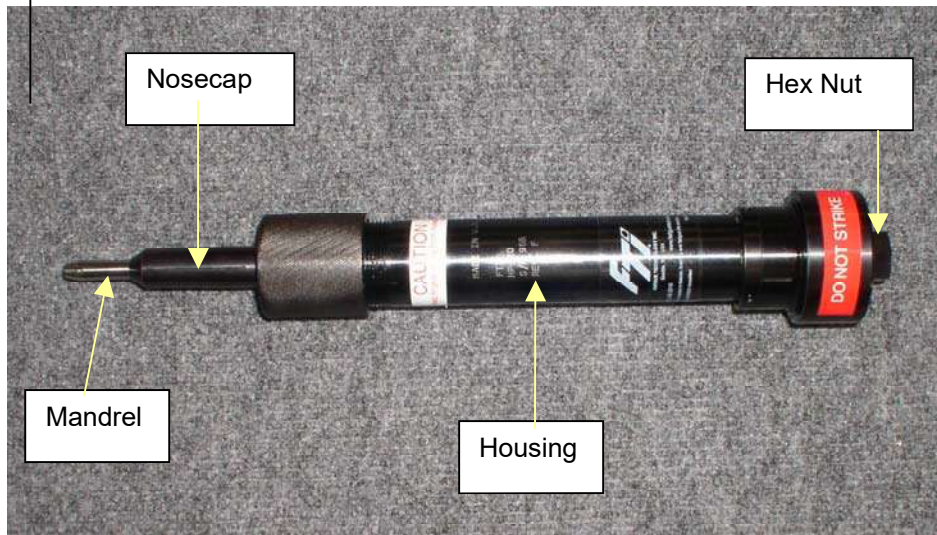


Figure 1
HP-20 Hand Puller Unit Parts (External)

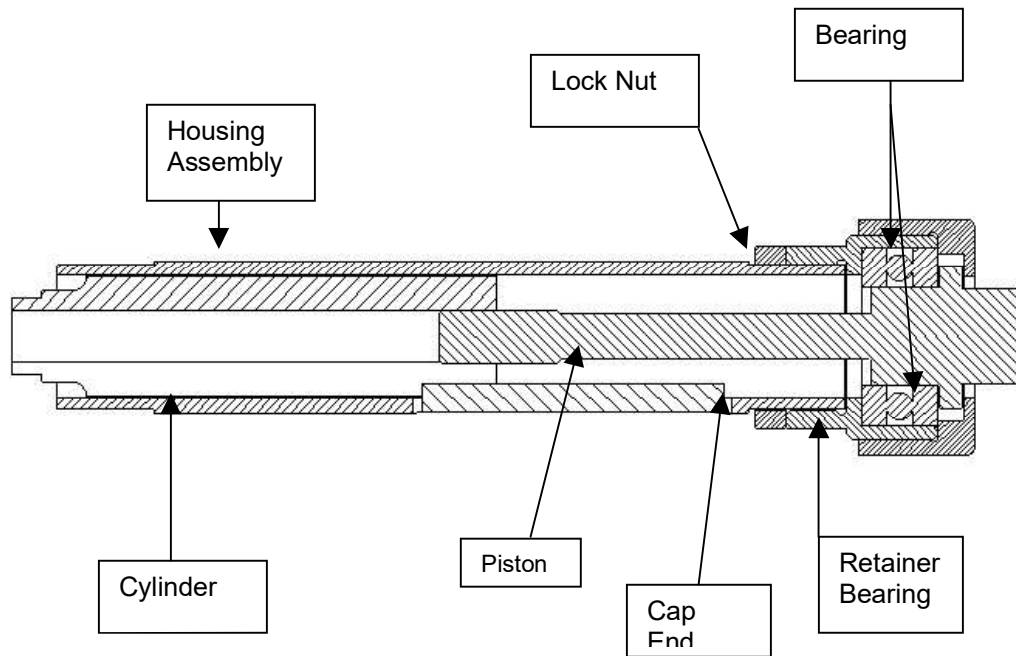


Figure 2
HP-20 Hand Puller Unit Parts (Internal)

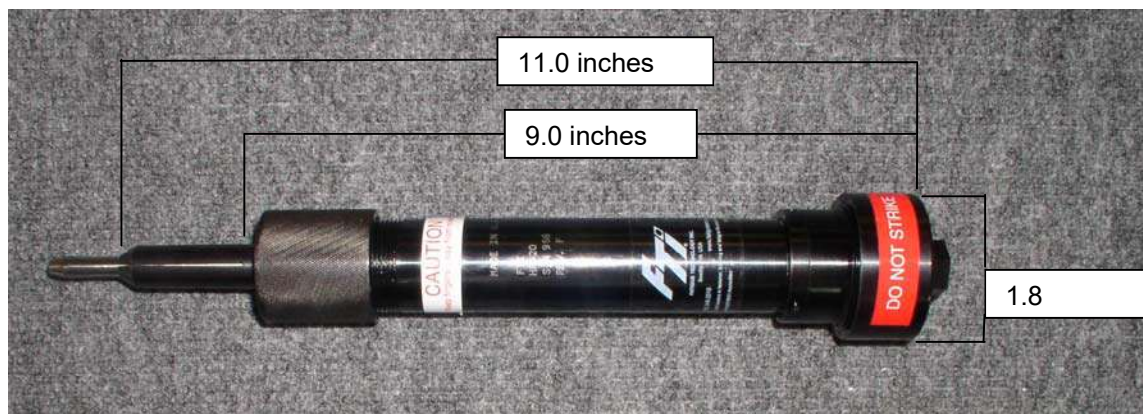


Figure 3
HP-20 Hand Puller Basic Dimensions

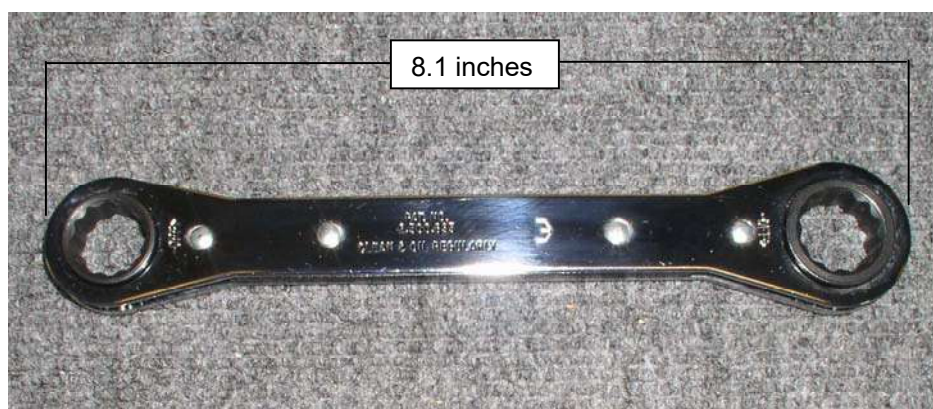


Figure 4
Wrench 5/8 inch x 11/16 inch Ratchet Box

SECTION 2: SAFETY

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

Ultimately, operators are responsible for their own safety; however, the following general safety precautions should be observed.

1. Wear eye protection when operating the hand puller unit.
2. Keep hands away from the moving parts while performing the installation process.
3. Operators must read this manual in its entirety before using the HP-20 Hand Puller.
4. Eye protection must be worn while operating the HP-20 Hand Puller.

SECTION 3: **HAND PULLER UNIT OPERATING INSTRUCTIONS**

Become familiar with these instructions before operating the hand puller.

3.1 *HAND PULLER UNIT UNPACKING PROCEDURE*

Follow these steps to unpack the puller unit:

1. Unpack the puller unit and check that all components in the packing list are present.
2. Make a general visual inspection of all components for any sign of damage or corrosion.
3. Apply lubricant to cylinder and piston prior to assembly with a lithium base molydysulfide grease.

3.2 *DURABLE TOOLING INSTALLATION PROCEDURE*

Follow these steps to attach durable tooling to HP-20 Hand Puller Unit:

1. Screw mandrel into the cylinder (HP-20-D3).



Figure 5
Mandrel Installation

2. Slide nose cap into mandrel and screw into housing assembly until hand tight.



Figure 6
Nosecap Installation

3. After tool setup, cycle puller completely to ensure mandrel passes completely inside nose cap.

3.3 ACTUATION OF HAND PULLER UNIT

This section will be detailed in the sequence used for actual operation of the HP-20 Hand Puller for Split Sleeve Cold Expansion™ (SsCx™) applications.

1. Select the position of the HP-20 hand puller such that the ratcheting wrench will provide clockwise torque to pull the mandrel securely through the material to be cold expanded.



Figure 7
Hand Puller Orientation

Caution: Do not use powered nut drivers with the HP-20 Hand Puller as severe damage to the unit may occur.

2. With the “ON” side oriented facing up, turn ratcheting wrench to extend the mandrel until fully extended through the nose of the puller unit.



Figure 8
Mandrel Extension

3. Insert the mandrel into the material to be cold worked (refer to applicable specification for specific instructions on each FTI product) until nosecap comes in contact with material.



Figure 9
HP-20 Hand Puller – Setup Prior to Cold Expansion

4. With the “OFF” side oriented up, turn the ratchet box wrench until the mandrel is pulled completely through the material to be cold worked.



Figure 10
Hand Puller Actuation

SECTION 4: HAND PULLER UNIT 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.

4.1 *GENERAL CLEANING*

1. Periodically clean the outer surfaces of the hand puller unit.
2. Keep all threads, especially those of the hex nut, free of dirt and grime. Doing so will dramatically extend the life of the threads.
3. Always remove any adhesives or sealants from all components and threads before they dry and/or harden.

4.2 *LUBRICATION*

1. Approximately every 25 uses, apply a complete coating of lithium base molydysulfide grease to the lubricant cylinder and piston.
2. Whenever the puller is to be stored for a long period of time, maintain a thin coat of 10-weight oil on the outside surfaces.

4.3 *INSPECTION*

Periodically inspect all threaded components, including the piston and hex nut, for damage. Replace prior to use if damage is detected.

SECTION 5: TROUBLESHOOTING

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

PROBLEM	CAUSE	SOLUTION
1. Mandrel does not provide enough stroke.	(a) Mandrel not seated correctly in housing assembly. (b) Mandrel too long. (c) Nosecap Assembly too long.	(a) Review tool setup instructions.
2. After installation, the HP-20 Hand Puller will not come out of the hole.	(a) The nut threads will not release the threaded rod.	(a) Pull on the HP-20 Hand Puller while turning the threaded rod knurled knob to get the threads to re-engage. (b) The threaded rod may need to be cut free. Contact FTI for assistance.
3. The hex nut does not operate smoothly.	(a) There is insufficient lubrication on the hex nut threads. (b) The hex nut has been damaged.	(a) Apply lubricant per Section 4.2. (b) Contact FTI for a replacement.

SECTION 6: ILLUSTRATED PARTS BREAKDOWN

6.1 HAND PULLER PARTS LIST AND ASSEMBLY DIAGRAM

See Table 1 below for a list of the HP-20 Hand Puller parts, and Figure 11 for the corresponding assembly diagram.

Table 1
HP-20 Hand Puller Parts List

Reference #	Description	Part #	Reference Information
2	Assy, Housing	2537 – 001	HP-20-D9
3	Cylinder	2531 – 001	HP-20-D3
4	Piston	2532 – 001	HP-20-D4
5	Cap, End	2533 – 001	HP-20-D5
6	Locknut	2120 – 001	HP-20-D7
7	Retainer, Bearing	2536 – 001	HP-20-D8
8	Bearing	1045 – 107	Thrust
9	Wrench, 11/16 inch Ratchet	1045 – 095	--
10	Label, "DO NOT STRIKE"	1009 – 184	--
11	Label, "WARNING"	1009 – 185	--
12	Label, "FTI I.D."	1009 – 094	--

Note:

1. One of each item listed is included.

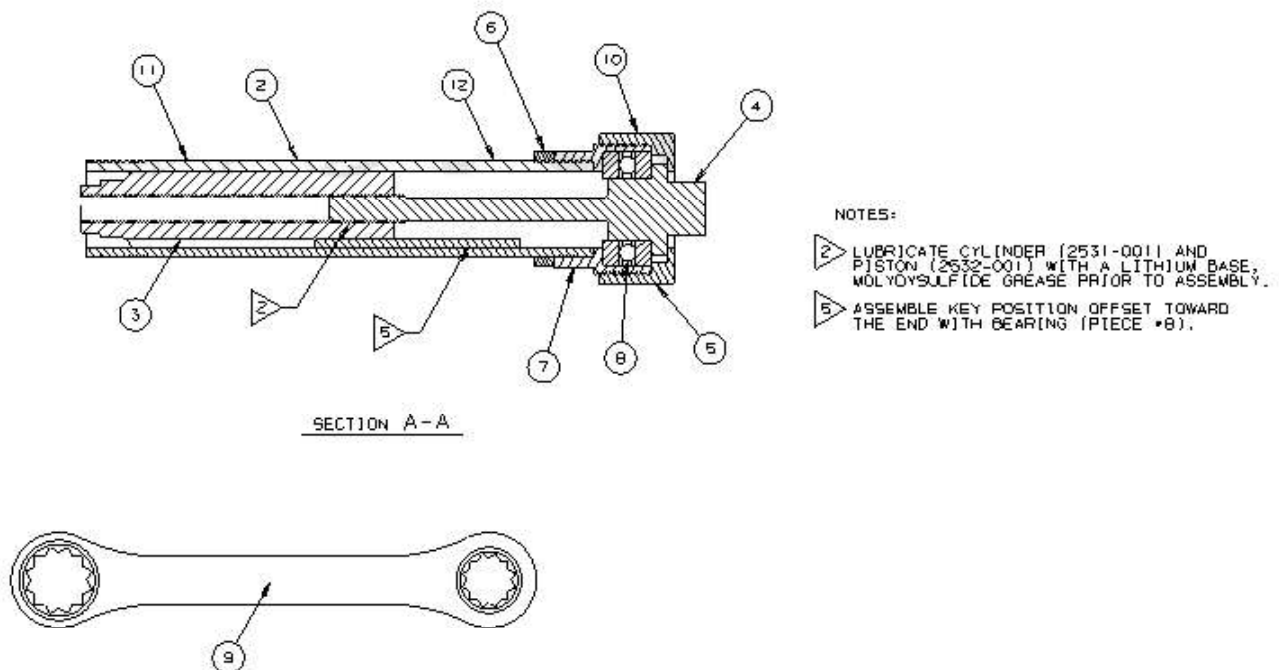


Figure 11
HP-20 Hand Puller Assembly Diagram