

**ASME B107.46-2004**  
(Revision of ASME B107.46M-1998)

# **Stud, Screw, and Pipe Extractors: Safety Requirements**

**AN AMERICAN NATIONAL STANDARD**



**The American Society of  
Mechanical Engineers**



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Mechanical Engineers

A N A M E R I C A N N A T I O N A L S T A N D A R D

# STUD, SCREW, AND PIPE EXTRACTORS: SAFETY REQUIREMENTS

**ASME B107.46-2004**  
(Revision of ASME B107.46M-1998)

Date of Issuance: September 30, 2004

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# FOREWORD

The American National Standards Committee B107, Socket Wrenches and Drives, under sponsorship by The American Society of Mechanical Engineers, was reorganized as an ASME Standards Committee and its title was changed to Hand Tools and Accessories. In 1996, the B209 Committee, which has published an earlier version of this Standard as ANSI/HTI B209.10-1990, merged with the B107 Committee and the B107 Committee scope was expanded to include safety considerations.

The purposes of this Standard are to define essential performance and safety considerations specifically applicable to extractors, to specify test methods to evaluate performance relating to the defined considerations, and to indicate limitations of safe use.

Members of the Hand Tools Institute Striking and Struck Tools Standards Committee have been major contributors to the development of this Standard in their committee work, their knowledge of the products, and their active efforts in the promotion of the adoption of this Standard.

The format of this Standard is in accordance with *The ASME Codes and Standards Writing Guide 2000*. Requests for interpretations, and suggestions for the improvement of this Standard, should be addressed to The American Society of Mechanical Engineers, Secretary, B107 Standards Committee, Three Park Avenue, New York, NY 10016-5990.

The requirements of this Standard become effective at the time of publication. ASME B107.46-2004 was approved as an American National Standard on May 25, 2004.

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Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings, which are necessary to explain the question; however, they should not contain proprietary names or information.

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# STUD, SCREW, AND PIPE EXTRACTORS: SAFETY REQUIREMENTS

## 1 SCOPE

This Standard provides performance and safety requirements for handheld screw and pipe extractors that are intended specifically for removing broken screws, pipes, bolts, studs, and fittings from threaded openings.

It is intended to cover only those designs that require striking of the extractor to seat it properly in the broken pipe or fastener being removed. This Standard, therefore, does not cover designs that do not require striking, such as the ground thread extractor.

The Standard is intended to serve as a guide in selecting, testing, and using the hand tools covered. It is not the purpose of this Standard to specify the details of manufacturing. The Standard is also meant to serve as a guide in developing manuals and posters for training personnel in safe practices.

This Standard may be used as a guide by state authorities or other regulatory bodies in the formulation of laws or regulations.

## 2 CLASSIFICATION

Various typical styles of extractors and their usages are listed here and shown in Figs. 1 through 4. The names given in this Standard are those generally recognized. The styles covered by the Standard are not limited to those listed or illustrated.

**Type I:** Multi-Spline Extractor

**Type II:** Spiral Flute Extractor

**Type III:** Straight Flute Extractor

**Type IV:** Tapered Flute Extractor

## 3 REFERENCES

The following documents are referenced in this Standard. At the time of publication, the editions indicated for dated references were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent edition of the documents indicated below. If a date is not specified, the latest edition shall be used.

ANSI Z87.1, Practice for Occupational and Educational Eye and Face Protection  
ANSI Z535.4, Product Safety Signs and Labels

Publisher: American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036

ASTM E 18, Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

Publisher: American Society for Testing and Materials, (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428

Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care

Publisher: Hand Tools Institute (HTI), 25 North Broadway, Tarrytown, NY 10591

## 4 DEFINITIONS

*body*: the portion of the extractor exclusive of the taper and/or flutes.

*chamfer*: the angled flat surface or equivalent radius between the struck face and the body of the extractor encircling the perimeter of the struck face.

*cutting edge*: the edge formed by the flute.

*equivalent*: the word *equivalent* in this Standard shall be interpreted to mean alternative designs or features that will provide an equal degree of safety.

*flute*: the straight or spiral groove that forms the cutting edge of the extractor.

*hardness*: the condition of the extractor resulting from heat treatment.

*rounded head*: an equivalent design for the struck face and chamfer portion of the extractor.

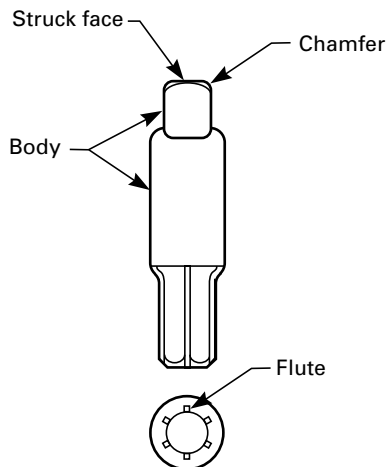
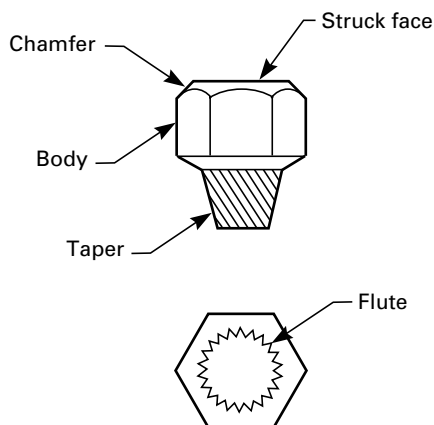
*safety message*: the information imprinted on or affixed to the extractor that is intended to promote safety.

*shall* and *should*: mandatory requirements of this Standard are characterized by the word *shall*. If a provision is of an advisory nature, it is indicated by the word *should* or is stated as a recommendation.

*struck face*: the portion of the extractor, directly opposite the fluted or tapered end.

*taper*: the portion of the extractor, when provided, opposite the struck face with a gradually reducing cross-sectional area.



**Fig. 1 Nomenclature for Straight Flute Extractor****Fig. 2 Nomenclature for Multi-Spline Extractor**

## 5 REQUIREMENTS

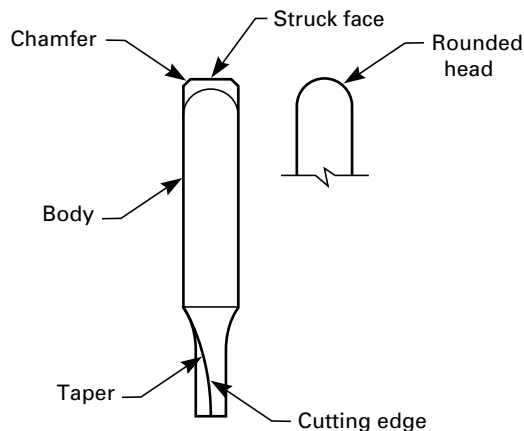
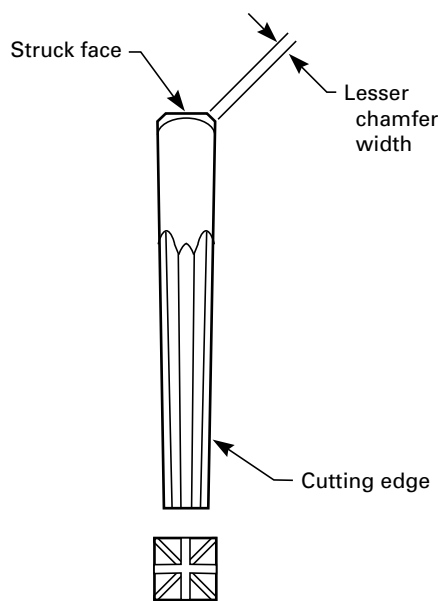
### 5.1 Design

Extractors shall have a straight or tapered fluted portion at one end for engaging and removing broken fasteners and pipes of materials that are softer than the extractor. The opposite end shall have a struck face to be struck by a hammer. Hole sizes to be used with extractors shall be supplied by the manufacturers.

**5.1.1** The struck face of extractors shall have a convex or flat surface.

**5.1.2** The struck face shall have a chamfer of approximately 45 deg or equivalent radius all around the perimeter, and the lesser width (see Fig. 4) shall be approximately one-tenth the body stock size. For example, if the body stock size equals 1 in., then the lesser chamfer width will equal approximately 0.10 in.

**5.1.3** The body portion of the extractor shall have a square, hexagonal, or other shape suitable for turning

**Fig. 3 Nomenclature for Spiral Flute Extractor****Fig. 4 Nomenclature for Tapered Flute Extractor**

the extractor with a wrench over all or part of its length.

**5.1.4** The flutes shall be on the straight or tapered portion of the extractor and of any shape that presents sharp edges suitable for cutting into the hole in the pipe or fitting, or a hole drilled into the fastener when the extractor is struck with an appropriate hammer. Spiral flutes, when present, shall be of a left-hand thread orientation (for right-hand fastener threads), so that when the extractor is engaged with the pipe, fitting, or fastener and turned counterclockwise with a wrench, the extractor tends to further engage while the part to be extracted is removed.

**5.1.5** Extractors shall be free of nonfunctional sharp edges, points, and surface roughness that could inflict personal injury on the user when handling the tool. Extractors shall be free of manufacturing defects such as seams, laps, pipes, and cold shuts that would jeopardize sound construction, and shall withstand the tests specified in section 6.

## 5.2 Materials

The materials used in the manufacture of extractors shall be such as to produce tools conforming to this Standard.

## 5.3 Mechanical Properties

Hardness of the cutting edges shall be 45 HRC to 60 HRC or equivalent. Hardness of the struck face of the extractor shall not exceed 43 HRC or equivalent.

## 6 TESTS

Many tests required herein are inherently hazardous; adequate safeguards for personnel and property shall be employed in conducting such tests.

Separate (new) samples shall be used in each of these tests. Failure to pass any one of the tests indicates the extractors are not in compliance with this Standard.

### 6.1 Hardness Determination Test

Hardness determination with respect to cutting edges and struck faces shall be made on a fixtured tool or on a suitable mounted or unmounted specimen that has been cut from the tool using the wet abrasive method or equivalent. Any hardness test will be acceptable that utilizes equipment and methods equivalent to Rockwell hardness determinations as specified in ASTM E 18.

### 6.2 Impact Test

For this test, the extractor shall be mounted vertically in a hole in a steel plate. The hole diameter shall be equal to the drill size recommended by the extractor manufacturer, and the depth shall be sufficient to prevent bottoming out. The steel plate shall be at least 1 in. thick and shall be of medium carbon alloy steel heat treated to 35 HRC to 40 HRC. A steel weight, having a striking face hardness of 45 HRC to 60 HRC and having weight as specified in Table 1, shall be dropped 20 times from the height indicated in Table 1 squarely onto the extractor struck face. The diameter of the striking face of the weight shall not be less than 0.375 in. larger than the struck face of the extractor. Typically, the weight is cylindrical and is dropped through a seamless tube slightly larger than the diameter of the weight.

**Table 1 Impact Test Parameters**

Extractor — Corresponding Drill Size, in. [Note (1)]	Drop Weight, lb	Drop Height of Weight, in.
$\frac{1}{16}$	1.0	1.0
$\frac{3}{32}$	1.0	2.0
$\frac{1}{8}$	1.0	5.0
$\frac{5}{32}$	1.0	10.0
$\frac{3}{16}$	2.5	10.0
$\frac{7}{32}$	2.5	20.0
$\frac{1}{4}$	2.5	30.0
$\frac{5}{16}$	5.0	25.0
$\frac{3}{8}$	5.0	35.0
$\frac{7}{16}$	10.0	22.5
$\frac{1}{2}$	10.0	27.5
$\frac{5}{8}$	20.0	19.0
$\frac{3}{4}$	20.0	24.0

NOTE:

(1) Sizes other than those listed shall be tested to the next smaller drill size.

The extractor shall not chip, spall, crack, or bend when subjected to this test. Normal deformation of the struck face and cutting edges is permitted.<sup>1</sup>

## 7 SAFETY REQUIREMENTS AND LIMITATIONS OF USE

Instructors and employers shall stress proper use and safety in the use of extractors and shall emphasize the need to wear, and ensure the use of, safety goggles. The publication *Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care* provides guidelines for the safe use of hand tools.

(a) Screw and pipe extractors are special purpose tools designed and intended only for removing broken screws, pipes, bolts, studs, and fittings from threaded openings. They are intended only for removing threaded metal pipes and fasteners that are of softer material than the extractor. An initial cautious blow may be used to ascertain the relative difference in hardness of the extractor and object being removed. To avoid possible eye or other bodily injury, extractors shall not be used to extract objects as hard as or harder than the extractor cutting edges.

(b) A blow from an appropriate striking tool should always be struck squarely, with the striking face parallel with the struck face of the extractor. Glancing blows, overstrikes, and understrikes should be avoided.

<sup>1</sup> This test is so severe that a degree of permissible deformation of the cutting edge and the struck face can be anticipated. A much less severe test would avoid this, but it would not provide the level of safety assurance desired.

An *appropriate striking tool* shall mean a ball peen, hand drilling, or engineer's hammer with a striking face approximately 0.375 in. larger in diameter than the struck face of the extractor.

(c) Extractors shall always be used with hole sizes as specified in the manufacturer's instructions.

(d) Extractors shall not be used as a punch, pry bar, or wedge.

(e) When using a wrench to turn an extractor, the user should always pull on the handle and adopt a stance that will prevent a fall in the event of a sudden tool or fastener failure.

(f) Safety goggles or equivalent eye protection conforming to ANSI Z87.1 shall be worn by the user and by all persons in the immediate area in which any extractor is being used to avoid possible eye injury from flying objects.

(g) Extractors shall be inspected prior to each use, and their use shall be discontinued at the first sign of bending of the extractor or of chipping or cracking of the cutting edges or the struck face.

(h) Except as indicated in para. 7(i), no area, section, or portion of the extractor shall be ground, welded,

treated by reheating, or otherwise altered from the original condition as furnished by the manufacturer.<sup>2</sup>

(i) At the first indication of mushrooming, the extractor struck face shall be redressed to its original contour by the use of a hand file.<sup>2</sup>

(j) Each extractor shall be stamped, labeled, or otherwise marked, size permitting, by the manufacturer with the following safety message or the equivalent:



**WARNING**  
**WEAR SAFETY GOGGLES**  
**USER AND BYSTANDER**

This safety message shall be located in a position that will not interfere with the quality or performance of the tool.

The principles set forth in ANSI Z535.4 shall be used as the guide for alternate, equivalent methods of labeling.

<sup>2</sup> It is understood that industrial users with adequate facilities and properly trained personnel may choose to redress or resharpen these tools by other means without altering the metallurgical characteristics of the tools.

# AMERICAN NATIONAL STANDARDS FOR HAND TOOLS

Socket Wrenches, Hand (Inch Series) .....	B107.1-2002
Socket Wrenches, Extensions, Adaptors, and Universal Joints, Power Drive (Impact) (Inch Series).....	B107.2-2002
Driving and Spindle Ends for Portable Hand, Impact, Air, and Electric Tools (Percussion Tools Excluded). ....	B107.4M-1995
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# ASME B107.46-2004

ISBN 0-7918-2920-0



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