SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS6173

Issued 2012-10

Cutting Tools, Wire, Electrical, General Specification For

RATIONALE

Prior to release of this document, there was no standardization of wire cutting tools or specific requirements for performance. These tools were typically procured by manufacturer part numbers.

1. SCOPE

1.1 Purpose

This standard covers design requirements, performance requirements, and methods of procurement for tools and associated accessories used to cut aerospace vehicle electrical wire and cable. Aerospace vehicle electrical wire has stranded conductors with protective plating and specialized insulation. Poor quality wire cutting can compromise the performance of wiring.

1.2 Classification

Wire cutting tools covered by this standard are of the following types:

Type I - Tools for cutting individual wires

Type II - Tools for cutting wiring bundles/jacketed cables

Type III - Powered tools for cutting individual wires

Type IV - Powered tools for cutting wire bundles/jacketed cables

1.3 Part Number Structure

Unless otherwise specified in the detail standard slash sheet, the part number structure for the tool shall be:

AS6173/Y – XX
- XX: Tool Assembly
- Y: Detail Standard Slash Sheet
- 6173: Basic Standard Number
- AS: Aerospace Standard

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AS6173

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AIR1351 Manufacturers' Identification of Aerospace Electrical and Electronic Wiring Devices and Accessories

AS6173/1 Cutting Tool, Electrical, Wire Cutting with Lace/Tie Strap Cutter, Hand Actuated, Type I, For Aircraft Wire, Wire Range 26 - 10 AWG

AS6173/2 Cutting Tool, Electrical, Wire Cutting with Gripping Teeth, Hand Actuated, Type I, For Aircraft Wire, Wire Range 26 - 10 AWG

AS6173/3 Cutting Tool, Electrical, Wire Cutting with Curved Jaws, Hand Actuated, Type I, For Aircraft Wire, Wire Range 26 - 1/0 AWG

AS6173/4 Cutting Tool (Minature) Electrical, Wire Cutting, Hand Actuated, Type I, Wire Sizes 26-16

2.1.2 NCSL Publications

Available from National Conference of Standards Laboratories, 2995 Wilderness Place, Suite 107, Boulder, CO 80301-1032, Tel: 303-440-3339, www.ncsl.org

NCSL Z540-3 Requirements for the Calibration of Measuring and Test Equipment

2.1.3 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/.

MIL-STD-202 Department of Defense, Test Methods for Electronic and Electrical Component Parts

2.1.4 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.2 Definitions

2.2.1 SAE PREPARING ACTIVITY: SAE Preparing Activity is the SAE subcommittee responsible for preparing and maintaining the product standard and the required technical data.

2.2.2 PURCHASER: A purchaser is an activity that can issue a purchase order or contract.

2.2.3 MANUFACTURER: A manufacturer is an original component manufacturer that has design and production control of the processes used to produce the final component in accordance with the standard.

2.2.4 COMPONENT PREPARING ACTIVITY: The component preparing activity is an activity that controls a component standard or drawing that references a wire cutter tool required to assemble a wire or cable to the component specified.

2.2.5 SHEAR CUTTERS: Manually actuated mechanical wire cutter for round wire using shear blade design. Shear cutters use a shearing cut, with the by-pass cutting edges slicing cleanly through the wire.

2.2.6 DIAGONAL CUTTERS: Manually actuated mechanical wire cutter for round wire using compression type cut blade design. Compression wire cutters commonly referred to as diagonal wire cutters or side cutters use compression force of opposing cutting edges cut the wire by indenting and forcing the metal of the wire out of their way.

2.2.7 PRODUCTION LOT: A production lot is a defined quantity of finished wire cutters of identical configuration, fabricated from same raw material, produced as a continuous run, and presented for inspection at the same time.

3. REQUIREMENTS

3.1 Detailed Standard Slash Sheet

The tool requirements shall be as specified herein and in accordance with the applicable detail standard slash sheet. In the event of any conflict between the requirements of this standard and the detail standard slash sheet, the latter shall govern.

3.1.1 Criteria for Tool Inclusion

The criteria for defining a tool in a detail standard slash sheet is that a wire or cable intended to be used with the tool, the wire or cable document must be controlled by a preparing activity such as a user, government, or non-government standard body. It is the responsibility of the wire and cable standard preparer to determine if the specific tool can be used to cut the applicable wire or cable. After the tool has been determined to be acceptable for the wire or cable, the wire or cable preparing activity is recommended to request SAE International to establish an AS6173/XX detail standard slash sheet which should be referenced in the component standard. Requests for tools to be listed in AS6173 shall be made by the component preparing activity to SAE International (see 6.2.4).

3.1.2 Detail Standard Slash Sheet Tool Requirements

Each detail standard slash sheet shall include as a minimum the following:

a. The detail standard slash sheet shall specify wire cutter and part number, if necessary, with the corresponding tool part number for each tool, or other accessories. Part number shall designate all replaceable parts and removable components such as blades, stops, bench mount, and other accessories in the detail standard slash sheet. Replaceable parts such as screws, springs, hardware, covers, and miscellaneous parts shall be defined in the manufacturer's instruction sheet supplied with each tool. The basic tool and accessories shall include a part number on the body of each part in the detail standard slash sheet.

b. Detail cutter dimensions are recommended to ensure cutting performance characteristics, but not required. The basic tool footprint dimensions shall be definitive enough to ensure replacement of the tool in a storage container without modification of the container. Accessory footprint dimensions shall be definitive enough to ensure inter-changeability with manufacturers.

c. The required operation characteristics (see 3.7).

d. The life test operating cycles (see 3.10).

e. The metric equivalents may be provided to the nearest 0.01 mm and shown as (x.xx). Metric equivalents are calculated based on 1-in equals 25.4 mm.

f. Size, weight, and power requirements of tools shall be commensurate with the tool application. Maximum size and weight (including accessories) shall be included as a requirement on each detail standard slash sheet.

3.2 Materials (see 4.6.1)

All materials shall be suitable for the fabrication/produce ability or maintenance of aerospace hardware when used on land or sea. Materials shall be specified in the detail standard slash sheet.

3.3 Physical Characteristics Examination (4.6.2)

Physical characteristics shall be examined in accordance with 4.6.2.

3.4 Tool Assembly Instruction Examination (see 3.1.2a and 4.6.3)

Each tool specified with accessories shall be provided with concise and clearly written individual instructions. The tool shall be easily assembled and disassembled in accordance with the tool instruction without the use of special tools. Tool instructions shall be formatted with the following information:

a. Title: The instructions shall include AS6173 and manufacturer's part numbers.

b. Detail Tool Pictorials: The pictorials shall include AS6173 and manufacturer's part numbers.

c. Detail Accessories Pictorials: The pictorial shall include AS6173 accessories, and manufacturers' part numbers.

d. Replaceable Part List: The instructions shall include AS6173 and manufacturer designated part numbers. All replaceable parts (see 3.1.2a) designated in the detail standard slash sheet by part number shall be included in the assembly instructions. All parts that can be removed to assemble accessories shall be designated in the assembly instructions by part number or a physical description sufficient to permit replacement (i.e., screw thread and length description, etc.).

3.5 Visual Examination (see 4.6.4)

The tool and accessories shall exhibit no cracks, broken parts, or jagged edges. Tools with accessories shall be constructed to allow maintenance and repair necessitated by normal operational wear and handling. Tool dimensions shall be in accordance with the detail standard slash sheet.

3.5.1 Visual Examination of Manual Wire Cutter

Disassemble and reassemble the tool with replaceable blades if applicable in accordance with the tool assembly instructions (see 4.6.3)

3.5.2 Tool Assembly Weight (see 4.7.2)

The weight of the tool with all accessories attached shall be as specified in the detail standard slash sheet.

3.6 Marking Examination (see 4.8)

The identification marks shall be durable and withstand typical handling and usage. The identification marks shall be clearly readable after all specified tests. Trademarks and logos when used for identification rather than the manufacturer's name and address shall be registered in AIR1351.

3.7 Tool Cutting Performance (see 4.9)

Tool operation characteristics shall be defined in the detail standard slash sheet.

3.7.1 The Cutter Compression Force (see 4.9.1)

The cutter cutting force required to complete the cycle of the tool shall not exceed the value specified in the applicable detail standard slash sheet.

3.7.2 Cutting Performance Characteristics (see 4.9.2)

The wire insulation or the conductor may exhibit deformation following cutting of the wire. The out of roundness resulting from cutting the wire with insulated conductor shall not exceed 5% of the diameter of the wire with insulation.

3.8 Shock Characteristics (see 4.10)

The tool and/or required accessories attached shall meet marking legibility and the tool cutting performance requirement, after being subjected to the shock test (see 3.6 and 3.7).

3.9 Humidity Characteristics (see 4.11)

Corrosion that does not affect the performance characteristics of the tool is acceptable. The tool and/or required accessories attached shall meet marking legibility and the tool cutting performance requirement after being subjected to the humidity test (see 3.6 and 3.7).

3.10 Life Characteristics (see 4.12)

The tool and/or required accessories attached shall cut the wire or cable the number of cycles specified in the detail standard slash sheet. On the last cut, the tool and worn blades shall meet the cutting performance requirement (see 3.7) and the tool operation characteristics (see detail standard slash sheet). After exposure to the number of specified cycles, if the blades are replaceable, the tool shall be disassembled and blades (if specified) replaced in accordance with the tool assembly instructions (see 3.4). The tool and new blades shall meet the cutting performance requirements (see 3.7).

3.11 Workmanship (see 4.13)

The tool, and accessories shall be free of sharp edges, burrs, and other design or production related characteristics that would hamper the tool's performance or cause physical harm to the operator.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The manufacturer of the wire cutter shall supply all samples for manufacturer's test and shall be responsible for performing all required tests. Purchaser shall have the right to sample, and to perform any confirmatory testing deemed necessary to ensure that the parts conform to the requirements of this specification.

4.2 Responsibility for Compliance

The manufacturer's system for cutting tool production shall be based on preventing product defects, rather than detecting the defects at final inspection and then requiring corrective action to be invoked. An effective manufacturing in-process control system shall be established, subject to the approval of the purchaser, and used during the production of cutting tools.

4.3 Production Acceptance Tests

The purpose of production acceptance tests is to check, as simply as possible, using a method which is inexpensive and representative of the part usage, with the uncertainty inherent in random sampling, that the parts comprising a production inspection lot satisfy the requirements of this specification.

4.3.1 Tests to determine the conformance to all technical requirements of this specification are classified as acceptance tests and are divided into nondestructive and destructive testing (see 4.4.2 and 4.4.3).

4.4 Acceptance Tests Sampling

4.4.1 Material

Materials inspection shall consist of certification supported by verifying data that materials used in fabricating the delivered wire cutter are in accordance with the requirements of 3.1.

4.4.2 Nondestructive Tests (Table 1) - Visual and Dimensional

A random sample shall be selected from each production inspection lot in accordance with Table 3.

4.4.3 Destructive Tests (Table 2)

Destructive testing is required to demonstrate that the wire cutter is capable of meeting the performance and environmental requirements. This testing is required during the initial manufacturing of the wire cutter and periodically thereafter not to exceed 36 months.

4.4.4 Acceptance Quality

Of simple random samples tested, acceptance quality shall be based on zero defects.

4.4.5 Rejected Lots

If a production inspection lot is rejected (on the basis of an acceptance test defined by Table 1), the manufacturer of the parts shall perform corrective action to screen out or rework the defective parts.

4.5 Reports

The manufacturer of wire cutter shall maintain the necessary support records, and furnish upon request a report stating that the chemical composition conforms to the applicable material specification, and stating that the wire cutter conforms to the other technical requirements. This report shall include the purchase order number, AS6173 (Revision Letter), lot number, part number, nominal size, and quantity. Each shipment of the wire cutter(s) shall include paperwork that states the product complies with AS6173 (Revision Letter), and advises the purchaser of the availability of additional compliance documentation.

TABLE 1 - NON-DESTRUCTIVE TEST

Technical Requirements	Requirement Paragraph	Test Method Paragraph
Materials	3.2	4.6.1
Tool Design Characteristics Examination	3.3	4.6.2
Tool Assembly Instruction Examination	3.4	4.6.3
Visual Examination	3.5	4.6.4
Manual Wire Cutter	3.5.1	4.6.2
Tool Assembly Weight	3.5.2	4.7.2
Marking Examination	3.6	4.8
Workmanship	3.11	4.13

TABLE 2 - DESTRUCTIVE TEST

Technical Requirements	Requirement Paragraph	Test Method Paragraph
Tool Cutting Performance	3.7	4.9
Cutter Compression Force	3.7.1	4.9.1
Cutting Performance	3.7.2	4.9.2
Shock Characteristics	3.8	4.10
Humidity Characteristics	3.9	4.11
Life Characteristics	3.10	4.12

TABLE 2 - SAMPLING DATA

Non Destructive Tests, Visual and Dimensional Production Inspection Lot Size	Non Destructive Tests, Visual and Dimensional Production Inspection Sample Size
2 to 5	2
16 to 50	3
51 to 150	5
151 to 500	8

4.6 Test Methods

4.6.1 Material

The manufacturer shall certify all specified materials. The purchaser reserves the right to request verification of certified materials.

4.6.2 Tool Design Characteristic Examination (see 3.3)

Visually examine the tool and blades for characteristics specified in the detail standard slash sheet.

4.6.3 Tool Assembly Instruction Examination (see 3.4)

The tool instructions shall be examined for all information as defined in 3.4. Assemble and remove all accessories from the basic tool in accordance with the tool instructions. No special tools (unless supplied with the tool) shall be used for assembly and disassembly of the tool accessories unless otherwise specified by part number in the detail standard slash sheet. Only typical tools found in a mechanic's toolbox (i.e., screwdriver, hammer, pliers) shall be used.

4.6.4 Visual Examination (see 3.5)

Examine the tools and blades with 3X magnification for cracks, broken parts, loosened accessories, rough edges, or any other abnormalities. Examine for all dimensions with standard calibrated laboratory tools that measure at least one digit more than the required dimension.

4.6.5 Visual Examination of Cutter (see 3.5.1)

Position a light source behind and in the middle of the closed blades then visually inspect for imperfections or blade misalignment.

4.6.6 Tool Weight (see 3.5.2)

Weigh the tool on a calibrated scale with an accuracy of ±0.01 lb.

4.7 Marking Examination (3.6)

Examine wire cutter tool and accessories for required marking and legibility with 1X magnification. Verify the manufacturer's identification/symbol is listed or has been certified to be listed in AIR1351.

4.8 Cutter Performance (see 3.7)

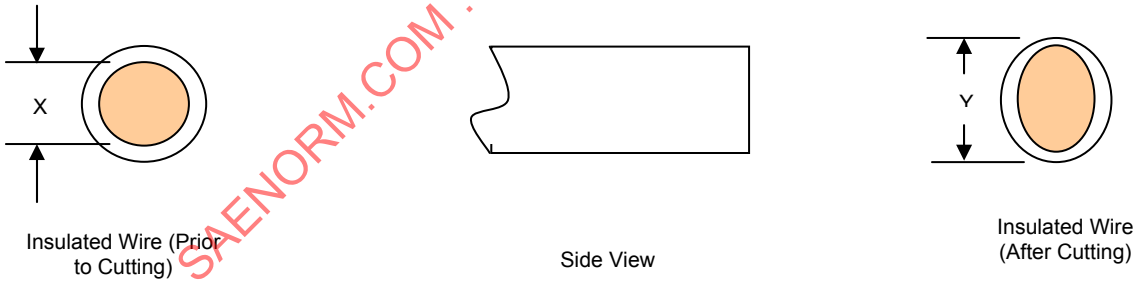
Examine the tool for the operation characteristics specified in the detail standard slash sheet.

4.8.1 Cutter Cutting Compression Force (see 3.7.1)

For handheld cutters, the tool shall be mounted such that a compression force can be exerted on the handles at a point 1.25 in ± 0.125 in from the end of the handles. The force shall be applied at a rate of 1 in/min. The wire/bundle called out in the detail standard slash sheet shall be used for the cutting compression test. The method for other tool types shall be defined in the detail standard slash sheet.

4.8.2 Cutter Performance Characteristics (see 3.7.2)

Measure and record the insulated wire or cable diameter or specified outer configuration at cut prior to cutting. The wire or cable diameter or outer configuration shall be in accordance with the wire or cable standard. Cut the specified wire or cable for the tool type in accordance with the tool instruction. Examine the wire or cable for cut performance characteristics with 3X magnification unless otherwise specified in the detail standard slash sheet. See Figure 1.



≤ 5% Out of Roundness = ((Y-X)/X) × 100

FIGURE 1 - INSULATED WIRE CUTTER PERFORMANCE

4.9 Shock Characteristics Test (see 3.8)

The tool, with the heaviest accessory(s) designed to be continually attached when cutting a component, shall be loosely placed in a box made of approximately 1/4 in (6 mm) plywood, which has been rigidly fastened to the carriage of a shock test device. The box dimension shall be a cube with sides approximately 4 in (100 mm) longer than the longest length of a fully assembled tool. The box may be open at the top to facilitate accessibility to the tool. The tool shall be subjected to a shock in accordance with test method 213 test condition I of MIL-STD-202. Two shocks shall be applied, one with the cutter entrance of the tool facing the bottom of the box and the other with the entrance facing away from the bottom. The tool shall be examined for tool performance (see 4.9.2) and marking legibility (see 4.8).