

METRIC

MIL-STD-1880A(AT)  
10 December 1991  
SUPERSEDING  
(See 6.4)

MILITARY STANDARD

CYLINDERS, RINGS AND SHROUDS, TURBINE,  
CAST, ACCEPTANCE CRITERIA FOR (METRIC)



AMSC N/A

DISTRIBUTION STATEMENT A.  
unlimited.

Approved for public release; distribution is

FSC 2835

MIL-STD-1880A(AT)

FOREWORD

1. This Military Standard is approved for use by U.S. Army Tank-Automotive Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

3. The intent of this standard is to define nondestructive testing acceptance criteria for cast cylinders, rings, shrouds, and finished machined and assembled parts.

## MIL-STD-1880A(AT)

## CONTENTS

| <u>Paragraph</u> |   | <u>Page</u> |
|------------------|---|-------------|
| 1.               | SCOPE . . . . .   | 1           |
| 1.1              | Scope . . . . .   | 1           |
| 1.2              | Classification . . . . .  | 1           |
| 2.               | APPLICABLE DOCUMENTS . . . . .  | 2           |
| 2.1              | Government documents . . . . .  | 2           |
| 2.1.1            | Specifications, standards, and handbooks . . . . .                    | 2           |
| 2.1.2            | Other Government documents, drawings, and<br>publications . . . . .   | 2           |
| 2.2              | Non-Government publications . . . . .                                 | 2           |
| 2.3              | Order of precedence . . . . .   | 3           |
| 3.               | DEFINITIONS (not applicable) . . . . .                                | 4           |
| 4.               | GENERAL REQUIREMENTS . . . . .  | 5           |
| 4.1              | Acceptance criteria . . . . .   | 5           |
| 4.1.1            | Surface imperfections (visual and<br>fluorescent penetrant) . . . . . | 5           |
| 4.1.2            | Internal imperfections (radiographic) . . . . .                       | 5           |
| 4.1.3            | Weld joint defects (visual, fluorescent,<br>and ultrasonic) . . . . . | 5           |
| 4.2              | Responsibility for inspection . . . . .                               | 5           |
| 5.               | DETAIL REQUIREMENTS . . . . .   | 6           |
| 5.1              | Production in process control . . . . .                               | 6           |
| 5.2              | Test methods . . . . .  | 6           |
| 5.2.1            | Visual and fluorescent penetrant . . . . .                            | 6           |
| 5.2.2            | Radiographic . . . . .  | 6           |
| 5.2.3            | Ultrasonic . . . . .  | 6           |
| 5.2.4            | Grain size . . . . .  | 6           |
| 5.3              | Rework . . . . .  | 6           |
| 5.3.1            | Blend areas . . . . .   | 8           |
| 5.3.2            | Electron beam weld areas . . . . .                                    | 6           |
| 5.3.3            | Weld rework of castings . . . . .                                     | 6           |
| 5.3.3.1          | Procedure . . . . .   | 7           |
| 5.3.3.2          | Inspection of weld rework . . . . .                                   | 7           |
| 5.3.3.2.1        | Acceptance limits . . . . .   | 7           |
| 5.3.3.3          | Surface roughness . . . . .   | 7           |
| 5.4              | Approval of weld rework . . . . .                                     | 7           |
| 6.               | NOTES . . . . .   | 8           |
| 6.1              | Intended use . . . . .  | 8           |
| 6.2              | Issue of DODISS . . . . .   | 8           |
| 6.3              | Data requirements . . . . .   | 8           |
| 6.4              | Supersession data . . . . .   | 8           |
| 6.5              | Subject term (key word) listing . . . . .                             | 8           |
| 6.6              | Changes from previous issue . . . . .                                 | 8           |

## MIL-STD-1880A(AT)

### 1. SCOPE

1.1 Scope. This standard covers the nondestructive testing acceptance criteria for cast cylinders, rings, shrouds, and finish machined and assembled parts.

1.2 Classification. Unless otherwise specified on the engineering drawing, castings shall be classified in accordance with the required level of radiographic inspection as follows:

- |                 |  |
|-----------------|--|
| MIL-STD-1880-P1 | - Radiographic inspection in accordance with 4.1.2a. |
| MIL-STD-1880-P2 | - Radiographic inspection in accordance with 4.1.2b. |

Note: When no classification (suffix) is specified, inspection shall be in accordance with MIL-STD-1880-P1.

## MIL-STD-1880A(AT)

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

## STANDARDS

## MILITARY

|              |   |
|--------------|---|
| MIL-STD-453  | - Inspection, Radiographic.                                   |
| MIL-STD-1890 | - Welded Joints, Inspection of.                               |
| MIL-STD-1892 | - Welding, Arc and Oxyfuel Gas, Process and Requirements for. |
| MIL-STD-6866 | - Inspection, Liquid Penetrant.                               |

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Navy Publications and Printing Service Office, Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

## PURCHASE DESCRIPTIONS

## MILITARY

|             |  |
|-------------|--|
| M1PD-C-3602 | - Casting, Investment, Nickel Base (713c).               |
| M1PD-C-3612 | - Casting, Investment, Nickel Base (0021).               |
| M1PD-C-3617 | - Casting, Investment, Nickel Base (C101).               |
| M1PD-E-6203 | - Electron Beam Welding, Process for.                    |
| M1PD-C-6800 | - Casting, Stainless and Low Alloy Steel, Inspection of. |
| M1PD-U-6803 | - Ultrasonic Inspection.                                 |

(Copies of purchase descriptions may be obtained from the U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48937-5000.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

MIL-STD-1880A(AT)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- |          |   |
|----------|---|
| AMS 5786 | - Alloy Welding Wire, Corrosion and Heat Resistant. |
| AMS 5837 | - Alloy Welding Wire, Corrosion and Heat Resistant. |

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the 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.

MIL-STD-1880A(AT)

3. DEFINITIONS

(This section is not applicable to this standard.)

MIL-STD-1880A(AT)

4. GENERAL REQUIREMENTS

4.1 Acceptance criteria.

4.1.1 Surface imperfections (visual and fluorescent penetrant). The limits for imperfections in the material shall be as follows:

- a. There shall be no evidence of cracks, folds, dross, cold shuts, and hot tears.
- b. The presence of mold ridges, fins, and gate witnesses shall be not acceptable in the hot gas flow path. In other areas, positive metal (mold ridges, fins, gate witnesses) up to 0.762 millimeters (mm) (0.030 inch) in height shall be acceptable.
- c. All other indications not specified in 4.1.1a and 4.1.1b shall be acceptable.

4.1.2 Internal imperfections (radiographic). Castings containing radiographic evidence of internal defects shall be acceptable provided they do not exceed the following limits of acceptability:

- a. MIL-STD-1880-P1 shall meet the radiographic acceptance requirements of M1PD-C-6800, classification P1.
- b. MIL-STD-1880-P2 shall meet the radiographic acceptance requirements of M1PD-C-6800, classification P2.

4.1.3 Weld joint defects (visual, fluorescent, and ultrasonic). Electron beam welded joints shall meet the limits of acceptability specified in M1PD-E-6203 with the following exceptions:

- a. Full penetration shall be required for 95 percent (%) of weld length.
- b. Partial penetration or lack of weld shall be permitted for 5% of the weld length.

4.2 Responsibility for inspection. The contractor is responsible to conduct and complete a sufficient inspection of the casting to ensure:

- a. Compliance with all of the requirements in this standard.
- b. That adequate traceability exists to verify that the requirements of this standard have been meet.
- c. That the integrity of castings is equivalent in all other respects to sound acceptable castings.

MIL-STD-1880A(AT)

5. DETAIL REQUIREMENTS

5.1 Production in process control. The contractor shall ensure that the supplier identifies the part number of the cast item to the following (see 6.3):

- a. Engineering drawing and revision.
- b. Quantity of items in the lot.
- c. Lot number.
- d. Applicable issue and revision of this standard.

5.2 Test methods.

5.2.1 Visual and fluorescent penetrant. Castings, finish machined parts, and electron beam welded joints shall be visually examined and fluorescent penetrant inspected in accordance with MIL-STD-6866, Method P1 to verify conformance to 4.1.1 (see 5.3.3.3).

5.2.2 Radiographic. Castings shall be radiographically inspected in accordance with MIL-STD-453 to verify conformance to 4.1.2.

5.2.3 Ultrasonic. Electron beam welded joints shall be ultrasonically inspected in accordance with M1PD-U-6803 to verify conformance to 4.1.3.

5.2.4 Grain size. Unless otherwise specified in the engineering drawing, grain size inspection shall not be required.

5.3 Rework. Except for the specific methods specified herein, castings may be reworked providing that all of the engineering drawing and specification requirements of the finished part are met.

5.3.1 Blend areas. Blending shall be limited to the following:

- a. Blending shall not exceed minimum dimensions and surface finish requirements of the engineering drawing.
- b. The blend area diameter shall be at least 10 times the blend depth.
- c. After blending, inspection of blend area shall be in accordance with 5.2.1.

5.3.2 Electron beam weld areas. Electron beam weld joints shall be reworked in accordance with the requirements of M1PD-E-6203.

5.3.3 Weld rework of castings. Weld rework of castings is permitted except for those area that provide a surface for electron beam welding and with the following weld rework dimensional limitations:

- a. The maximum size of the weld rework area shall be equal to a 12.700 mm (0.500 inch) diameter circle with maximum depth of 3.175 mm (0.125 inch).
- b. Two weld rework areas of maximum size shall be permitted per casting.

## MIL-STD-1880A(AT)

- c. More than two weld rework areas shall be permitted per casting provided the total amount of area for all weld rework does not exceed the area of two 12.700 mm (0.500 inch) diameter circles [253.550 square mm (0.393 square inch)].
- d. Weld rework areas shall be separated by a minimum distance equal to four times the major dimension of the larger weld rework area.

5.3.3.1 Procedure. The weld rework procedure shall include but not be limited to the following requirements:

- a. The defective area shall be removed from the casting by routing or machining.
- b. The routed or machined area shall be chemically etched to remove any flowed metal. The area shall then be inspected in accordance with the requirements of this standard.
- c. Approved filler materials used for weld rework shall be as follows:

| <u>Casting alloy</u> | <u>Filler alloy</u>    |
|----------------------|------------------------|
| M1PD-C-3602 (713C)   | AMS 5786 (Hastelloy W) |
| M1PD-C-3612 (0021)   | AMS 5786 (Hastelloy W) |
| M1PD-C-3617 (C101)   | AMS 5837 (625)         |

- d. The prepared area shall be welded in accordance with the requirements of MIL-STD-1892.
- e. After completion of weld rework, the casting shall be stress relieved as specified in the weld rework instructions.
- f. The weld reworked area shall be clearly marked (encircled with a ring of white paint) on the casting.

5.3.3.2 Inspection of weld rework. Radiographic, visual, and fluorescent penetrant inspection of the weld rework area shall be performed in accordance with the requirements for a class 1 weld as defined in MILL-STD-1890.

5.3.3.2.1 Acceptance limits. After any weld rework, castings shall be capable of passing all engineering drawing and applicable specification requirements.

5.3.3.3 Surface roughness. Acceptance criteria of borderline cases of imperfections shall be determined after the casting has been either sand or grit blasted to meet the surface roughness [arithmetic average (AA)] specified in the engineering drawing.

5.4 Approval of weld rework. Weld rework of turbine cast cylinders, rings, and shrouds to restore the weld area to meet all engineering drawing requirements shall be permitted to the extent specified in this standard upon written approval of the acquisition-activity. The written request shall state the reason for the rework, location and size of defect, and the procedure to be used.

## MIL-STD-1880A(AT)

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The nondestructive acceptance testing procedures covered in this standard are intended to ensure that cast cylinders, rings, shrouds and finish machined and assembled parts conform to the requirements specified in the engineering drawings.

6.2 Issue of DODISS. When this standard is used in acquisitions, the applicable issue of the DODISS must be cited in the solicitation (see 2.1.1 and 2.2).

6.3 Data requirements. Although this standard does not include any requirements for data, it does not exclude contractors from obtaining data from its suppliers as required to ensure compliance to this standard and to verify conformance to the applicable engineering drawings.

6.4 Supersession data. This standard supersedes MIL-STD-1880(AT), dated 5 May 1983 and Textron Lycoming specification P7050C, dated 26 April 1982.

6.5 Subject term (key word) listing.

Blend areas  
Casting  
Cylinder  
Electron beam weld areas  
Fluorescent penetrant  
Internal imperfection  
Radiographic  
Ring  
Shroud  
Surface roughness  
Turbine  
Ultrasonic

6.6 Changes from previous issue. Vertical lines or asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

MIL-STD-1880A(AT)

CONCLUDING MATERIAL

Custodian:  
Army - AT

Preparing activity:  
Army - AT

(Project 2835-A028)

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

**INSTRUCTIONS:** This form is provided to solicit beneficial comments which may improve this document and enhance its use. DoD contractors, government activities, manufacturers, vendors, or other prospective users of the document are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity. A response will be provided to the submitter, when name and address is provided, within 30 days indicating that the 1426 was received and when any appropriate action on it will be completed.

**NOTE:** This form shall not be used to submit requests for waivers, deviations or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. FSC 2835

DOCUMENT IDENTIFIER (Number) AND TITLE MIL-STD-1880A(AT); Cylinders, Rings & Shrouds, Turbine, Cast Acceptance Criteria for (Metric)

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

VENDOR       USER       MANUFACTURER

1.  HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?       IS ANY PART OF IT TOO RIGID, RESTRICTIVE, LOOSE OR AMBIGUOUS? PLEASE EXPLAIN BELOW.

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDED WORDING CHANGE

C. REASON FOR RECOMMENDED CHANGE(S)

2. REMARKS

SUBMITTED BY (Printed or typed name and address - Optional)

TELEPHONE NO.

DATE

**DD** FORM **1426**  
1 OCT 76

EDITION OF 1 JAN 72 WILL BE USED UNTIL EXHAUSTED.

FOLD

---

**U.S. ARMY TANK - AUTOMOTIVE COMMAND  
ATTN: AMSTA-GDS  
WARREN, MICHIGAN 48397-5000**

POSTAGE AND FEES PAID



**OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300**

**COMMANDER  
U.S. ARMY TANK - AUTOMOTIVE COMMAND  
ATTN: AMSTA-GDS  
WARREN, MICHIGAN 48397-5000**

---

FOLD