

MIL-STD-343(AT)  
26 May 1988  

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SUPERSEDING  
(see 6.3)

MILITARY STANDARD  
TRACE ELEMENTS; LIMITS OF



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DEPARTMENT OF DEFENSE  
Washington, DC 20301

Trace Elements; Limits Of

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### FOREWORD

The trace elements present in various iron and nickel base alloys will have deleterious effect on the mechanical properties of those alloys. Therefore, the level of each trace element as well as the combined total weight of the trace elements present in an alloy shall be established in any single master heat in accordance with the engineering requirements. The acceptable levels of trace elements defined in this standard are to supplement the applicable engineering drawings or material specifications used for the manufacture of AGT 1500 gas turbine engine of the M1 tank.

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### 1. SCOPE

1.1 Scope. This military standard establishes the acceptable levels of trace elements present in various iron and nickel base alloys. The requirements stated in this standard are to supplement the chemical composition requirements of the applicable material specifications.

1.2 Purpose. The purpose of this standard is to supplement the applicable engineering drawings or material specifications to establish the acceptable levels of trace elements present in alloy steels or in powder metallurgy products used to manufacture AGT 1500 gas turbine engine of the M1 tank.

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**2. REFERENCED DOCUMENTS**

**Not applicable.**

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## 3. DEFINITIONS

3.1 Trace element. Any chemical element found combined in minute quantities in alloy steels or in powder metallurgy products that was not intentionally added as an alloying element and has deleterious effect on the mechanical properties of that alloy when present in excess.

3.2 Master heat. A master heat is previously refined metal of a single furnace charge produced by controlled vacuum melting procedures.

3.3 Check analysis. An analysis made by the purchaser after the steel or alloy has been worked into semi-finished or finished forms or fabricated into parts, and is either for the purpose of verifying the composition of a heat or lot or to determine variations in the composition within a heat. Acceptance or rejection of a heat or lot of material or batch of parts may be made by a purchaser on the basis of this check analysis. In the analysis of finished parts, these values do not apply to elements whose percentage can be varied by fabricating techniques employed (for example, carbon in steel) unless the sample is taken in such a manner as to exclude such changes.

3.4 Nickel base - iron alloy. An alloy in which nickel is the major alloying element and iron makes up the balance of the composition. Examples are AMS 5662 (UNS N07718) and AMS 5746 (UNS N09979).

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**4. GENERAL REQUIREMENTS**

**Not applicable.**



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## 5. DETAILED REQUIREMENTS

5.1 Classification. The trace element classification shall be designated on the engineering drawing or material specification as follows:

- a. Type I - Typically for low alloy steels, martensitic and austenitic corrosion and heat resistant steels and iron base alloys.
- b. Type II - Typically for nickel base-iron alloys.
- c. Type III - Typically for nickel base alloys.
- d. Type IV - Typically for products produced by powder metallurgy processes.

5.2 Composition limits. The trace elements listed herein shall not exceed the weight expressed in parts per million (ppm). Check analysis limits shall not apply to these trace elements.

5.2.1 Type I.

- a. The following elements shall have the maximum weight as follows:
 

Lead	- 10.0 ppm
Antimony	- 50.0 ppm (if exceeds 40.0 ppm, retest is needed).
- b. The amount of element tin shall be kept as low as possible and the weight shall be reported in ppm.

5.2.2 Type II.

- a. The following elements shall have the maximum weight as follows:
 

Lead	- 10.0 ppm
Bismuth	- 1.0 ppm
- b. The amount of elements selenium, tellurium and thallium shall be kept as low as possible and the weight shall be reported in ppm.

5.2.3 Type III.5.2.3.1 Cast.

- a. The following elements shall have the maximum weight as follows:

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Selenium	- 5.0 ppm
Tellurium	- 0.5 ppm
Thallium	- 5.0 ppm
Lead	- 5.0 ppm
Bismuth	- 0.5 ppm

- b. The maximum weight shall be 50.0 ppm for each of the following elements:

Sodium	Germanium	Indium	Mercury
Potassium	Arsenic	Tin	Thorium
Zinc	Silver	Antimony	Uranium
Gallium	Cadmium	Gold	

5.2.3.2 Wrought.

- a. The following elements shall have the maximum weight as follows:

Lead	- 10.0 ppm
Bismuth	- 0.5 ppm

- b. The amount of elements selenium, tellurium and thallium shall be kept as low as possible and the weight shall be reported in ppm.
- c. The elements listed in 5.2.3.1b shall apply.

5.2.3.3 Combined weight. The combined total weight of all the trace elements listed in 5.2.3.1b or 5.2.3.2c shall not exceed 400.0 ppm in any single master heat.

5.2.4 Type IV.

- a. The following elements shall have the maximum weight as follows:

Lead	- 2.0 ppm
Bismuth	- 0.5 ppm

- b. The amount of elements selenium, tellurium and thallium shall be kept as low as possible and the weight shall be reported in ppm.
- c. The elements listed in 5.2.3.1b shall apply.

5.2.5 Copper. Unless otherwise specified in the applicable material specification, the copper content for any material shall not exceed 500.0 ppm.

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5.3 Test methods. The analytical test methods and the procedures used for accurate quantitative determination of trace elements in alloys and powder metallurgy products shall be as agreed upon by the Government and the vendor.

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6. NOTES

6.1 Intended use. This standard, when specified in a material specification or on the engineering drawings used for AGT 1500 gas turbine engine of the M1 tank, is intended to maintain strict control of all trace elements present in that material.

6.2 Subject term (key word) listing.

Chemical composition  
Elements, trace, limits of  
Limits of trace elements

6.3 Supersession data. This document supersedes AVCO Lycoming Division specification no. P6813C, dated 15 November 1983.

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