

MIL-H- 47143(MI)

~~June 1974~~

SUPERSEDING

MIS-14131C

14 August 1970

MILITARY SPECIFICATION

HEAT TREATING, TYPE D6AC ALLOY STEEL, PROCESSES FOR

This specification is approved for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers three methods of heat treating parts fabricated from D6AC alloy steel conforming to MIL-S-47036 to an ultimate strength level of 200,000 to 230,000 pounds per square inch (psi).

1.2 Classification. Heat treating in accordance with this specification shall be of the following methods, as specified:

- Method I. - Utilizing salt baths for austenitizing and quenching.
- Method II. - Utilizing an endothermic atmosphere furnace for austenitizing and an oil bath for quenching.
- Method III. - Utilizing a vacuum furnace for austenitizing and an inert gas atmosphere or an oil bath for quenching.

1.2.1 Applicability of method. Reference to this specification on engineering drawings and in other specifications shall be by basic number and method number, for example: MIL-H- Method I.

2. APPLICABLE DOCUMENTS

FSC MISC

MIL-H-47143(MI)

2.1 Government documents. The following documents, of the issue in effect on date of invitation for bids or request for proposals, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-L-3150	Lubricating Oil, Preservative, Medium
MIL-S-5002	Surface Treatments and Metallic Coatings for Metal Surfaces of Weapons Systems
MIL-H-6875	Heat Treatment of Steels (Aircraft Practice), Process for
MIL-S-10699	Salts, Heat Treating (for Metals)
MIL-S-47036	Steel, Alloy, High Strength

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Certification. When the prescribed method of heat treat is Method III (see 1.2), parts shall be heat treated only by suppliers who have complied with the certification requirements of this specification (see 4.3). Certification, as used in this specification, refers to the testing program upon which an assessment of production techniques will be based.

3.2 Equipment and material.

3.2.1 Equipment. Unless otherwise specified herein, the equipment used for heat treating shall be in accordance with MIL-H-6875.

3.2.2 Material. The material shall be D6AC alloy steel conforming to The D6AC alloy steel shall be in the normalized condition prior to heat treating in accordance with this specification.

3.3 Procedure.

3.3.1 Degreasing. Prior to start of the heat treat operation, parts and test specimens shall be vapor degreased in accordance with MIL-S-5002.

MIL-H-47143(MI)

3.3.2 Heat treatment. Mechanical properties of parts and test specimens, decarburization and carburization limits, and physical properties shall conform to the requirements of the applicable drawing.

3.3.2.1 Preheat methods.

3.3.2.1.1 Method I preheat. Parts and test specimens shall be preheated in a neutral salt bath in accordance with MIL-S-10699, class 4, or in an air atmosphere furnace. The temperature of the salt bath or furnace shall be in the range of 621 to 732 degrees Celsius (C) (1150 to 1350 degrees Fahrenheit (F)). Parts and test specimens shall be soaked for 30 to 60 minutes at the specified temperature.

3.3.2.1.2 Method II preheat. Parts and test specimens shall be preheated in an air atmosphere furnace at 538 to 649 degrees C (1000 to 1200 degrees F). Parts and test specimens shall be soaked for 30 to 60 minutes at the specified temperature prior to transfer to the austenitize furnace.

3.3.2.1.3 Method III preheat. Parts and test specimens shall be preheated in a vacuum furnace at 732 plus or minus 14 degrees C (1150 plus or minus 25 degrees F) for not less than 30 minutes.

3.3.2.2 Austenitize and quench. The austenitize and quench procedures shall be as follows:

3.3.2.2.1 Method I austenitize. The parts and test specimens to be austenitized shall be transferred from the preheat bath or furnace to a neutral salt bath conforming to MIL-S-10699, Class 4, maintained at a temperature of 899 plus or minus 14 degrees C (1650 plus or minus 25 degrees F). The total elapsed transfer time shall be not more than 60 seconds. Parts and test specimens shall be soaked for not less than 30 minutes at soak temperature. The total exposure to soak temperature shall be not more than 90 minutes.

3.3.2.2.2 Method II austenitize. The parts and test specimens to be austenitized shall be transferred from the preheat furnace to an endothermic atmosphere furnace operated at a temperature of 899 plus or minus 14 degrees C (1650 plus or minus 25 degrees F). The total elapsed transfer time shall be not more than 60 seconds. Parts and test specimens shall be soaked for not less than 30 minutes at soak temperature. The total exposure to soak temperature shall be not more than 90 minutes. The carbon potential of the endothermic atmosphere shall be maintained at a level necessary to limit the change in surface carbon content (resulting from carburization or decarburization) to the amounts specified on the applicable drawing.

3.3.2.2.3 Method III austenitize. The parts and test specimens shall be austenitized in vacuum furnace at a temperature of 899 plus or minus 14 degrees C (1650 plus or minus 25 degrees F). The furnace temperature shall be increased to austenitizing temperature when preheating has been completed. The parts and

MIL-H-47143(MI)

test specimens shall be soaked for not less than 30 minutes. The total exposure to soak temperature shall be not more than 90 minutes.

3.3.2.2.4 Method I quench. At completion of the soak period, the parts and test specimens shall be quenched in a draw and quench salt bath in accordance with MIL-S-10699, Class I, at a temperature of 204 plus or minus 6 degrees C (400 plus or minus 11 degrees F) for a period of not less than 3 minutes. The total elapsed transfer time from the high to the low temperature salt bath shall be not more than 60 seconds. Quench bath volume and circulation shall be such that the rise in bath temperature during quenching shall be not more than 14 degrees C (25 degrees F).

3.3.2.2.5 Method II quench. At completion of the soak period, the parts and test specimens shall be quenched in oil at a temperature between 54 and 88 degrees C (130 and 190 degrees F), with the parts and test specimens remaining immersed until oil bath temperature stabilization has been reached, but for not less than 5 minutes. The total elapsed time from endothermic atmosphere furnace to oil quench shall be not more than 60 seconds. Quench bath volume and circulation shall be such that the rise in bath temperature during quenching shall be not more than 14 degrees C (25 degrees F).

3.3.2.2.6 Method III quench. **At completion of the soak period,** the parts and test specimens shall be quenched using an inert gas atmosphere or an oil bath as the quenching medium. Total elapsed time from vacuum furnace to quench medium shall be not more than 60 seconds.

3.3.2.3 Cool. At completion of the quench period, the parts and test specimens shall be air cooled to ambient temperature.

3.3.2.4 As-quenched hardness. As-quenched hardness of the parts and test specimens shall be not less than $R_c 55$.

3.3.2.5 Cleaning. Parts shall be suitably cleaned and dried prior to tempering to remove all residual salt, quench oil, or other surface contaminants.

3.3.2.6 Tempering. Parts and test specimens shall be tempered as soon as possible, but not more than 4 hours, after quench hardening. Tempering shall consist of two cycles in an air atmosphere furnace at a temperature of not less than 538 degrees C (1000 degrees F). Exact tempering temperatures used shall be such that an ultimate tensile strength of 200,000 to 230,000 psi is obtained. Each cycle shall consist of exposure to the required temperature for 2 hours followed by air cooling to ambient temperature. If the time interval between quench and start of first temper is more than 4 hours, parts and test specimens shall be subjected to stress-relief treatment at 191 to 316 degrees C (375 to 600 degrees F) for not less than 2 hours. With this treatment, the time delay from quench to temper shall be not more than 48 hours.

MIL-H-47143(MI)

3.3.2.7 Final cleaning. At completion of the heat treating operation, all parts and test specimens shall be suitably cleaned to remove scale and other residue of the heat treat operation as required for subsequent machining and finishing processes.

3.4 Parts and test specimens. Parts and test specimens shall be coated with a rust inhibiting oil, packaged and protected from scratching and denting during shipping and storage. The rust inhibiting oil shall be in accordance with MIL-I-3150, or equal.

3.5 Workmanship. The workmanship shall be such as to ensure heat treated parts are in conformance with this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Preproduction procedure. A detailed production procedure shall be submitted by the supplier prior to the start of heat treatment. This procedure shall identify the specific equipment, temperature, and times to be used during heat treatment.

4.3 Certification requirements. The certification requirements specified herein apply only when fabricated parts are heat treated in accordance with Method III of this specification. A supplier will not be permitted to initiate vacuum heat treating of production parts unless he can show proof of compliance with the following certification requirements. Upon satisfactory completion of the certification procedure, specific approval for the particular application will be granted by the procuring activity.

4.3.1 Conditions of certification. Equipment (identified by serial number), processing media, hardware, test specimens, and vacuum heat treating techniques used for the certification procedure shall be in accordance with all the provisions of this specification applicable to Method III, and shall be as intended for use in production. Quantity and distribution of the furnace load (hardware items and test specimens) shall be the same as intended for production. At completion of the heat treat process, parts and test specimens shall comply with all the mechanical properties, physical properties, and carburization/decarburization limits specified on the applicable drawing.

MIL-H-47143(MI)

4.3.2.1 Special consideration. The quenching technique represents a highly critical phase of heat treating by the vacuum method. Therefore, in order to lend greater validity to the qualification procedure, measurements for as-quenched hardness to verify compliance with 3.3.2.4 shall be taken using actual hardware rather than test specimens. Test specimens may be used for measurement of final hardness.

4.4 Inspection records. Data relative to each individual lot of parts and test specimens undergoing heat treatment shall be recorded and shall be submitted concurrently with delivery of the applicable heat treat lot. The records shall include the following information:

- a. Purchase order number (when applicable).
- b. Heat treat method number.
- c. Heat treat lot number.
- d. Date of heat treat.
- e. Part numbers.
- f. Serial numbers (when applicable).
- g. Furnace type.
- h. Furnace temperature reading.
- i. Duration of each temperature cycle (actual).
- j. Certification that heat treatment by the specified method has been conducted in accordance with the provisions of this specification (see 4.5.1).
- k. For Method III only, certification that the supplier is qualified to process parts in accordance with the requirements for Method III of this specification.

4.5 Lot acceptance. The lot acceptance requirements for parts heat treated in accordance with this specification shall include the following:

- a. Certification received (see 4.5.1).
- b. Inspection records received showing conformance to 4.4.
- c. Acceptance tests as specified on the applicable part drawing.

MIL-H-47143(MI)

4.5.1 Certification. Certification shall be provided by the supplier stating that all parts and test specimens have been heat treated in accordance with the specified method of this specification.

4.6 Preservation, packaging, and packing. The preservation, packaging, and packing shall be examined for compliance with Section 5.

5. PREPARATION FOR DELIVERY

This section is not applicable to this specification.

6. NOTES

6.1 Intended use. This specification is intended to be used to cover three methods of heat treating parts fabricated from 06AC alloy steel conforming to MIL-S-47036 to an ultimate strength level of 200,000 to 230,000 pounds per square inch.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Method(s) of heat treating (see 1.2).
- c. Disposition of parts and test specimens (see 3.4).

6.3 Supersession data. This specification includes the requirements of Missile Interim Specification MIS-14131C, dated 14 August 1970.

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