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MILITARY SPECIFICATION

FURNACES, HEAT-TREATING, ELECTRIC, NATURAL ATMOSPHERE, BOX TYPE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers horizontal box type, natural atmosphere, heat-treating furnaces of the electrically heated, forced air convection, and radiation design with equipment and accessories specified herein.

1.2 Classification. The furnaces shall be of the following types and classes. The type and class to be furnished shall be as specified (see 6.2.1).

Type I - Forced convection design

Class A - 1400° operating temperature

Type II - Radiation design

Class A - 2000° F operating temperature

Class B - 2500° F operating temperature

Class C - 2750° F operating temperature

1.2.1 Sizes. (See 3.5)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Industrial Plant Equipment Center, ATTN: DIPEC-SSM, Memphis, Tennessee 38114-5297, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

* 2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issue of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-F-3296 - Forges, Furnaces, and Ovens (Exclusive of Space Heating and Cooking), Packaging of.

STANDARDS

FEDERAL

FED-STD-H28 - Screw Thread Standards for Federal Services.

FED-STD-376 - Preferred Metric Units for General Use by the Federal Government.

2.1.2 Other Government documents and publications. The following other Government documents and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

U. S. DEPARTMENT OF LABOR

29 CFR 1910 - Occupational Safety and Health Standards (OSHA)

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

(Copies of specifications, standards, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

* 2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issue of documents not listed in the DoDISS shall be the issue of the non-Government documents which are current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/NEMA MG 1 - Motors and Generators.

ANSI/NEMA ICS 1 - Industrial Control and Systems.

ANSI MC 96.1 - Temperature Measurement Thermocouples.

(Application for copies should be addressed to the American National Standards Institute, ATTN: Sales Dept., 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3951 - Standard Practice for Commercial Packaging.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may 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 specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

* 3.1 First article. When specified in the contract or purchase order (see 6.2.1), a sample shall be subjected to first article inspection (see 4.4 and 6.4).

3.2 Design. The furnace shall be of the manufacturer's current design, shall be new and include any additional features necessary to comply with the requirements specified herein. Additional features which are not specified herein that are a part of the manufacturer's current design shall be included in the equipment furnished. The furnace shall be of the horizontal box design, having a hearth to support the charge and a single opening located in the end of the chamber for loading and unloading on a horizontal plane.

3.2.1 Type I. The type I furnace shall employ the forced air convection method of heating. Design and construction of the furnace shall provide for the charge to be heated by forced air convection. The air shall be heated in an area separated from the charge and blown into the work chamber by one

or more fans. The charge shall not be exposed to radiant heat emitted by the heating elements.

3.2.2 Type II. The Type II furnace shall employ the radiation method of heating with the charge directly exposed to the radiant heat emitted by the heating elements.

* 3.2.3 Measurement systems. Unless otherwise specified, either the U.S. Customary System of Units (US) or the International System of Units (SI) shall be used in the design and construction of the furnace. When only one system of measurement is acceptable, the particular system required shall be as specified (see 6.2.1). In this specification, all measurements, dimensions, sizes, and capacities are given in US units. These measurements may be converted to SI units through the use of the conversion factors and methods specified in FED-STD-376.

* 3.2.4 Safety and health requirements. Covers, guards, or other safety devices shall be provided for all parts of the furnace that present safety hazards. The safety devices shall not interfere with the operation of the furnace. The safety devices shall prevent unintentional contact with the guarded part, and shall be removable to facilitate inspection, maintenance, and repair of the parts. All furnace parts, components, mechanisms, and assemblies furnished on the furnace, whether or not specifically required herein, shall comply with all of the requirements of OSHA 29 CFR 1910 that are applicable to the furnace itself. Additional safety and health requirements shall be as specified (see 6.2.1).

* 3.2.5 Mercury restriction. The furnace shall not contain mercury or mercury compounds nor be exposed to free mercury during manufacture.

* 3.2.6 Asbestos restriction. Asbestos and materials containing asbestos shall not be used on or in the furnace.

* 3.2.7 Environmental protection. The furnace shall be so designed and constructed that under the operating, service, transportation, and storage conditions described herein, the furnace shall not emit materials hazardous to the ecological system as prescribed by Federal, state, or local statutes in effect at the point of installation (see 6.4).

3.2.8 Lubrication. Means shall be provided to ensure adequate lubrication for all moving parts. Recirculating lubrication systems shall include a filter which is cleanable or replaceable. Each lubricant reservoir shall have means for determining fluid level. All oil holes, grease fittings, and filler caps shall be accessible.

3.2.9 Interchangeability. To provide for replacement of worn parts, all parts shall be manufactured to definite dimensions and tolerances.

3.2.10 Accessibility. All parts subject to wear, breakage or distortion, and all parts which require periodic maintenance shall be accessible for adjustment and replacement, as applicable.

3.2.11 Material. All material used in the fabrication of the furnace and related equipment shall be of the quality necessary to produce a furnace to meet the requirements described herein. Materials that are exposed to the internal environment of the furnace chambers shall be compatible with the atmosphere and temperature conditions they will encounter.

3.2.12 Reclaimed materials. The furnace may contain reclaimed materials provided such materials will not jeopardize the furnace's intended use and performance. The reclaimed materials shall have been reprocessed, remanufactured, or recycled in a manner which will restore them to the same chemical composition and physical properties as the materials originally selected for use on the furnace.

3.3 Construction. The furnace shall be constructed of parts which are new, without defects, and free of repairs. The structure shall be capable of withstanding all forces encountered during operation of the furnace to its maximum rating and capacity without permanent distortion.

3.3.1 Castings and forgings. All castings and forgings shall be free of defects, scale and mismatching. No processes such as welding, peening, plugging, or filling with solder or paste shall be used for reclaiming any defective part.

3.3.2 Welding, brazing or soldering. Welding, brazing and soldering shall be employed only where those operations are required in the original design. These operations shall not be employed as repair measures for defective parts.

3.3.3 Fastening devices. All screws, pins, bolts, and other fasteners shall be installed in a manner to prevent change of tightness. Fastening devices subject to removal or adjustment shall not be swaged, peened, staked, or otherwise permanently installed.

3.3.4 Surfaces. All surfaces shall be clean and free of sand, dirt, fins, sprues, flash, scale, flux, and other harmful or extraneous materials. All edges shall be either rounded or beveled unless sharpness is required to perform a necessary function. Except as otherwise specified herein, the condition and finish of all surfaces shall be in accordance with the manufacturer's commercial practice.

3.3.5 Painting. Unless otherwise specified (see 6.2.1), the furnace shall be painted in accordance with the manufacturer's commercial practice.

3.3.6 Threads. All threaded parts used on the furnace and its related attachments and accessories shall conform to FED-STD-H28 and the applicable "Detailed Standard" section referenced therein.

3.3.7 Plates. All words on instruction and indicating plates shall be in the English language. Characters shall be engraved, etched, embossed or stamped in boldface on a contrasting background.

3.4. Electrical equipment. The furnace shall be furnished complete with all accessory electrical motors, contactors, controls, relays, transformers, signal lights and switches prewired where possible for operation upon connection to source of power. All power operated, manually adjusted and automatic controls shall operate on and shall be wired for 115 volts. The electrical systems and enclosure shall conform to NEMA Standard ICS 1.

3.4.1 Power supply. The furnace shall be designed for operating from the power source specified (see 6.2.1).

3.4.2 Motors Motors rated in excess of 1/2 horsepower shall be dual voltage, 230/460 volt, initially wired to operate on the voltage specified for the furnace. Motors shall conform to NEMA Standard MG-1.

3.4.3 Electrical connections. Connections of conductors and terminal parts shall be of the screw, pressure or solder type. When soldered connections are used, the connections shall be mechanically secured before soldering. Rosin base fluxes only shall be used in soldering operations. Connections to screw type terminals shall be mechanically secured with means to prevent loss to tightness.

3.4.4 Wiring data plates. When dual voltage furnaces are supplied, metal data plates shall be furnished showing the wiring arrangement to facilitate change from one voltage to another. The plates shall be located at or near the terminal boards or panels where the components are connected.

* 3.4.5 Energy efficiency. The furnace and its applicable components that directly consume energy in normal operation shall be designed and constructed for the highest degree of energy efficiency as governed by the latest developments available within the industry.

3.5 Sizes. The size of the furnace chamber shall be as specified (see 6.2.1). The minimum size of type I furnace chamber shall be not less than 18 inches in width by 30 inches in length by 18 inches in height. The minimum size of type II furnace shall be 6 inches in width by 12 inches in length by 6 inches in height. Size changes shall increase in increments of 3 inches in width or height and 6 inches in length up to a chamber size of 18 W by 30 L by 18 H. Furnace chambers larger than 18 W by 30 L by 18 H shall increase in increments of 6 inches in any dimension as required. The inside dimensions of the heating chamber shall be not less than the dimensions specified. The door opening size shall be not less than the width and height dimensions specified for the size furnace.

3.6 Performance. Each furnace shall be capable of operating continuously with a maximum charge at any temperature within its operating range.

3.6.1 Operating temperature range.

3.6.1.1 Type I, class A. The minimum operating temperature for the type I, class A furnace shall be not higher than 600° F, and the maximum operating temperature shall be not less than 1400° F.

3.6.1.2 Type II, class A. The type II, class A furnace shall operate with maximum efficiency within the temperature range of 1400 to 2000° F. The minimum operating temperature shall be not higher than 600° F, and the maximum operating temperature shall be not less than 2000° F.

3.6.1.3 Type II, class B. The minimum operating temperature of the type II, class B furnace shall be 1400° F, and the operating temperature range shall be from 1400° F through not less than 2500° F.

3.6.1.4 Type II, class C. Type II, class C furnaces shall operate with maximum efficiency within the temperature range of 1400 to 2750° F. The minimum operating temperature shall be not higher than 1000° F, and the maximum operating temperature shall be not less than 2750° F.

3.6.2 Temperature uniformity.

3.6.2.1 Type I. When charge and the temperature stabilized on the type I furnace, the temperature variation from the instrument control point in the heating chamber to any other point in the heating chamber shall vary not more than +10° F. The furnace shall be capable of maintaining the temperature uniformity at any desired control point between 600 and 1400° F. The heating chamber shall be defined as the space of the inside dimensions specified for the size furnace.

3.6.2.2 Type II. When charged and the temperature stabilized in the type II furnace, the temperature variation from the instrument control point in the heating chamber to any other point within the effective working area in the chamber shall vary not more than +10° F. The effective working area may be defined as being one-sixth less than each of the actual inside dimensions specified for the size furnace. The type II, class A furnace shall be capable of maintaining the temperature uniformity at any desired control point from 1400° F through 2000° F; the type II, class B from 1400° F through 2500° F, and the type II, class C from 1400° F and through 2750° F.

3.6.3 Recovery rate and heating capacity. Recovery rate and heating capacity shall be in accordance with 3.6.3.1 and 3.6.3.2 for the type and class furnace specified. Hearth area for heating capacity refers to the whole hearth. Recovery load and heating capacity requirements shall include the weight of trays or fixtures required to retain the workload.

3.6.3.1 Type I. Type type I furnace shall have a recovery rate of not less than 60 pounds of steel for each square foot of hearth area per hour to

1400° F. The maximum capacity of the type I furnace shall be not less than 130 pounds per square foot of hearth area.

3.6.3.2 Type II. The type II, class A furnace shall have a recovery rate equivalent to not less than 60 pounds of steel for each square foot of hearth area per hour to a temperature of 2000° F. The type II, class B and class C furnace shall have a recovery rate of not less than 50 pounds of steel for each square foot of hearth area per hour to a temperature of 2150°F. The maximum capacity of the type II, class A furnace shall be not less than 100 pounds/square foot at 2000° F; class B, 80 pounds/square foot at 2500° F; and the class C, 60 pounds/square foot at 2750° F.

3.7 Components.

3.7.1 Frame. The furnace shall have a structural frame and shall provide a stable support for the work chamber and a maximum load. If legs are used, they shall be braced and provided with bearing plates. Floor mounted furnaces with work chambers up to 36 inches wide shall have a working height above the floor of not less than 30 inches. Furnaces with work chambers over 36 inches wide shall have a working height above the floor of not less than 18 inches. Each furnace shall have provision for forklift handling.

3.7.2 Shell. The outer shell of the furnace shall be constructed of sheet steel, properly reinforced and securely welded or riveted at all joints to provide a rigid structure. The walls shall be constructed in such a manner that the use of through fastening devices which conduct heat to the outer shell will be minimized. The front of the furnace shall be constructed of material to prevent distortion.

3.7.3 Hearth. The hearth plates shall be made of materials that will readily conduct heat to the interior of the furnace and shall withstand atmosphere and temperatures encountered in normal service use. The hearth shall be capable of supporting maximum furnace loads under all operating conditions without permanent distortion. The type II, class B and class C furnace shall have hearth plates constructed of silicon carbide. When specified (see 6.2.1), rollers or slide rails shall be provided for moving the charge in and out of the chamber.

3.7.3.1 Shelves. When required, the furnace shall be provided with removable open grid type shelves. Number and arrangement of shelves shall be as specified (see 6.2.1).

3.7.4 Insulation.

* 3.7.4.1 Ceramic fiber (type I and type II, class A). The lining of the type I, class A furnace shall consist of not less than 4 inches of 8 lbs/cu ft density, 2300° F ceramic fiber, backed up with 4 inches of not less than 4 lbs/cu ft density, 1700° F ceramic fiber. The lining of the type II, class A furnace shall consist of not less than 4 inches of 8 lbs/cu ft density, 2200° F ceramic fiber, backed up with 5 inches of not less than 6

lbs/cut ft density, 1700° F ceramic fiber. The quality of the ceramic fiber material and the installation techniques shall withstand the air velocities encountered in the furnaces. All lining joints shall be staggered from other joints at least 4 inches and the lining shall be preheated to minimize shrinkage or compressed to at least the density recommended by the fiber material manufacturer to compensate for shrinkage. All installation hardware and installation techniques shall conform with the recommendations of the fiber material manufacturer. With the chamber temperature stabilized at maximum temperature, the outside surface temperature of the type I, class A furnace shall not exceed 60° F above ambient, or the type II, class A furnace 120° F above ambient temperature.

3.7.4.2 Refractory and insulation (type II, class B and class C). The type II, class B and C furnaces shall be lined with insulating fire brick and refractory insulation selected to ensure long life and minimum heat loss. Overall thickness and quality of the lining shall be such that with the chamber temperature stabilized at maximum operating temperature, the outside surface temperature of the class B furnace shall not exceed 150° F or the class C furnace 200° F above ambient temperature. Powder, shredded or granular insulation shall not be used. When mortar is used, it shall be of the same material as the units being cemented together.

* 3.7.5 Door. Unless otherwise specified, the door shall be of the vertical lift type, either manually operated with suitable counterweights, or power operated with a foot control device. When specified (see 6.2.1), the door shall be power operated with a foot control device. The door of each furnace, including the refractory lined furnaces, shall be lined with ceramic fiber insulation. The door of ceramic lined furnaces shall be lined with material having a temperature rating, density and thickness of not less than the requirements specified for the furnace lining. The hot face lining temperature rating for the door of refractory lined furnaces shall be not less than 300° F higher than the maximum furnace temperature and the backup insulation shall have a temperature rating of not less than 2300° F. The door opening shall have metal-to-metal door seals or the design shall provide for the door to move horizontally away from the face of the furnace a sufficient distance to prevent any sliding contact of the ceramic fiber insulation during opening and closing actions. The door shall overlap the facing of the furnace not less than 2-1/2 inches on all four sides for chambers up to 30 inches in width and not less than 1/12 the work chamber width for chambers wider than 30 inches. The outside surface temperature of each door shall be compatible with the surface temperature of the furnace.

3.7.6 Air circulating system. The type I furnace shall be provided with one or more fans of the circulating type, constructed of heating resisting, nonoxidizing alloy suitable for continuous operation at maximum furnace operating temperature. The number of fans and the capacity of the system shall assure adequate circulation of air for uniform temperature control as specified in 3.6.2. Adequate means shall be provided to assure proper cooling for all bearings and components. Fans shall be interlocked or provided with

a safety switch to prevent operation of the furnace in the event of fan failure.

3.7.7 Heating elements. Furnaces having a temperature rating of 2000° F or less shall have heating elements fabricated from a high-resistance alloy containing approximately 80 percent nickle and 20 percent chromium with not more than 1 percent iron as an impurity, or an equivalent alloy having a good or better characteristics. Furnaces having a temperature rating in excess of 2000° F shall have heating elements of silicon carbide or of an equivalent material having as good or better overall characteristics. A multiple-tap transformer with not less than eight steps for changing voltage shall be furnished with all heating elements of the silicon carbide type to compensate for the change in resistance. An ammeter or a comparable instrument shall be furnished with furnaces having heating elements of the silicon-carbide or equivalent type to detect changes in resistance. The power density of the heating elements shall not exceed 15 watts per square inch of radiation surface for alloy type elements, 50 watts for silicon-carbide elements operating at 2500° F, and 25 watts for silicon carbide elements operating at 2750° F.

3.7.7.1 Elements hanger supports (fiber lined furnaces). The heating element hanger support system for ceramic fiber lined furnaces shall be of the double electrically insulated type, consisting of an alloy extension stud, ceramic spool, and an electrically insulated base joint device for stud welding to the furnace shell; or the hanger support system employed shall be of a type which has had a satisfactory history of service on the commercial market in the type furnaces covered by this specification. Extension studs for the type I furnace shall be of 601 inconel material. The maximum element weight per stud shall not exceed the stud manufacturer's recommendations for the type stud and furnace temperature.

3.7.7.2 Terminals. The terminal of the metallic heating elements shall be designed to have not less than twice the current-carry capacity of the heating element. Solderless connections to power lead shall be furnished.

3.7.8 Thermocouples. Furnaces having a temperature rating in excess of 2000° F shall be provided with platinum-rhodium type thermocouples. Furnace having a temperature rating of 2000° F and lower shall be provided with chromel-alumel type thermocouples. The thermocouples shall be adequately protected from contamination of furnace atmospheres by means of suitable protective tubes. The thermocouples shall conform to ANSI-MC 96.1. Unless otherwise specified (see 6.2.1), thermocouple lead wires shall be not less than 25 feet in length. Thermocouple wires shall be of the same material as the thermocouples, or have the same thermoelectric characteristics.

* 3.7.9 Instruments. The instruments shall be of solid-state design, shall be marked to indicate the particular type thermocouple for which they are calibrated and have automatic reference junction compensation in all instruments using thermocouples as the temperature sensing element. The controllers shall provide thermocouple upscale fail-safe protection that will shut off the heat source at approximately 100° F above maximum temperature.

* 3.7.9.1 Temperature controller. Unless otherwise specified (see 6.2.1), the furnace shall be provided with microprocessor based digital controller with an accuracy of 0.5 percent of set point. The controller shall be capable of maintaining the set control temperature within $\pm 2^{\circ}$ F and shall provide output receptacles for a recorder or process reporter. The controller shall be of the time proportioning type control and shall operate a contactor through an intermediate relay system.

* 3.7.9.1.1 Digital display. The indications of the control shall be direct readings in degrees F with a resolution of 1° F. The instrument shall provide simultaneous display of temperature set point and actual temperature with individual digits of the actual temperature not less than 0.56 inch high. The controller shall provide key-touch selections of functions. The keyboard shall be membrane covered to seal out dust and vapors.

* 3.7.9.2 Temperature recorder. Unless otherwise specified (see 6.2.1), the furnace shall be provided with a temperature recorder. The recorder shall be of the strip chart, self-balancing type. Unless otherwise specified, the calibrated chart width shall be not less than 6 inches, and the chart length shall be not less than 80 feet to the roll. The chart speed shall be 1 inch per hour. The chart mechanism shall be furnished in a dust-proof housing with a glass door that permits full view of chart width, and not less than 7 inches of chart length. When required, the chart width shall be not less than 9 inches and provisions provided for changing chart speed to 4 and 6 inches per hour as specified (see 6.2.1).

* 3.7.9.2.1 Process reporter. When specified (see 6.2.1), the furnace shall be provided with a digital process reporter in lieu of a strip chart recorder.

* 3.7.9.3 Excess temperature controller. When specified (see 6.2.1), the furnace shall be provided with an excess temperature controller. The controller may be either a built-in function of the temperature controller, programmer, or a separate instrument. In either case, the excess temperature control circuit shall be independent of the control circuitry. The controller shall provide for selecting the over-temperature control point and shall function to shut off the heat source to the furnace when the over-temperature control point is reached. The excess temperature controller shall provide for furnace shut-down in the event of thermocouple failure, or failure of other components in the circuit. In case the furnace is shut down by the excess temperature control system, it shall sound an audible alarm and the furnace shall remain off until started manually. Calibrated accuracy shall be within 1 percent of full scale reading.

* 3.7.9.4 Program control. When required, digital control programmer shall be furnished and integrated with the furnace control system to provide temperature control and other control functions in accordance with a pre-selected program as specified (see 6.2.1).

3.7.9.5 Instrument panel. Unless otherwise specified (see 6.2.1), one floor-mounted type instrument panel conforming to NEMA Standard ICS-1 shall be provided with each furnace for mounting all instruments and accessory controls. The control accessories shall be mounted in a front opening NEMA type 12 enclosure with a disconnect switch. A separate enclosure shall be provided for mounting the power contactor individually and separate from the instrument panel. The panel shall provide for semi-flush or flush mounting of all instruments. When specified (see 6.2.1), the instrument panel shall be provided with shock-absorbing mounts. Signal lights shall be provided to indicate the furnace cycle performance.

3.7.9.6 Vibration and tilt requirements. When specified (see 6.2.1), indicating, recording, and control instruments shall retain their accuracy within the tolerances specified when:

- a. Exposed to a vibration of 0.030 inch excursion at 18 cycles per second.
- b. Operated in tilted positions 15 degrees from the normal vertical position in any direction.

3.8 Time totalizing meter. When specified (see 6.2.1), the furnace shall be provided with a meter to measure actual operating time of the heating elements. The time totalizing meter shall be of the nonresetting type and shall have a range of 0 to 100,000 hours in increments of 1 hour and 99999 shall be maximum readout. Lesser increments are not acceptable. Upon reaching the maximum accumulative hours, the meter readout shall automatically revert to zero and continue to totalize time. The meter shall be designed to prevent the entrance of dust and moisture and shall be mounted to withstand shock and vibration generated by the equipment.

3.9 Optional equipment. Optional equipment shall be furnished as specified and shall be fully described (see 6.2.1).

3.10 Nameplate. Unless otherwise specified (see 6.2.1), a nameplate shall be securely attached to each furnace and contain the information listed below. If the furnace is a special model, the model designation shall include the model of the basic standard furnace and a suffix identified in the manufacturer's permanent records. The captions listed may be shortened or abbreviated, provided the entry for each caption is clear as to its identify.

Nomenclature

Manufacturer's name

Manufacturer's model designation

Manufacturer's serial number

Inside dimensions (width, length, height, in inches)

Power input (volts, total amps, phase, frequency)
Contract Number or Order Number
National Stock Number or Plant Equipment Code
Date of manufacture

* 3.11 Technical data. When technical data is required it shall be furnished in accordance with the requirements of the contract. All technical data furnished shall be written in the English language.

3.12 Workmanship. Workmanship of the furnace and accessories shall be of a quality equal to that of the manufacturer's commercial equipment of the type specified herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

* 4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

* 4.3 Inspection conditions. Unless otherwise stated herein, all inspections, tests, and examinations shall be performed in the manufacturer's designated indoor test area under the ambient temperature, the relative humidity, and the air pressure existing inside the building at the time the inspections, tests, and examinations are performed.

4.4 First article inspection When a first article inspection is required, it shall be applied to the first article submitted in accordance with 3.1. Unless otherwise specified (see 6.2.1), first article inspection shall consist of the examination in 4.6 and all tests in 4.7. Failure of the item to pass the first article examination and all tests shall be cause for rejection.

4.5 Quality conformance inspection. Quality conformance inspection shall be applied to each item prior to being offered for acceptance under the contract. Unless otherwise specified (see 6.2.1), quality conformance inspection shall consist of the examination in 4.6, the test in 4.7.1, and the inspection in 4.8. Failure of the item to pass the examination, the test or inspection shall be cause for rejection.

4.6 Examination The furnace and equipment shall be examined for design, dimensions, construction, materials, components, electrical and safety compliance and workmanship to determine compliance with the requirements of this specification.

* 4.7 Tests. All tests shall be conducted at an ambient temperature of 77° F +18° F. Test instruments and sensing elements used to perform the test specified for the furnace and instruments should have been checked against a standard potentiometer type instrument and calibrated thermocouple of known accuracy within the previous 6 months to read accurate within +2° F.

4.7.1 Instrument test. Indicating and recording instruments shall be tested by impressing various predetermined voltages, simulating thermocouple outputs for different furnace temperatures to terminals where normally the thermocouples would be connected. These tests shall be made in accordance with, and results checked against, standards established in ANSI MC 96.1. The instruments shall be tested through their operating range.

4.7.2 Circuit test. Each circuit of the electrical system shall be tested for dielectric strength, continuity, insulation-resistance and faulty grounds in accordance with NEMA Standard ICS 1.

4.7.3 Tilt test. Instruments required to operate under tilt conditions shall be tested. The tests specified in 4.7.1 shall be repeated with the indicating and recording instruments at an angle of 15 degrees in any direction from the normal vertical position. The instruments shall operate and function within the tolerance specified.

4.7.4 Vibration tests. Instruments required to operate under vibration conditions shall be tested. The tests specified in 4.7.1 shall be repeated with the indicating and recording instruments being subjected to a vibration of 0.030 inch excursion at 18 cycles per second for a period of 15 minutes each in the lateral and transversal horizontal planes and in the vertical plane. The instruments shall function within the prescribed tolerances other than for minor adjustment.

4.7.5 Performance tests. The furnace shall be prepared for operation and operated in accordance with the manufacturer's handbook of instructions until the refractory and insulation has cured. With the temperature stabilized at the temperature specified in 3.6.3, the furnace shall be loaded with a batch-type charge of iron or steel equivalent to not less than the recovery rate specified for the type and class furnace under test. The recovery cycle shall be recorded and at the end of 1 hour the furnace temperature shall be within 10° F of the initial temperature. Each safety device, such as loss of thermocouple circuit and fan failure safety device, shall be tested by simulating a failure that normally would cause the system to operate. Each device or system shall perform its intended function.

4.7.6 Temperature uniformity test. The furnace shall be charged as specified in 4.7.5 and a temperature survey performed. A minimum of nine test locations shall be used, with one thermocouple located in each corner of the heating chamber of type I furnace. For type II furnaces, one thermocouple shall be located in each corner of the effective work zone. One thermocouple shall be located within 3 inches of the instrument control thermocouple. For furnaces with a chamber volume of less than 10 cubic feet, the test may be performed with a minimum of three thermocouples, with one located at the front, center and rear of the test zone. The survey shall be performed at the minimum and maximum temperature of type I furnace and the type II, class A furnace, and at the minimum and at 2150° F for the type II, class D and class C. From the time the heating cycle is initiated until the thermal equilibrium is reached, none of the temperature readings should exceed the maximum of the temperature range being surveyed. After thermal equilibrium is reached, readings shall be taken at 5 minute intervals for 30 minutes. The temperature variation between the instrument control point in the chamber and all points under test shall not exceed + 10° F. For furnaces with only three thermocouples, the temperature variation between the center of the chamber and ends of the chamber shall not exceed +10° F.

4.7.7 Chamber surface temperature test. The chamber temperature shall be stabilized at maximum operating temperature, and the surface temperature of the chamber and door checked at random locations. The surface temperature shall not exceed the limits specified in 3.7.4, except around door openings, ports and through-fastening devices. The type II furnaces shall be unloaded before increasing the temperature above the melting point of the charge.

4.8 Packaging inspection. Packaging shall be inspected to determine compliance with the requirements of section 5.

5. PACKAGING

5.1 Preservation , packing and marking. Unless otherwise specified, preservation, packing and marking shall be in accordance with ASTM-D 3951. When required, preservation and packing shall conform to Level A, B or C requirements of MIL-F-3296, as specified (see 6.2.1), and marking shall be as specified therein.

6. NOTES

6.1 Intended use. Furnaces covered by this specification are for use primarily in heat-treating shops for hardening, tempering, normalizing and annealing metal parts. Furnaces covered by this specification are not intended for atmosphere control use.

6. NOTES

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition document should specify the following:

- a. Title, number and date of this specification.
- b. Type and class required (see 1.2).
- c. Size required; specify width, length and height (see 1.2.1 and 3.5).
- d. First article, when required (see 3.1).
- e. Additional Safety and health requirements (see 3.2.4).
- f. Measurement system, if different (see 3.2.3).
- g. Painting, if different (see 3.3.5).
- h. Power supply; specify voltage and phase (see 3.4.1).
- i. Rollers or slide rails, if required (see 3.7.3).
- j. Shelves, if required; specify number and arrangement (see 3.7.3.1).
- k. Door, if different (see 3.7.5).
- l. Thermocouple lead wire length, if different (see 3.7.8).
- m. Temperature controller, if different (see 3.7.9.1).
- n. Temperature strip chart recorder, specify, if not required (see 3.7.9.2).
- o. Chart width if different (see 3.7.9.2).
- p. Process digital reporter, if required (see 3.7.9.2.1).
- q. Excess temperature control, if required (see 3.7.9.3).

- r. Program control and program requirements, if required (see 3.7.9.4).
- s. Instrument panel, if different (see 3.7.9.5); specify if floor-mounted panel is not required.
- t. Instrument panel with shock absorbing mounts, if required (see 3.7.9.5).
- u. Instruments capable of operating under vibration and tilt conditions, if required (see 3.7.9.6).
- v. Hour meter, if required (see 3.8).
- w. Specify and fully describe optional equipment, if required (see 3.9).
- x. Nameplate, if different (see 3.10).
- y. First article inspection, if different (see 4.4).
- z. Quality conformance inspection, if different (see 4.5).
- aa. Level of preservation, packing and marking, if different (see 5.1).

6.3 Contract data requirements. Required technical data such as operator's manuals, parts lists, foundation and anchor bolt plans, wiring diagrams and other instructions for operation and maintenance as identified on a numbered DD Form 1664 should be specified on a DD Form 1423 incorporated into the contract.

6.4 First article. When a first article is required, it shall be tested and approved under the appropriate provisions of 7-104.55 of the Defense Acquisition Regulation. A first article comprise a preproduction item or a standard production item from the contractor's current inventory. The contracting officer should include specific instructions in all procurement instruments, regarding arrangement for examination, test and approval of the first article.

6.5 Subject terms (key word) listing:

- Box type
- Furnace
- Hearth
- Heat treating
- Insulation
- Natural atmosphere
- Recorder
- Temperature

6.6 Marginal notation. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document, based on the entire content, irrespective of the marginal notations and relation to the last previous issue.

Custodians:

Army - AL
Air Force - 99

Preparing activity:

DLA - IP

Project (3424-0108)

Review activities:

Army - SM, CR
Navy - SH
Air Force - 84
DLA - GS

User activities:

Army - AR, AV
Navy - AS, SH

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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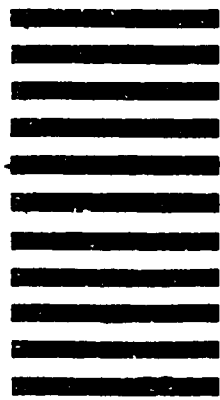
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER
MIL-F-80258A

2. DOCUMENT TITLE Furnaces, Heat-treating, Electric, Natural
Atmosphere, Box Type

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

VENDOR

USER

MANUFACTURER

OTHER (Specify): _____

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

B. DATE OF SUBMISSION (YYMMDD)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)