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FEDERAL SPECIFICATION

BURNERS, SINGLE: OIL, GAS, AND GAS-OIL COMBINATION FOR PACKAGED BOILERS (320,001 TO 125,000,000 BTU/HR THERMAL OUTPUT CAPACITY)

The General Services Administration has authorized the use of this specification by all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers single burners fired on gas, oil, or a combination of gas and oil designed for installation in a boiler.

1.2 Classification. Burners will be one of the following classes and styles as specified (see 6.2 and 6.5):

Class 1 - Heavy oil fired.
Class 2 - Light oil fired.
Class 3 - Gas fired.
Class 4 - Combination heavy oil and gas fired.
Class 5 - Combination light oil and gas fired.

2. APPLICABLE DOCUMENTS

2.1 Other publications. The following other documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Beneficial comments, recommendations, additions, deletions, clarifications, etc. and any data which may improve this document should be sent to: Commanding Officer (Code 15E2), Naval Construction Battalion Center, 1000 23rd Avenue, Port Hueneme, CA 93043-4301, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.13 - Methods for Measurement of Sound Pressure Levels.

(Private sector and civil agencies may purchase copies of this voluntary standard from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME CSD-1 - Controls and Safety Devices For Automatically Fired Boilers.
ASME Performance Test Code, PTC 4.1 - Steam Generating Units.

(Private sector and civil agencies may purchase copies of these voluntary standards from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.)

ASTM

ASTM D 396 - Fuel Oils.

(Private sector and civil agencies may purchase copies of this voluntary standard from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

FACTORY MUTUAL ENGINEERING CORPORATION (FM)

Factory Mutual Approval Guide.

(Private sector and civil agencies may purchase copies of this voluntary standard from the Factory Mutual Engineering Corporation, Factory Mutual System, 1151 Boston-Providence Turnpike, Norwood, MA 02062.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 - General Standards for Industrial Controls and Systems.
NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.
NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
NEMA MG 1 - Standards for Motors and Generators.

(Private sector and civil agencies may purchase copies of these voluntary standards from the National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, DC 20037.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 - National Electrical Code.
NFPA 8501 - Single Burner - Boiler Operation.

(Private sector and civil agencies may purchase copies of these voluntary standards from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.)

UNDERWRITERS LABORATORIES INC. (UL)

UL 296 - Oil Burners.
UL 795 - Commercial Industrial Gas-Heating Equipment.

(Private sector and civil agencies may purchase copies of these voluntary standards from the Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.)

(DoD activities may obtain copies of those adopted voluntary standards listed in the DoD Index of Specifications and Standards free of charge from the Defense Automated Printing Services, Attn: DoDSSP, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the reference cited herein, the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Description. The classes of burners covered by this specification shall either be furnished as part of a new packaged boiler or shall be a replacement or conversion on an existing boiler as specified (see 6.1.1, 6.2, and 6.4). The burner shall include a control system, a combustion control system, fuel piping, and ignition system. All burners shall be factory-wired and assembled as practical except for readily installed appurtenances, such as pressure and temperature gages, oil heater piping, and wiring of the burners to the control panel. The burners shall be complete and ready for operation when installed on the applicable equipment and connected to the fuel and electrical supplies.

3.2 Standards. Small burners with fuel inputs of less than 12,500,000 British thermal units per hour (Btu/hr) (3 663 389 watt (W)) shall comply with the applicable requirements of ASME CSD-1. Large burners with fuel inputs of greater than 12,500,000 Btu/hr (3 663 389 W) shall comply with the applicable requirements of NFPA 8501 (see 6.1.1). All burner electrical equipment shall conform to the applicable requirements of NFPA 70, UL 296, and UL 795. All control equipment not covered by the above shall have the UL label or listing mark or shall be listed in the Factory Mutual Approval Guide.

3.3 Standard commercial product. The burner shall, as a minimum, be in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the burner being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.4 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Material not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new.

3.5 Interchangeability. All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to ensure interchangeability of component parts, assemblies, accessories, and spare parts.

3.5.1 System of measurement. The dimensions used in this specification are not intended to preclude the use of the metric system of measurement in the fabrication and production of the material, individual parts, and finished product, provided form, fit, and function requirements are satisfied.

3.6 Design and construction. The burner shall be designed and constructed in accordance with the applicable requirements of 3.2 and the additional requirements specified herein.

3.6.1 Fuel characteristics. Unless otherwise specified (see 6.2), oil fired burners shall be designed and constructed to operate on the fuel oil characteristics described in ASTM D 396. When oil burners are required, grade of fuel required for firing and fuel oil supply temperature shall be as specified (see 6.2). When gas burners are required, fuel gas supply pressure shall be as specified (see 6.2). Unless otherwise specified (see 6.2), gas burners shall be designed and constructed to operate on the following fuel gas characteristics:

a. Natural gas (percent by volume, as fired).

(1) Ultimate analysis:

(a) Methane ---------- 90.0
(b) Ethane ---------- 5.0
(c) Nitrogen ---------- 5.0
(d) Ash ---------- Nil
(e) Moisture ---------- 0.01

(2) Higher heating value - 1,075 Btu/ft^3 (3.34 calories-kilogram per cubic metre (cal-kg/m^3)).

3.6.2 Ignition system. The ignition system shall be capable of igniting the pilot fuel or fuels as specified (see 6.1.1 and 6.2). The ignition system shall be integrated to operate with the control system of 3.6.7 and 3.6.8. Igniters for large burners rated at greater than 12,500,000 Btu/hr (3 663 389 W) fuel shall be in accordance with NFPA 8501. Igniters for small burners rated at less than 12,500,000 Btu/hr (3 663 389 W) fuel input shall be in accordance with ASME CSD-1.

3.6.2.1 Dual pilot fuel piping. A three-way valve shall be included in the pilot fuel supply piping if the pilot is to be capable of firing on two fuels (see 3.6.2). The three-way valve shall prevent the simultaneous flow of these fuels to the pilot.

3.6.3 Installation site characteristics. The burners shall be designed and constructed to operate for the following installation site characteristics as specified (see 6.2):

a. Site elevation in feet above sea level.

b. Anticipated maximum, minimum, and average ambient air temperature in degrees Fahrenheit (°F) (degrees Celsius (°C)).

3.6.4 Oil fired burners. When oil fired burners are required, the burners shall produce a clean, stable flame at all firing rates using the described grade of fuel oil as specified in 3.6.1. The burner flame shape shall fit the furnace without impingement on or overheating of the furnace walls. Burner parts shall be protected from overheating. The design of the fuel oil system including safety interlocks, limit switches, control valves, and fuel oil supply piping for large burners rated greater than 12,500,000 Btu/hr (3 663 389 W) fuel input shall be in accordance with NFPA 8501. The design for small burners rated less than 12,500,000 Btu/hr (3 663 389 W) fuel input shall be in accordance with ASME CSD-1. Fuel oil piping shall withstand 1.5 times the maximum operating pressure of the oil supply system without leakage. A fuel oil temperature gage shall be provided on systems firing heavy oil. The fuel oil system shall include an atomization system, fuel oil pump, strainer, relief valve, and trim heater as required below.

3.6.4.1 Fuel oil atomization. The fuel oil atomization system shall be of the steam atomization type, high pressure mechanical type, or the air atomization type as specified (see 6.2).

3.6.4.1.1 Steam atomization type. When provided, the steam atomization system (see 6.1.1) shall require not more than 0.3 pounds (0.136 kg) of steam per pound of oil burned at the maximum firing rate. The system shall be provided with the necessary valves and steam traps to ensure that dry steam is available at the burner nozzle. When specified (see 6.2), the necessary cold start piping and a cold start air compressor or auxiliary fuel pump shall be provided to equip the burner for either compressed air atomizing or integral pressure atomizing starting burners. Cold start integral pressure atomizing burners shall have not less than 30 percent of the maximum capacity of the main burner.

3.6.4.1.2 High pressure mechanical type. When provided, the high pressure mechanical atomizers shall maintain adequate atomizing pressure at all firing rates. Return flow type

mechanical atomizers shall be provided with a return flow safety shutoff and a spring-loaded check valve to prevent return oil leakage on a safety shutdown. The amount of fuel oil supplied to the furnace shall be a continuous function of the fuel oil return pressure.

3.6.4.1.3 Air atomization type. When provided, the air atomization system shall maintain adequate atomizing pressure at all firing rates. An air pressure regulator and a moisture trap to ensure moisture free atomizing air shall be provided. When specified (see 6.2), an air compressor system shall be provided mounted integrally with the boiler assembly.

3.6.4.2 Fuel oil pump. Unless otherwise specified (see 6.2), a fuel oil pump shall be provided. The pump shall be a motor driven positive displacement or variable displacement metering type. The pump shall be designed to deliver fuel oil at the required temperature (see 3.6.1) to the burner at sufficient quantity and pressure to maintain stable firing conditions at the maximum required firing rate. The available fuel oil pressure at the suction of the pump shall be as specified (see 6.2). The fuel oil pump may be driven from the fan motor for light oil fired burners on boilers of less than 10,000,000 Btu/hr (2 930 711 W) thermal output capacity (see 3.7.1).

3.6.4.3 Strainer. A fuel oil strainer shall be furnished to ensure the delivery of clean oil to the burner and prevent plugging of the interconnecting piping, valves, and atomizing oil nozzle. The strainer shall be located in front of the pump so that oil supplied to the burner passes through the strainer first. The strainer shall be sized in accordance with the guidelines of UL 296. A piping bypass shall be furnished to allow the strainer to be cleaned without shutting down the oil flow to the burner.

3.6.4.4 Relief valve(s). Automatic oil pressure relief valve(s) shall be provided if a fuel oil pump or trim heater is furnished with the burner (see 3.6.4.2 and 3.6.4.5) to prevent excessive pressure to the burner and associated piping. The relief valve(s) shall be located on the pump or heater discharge piping and shall be furnished with piping back to the low pressure oil supply line.

3.6.4.5 Trim heater. When specified (see 6.1.1 and 6.2), an auxiliary electric trim heater shall be provided to reduce the fuel oil viscosity prior to atomization. The trim heater shall be designed to heat 80 percent of the maximum fuel oil flow from the main oil supply outlet to the required atomization temperature. The trim heater and associated controls shall be located on the boiler assembly. When the required fuel oil temperature is reached and maintained by the heater, a thermostatic control or limit switch shall cut off the heater. Trim heater operating voltage shall be not greater than 230 volts. When provided, electric trim heaters rated up to 1,800 watts (W) shall be controlled by a line voltage thermostat switch or by a magnetic contactor with a coil operated by a thermostat. Heaters rated at greater than 1,800 W shall be controlled by a magnetic contactor having a magnetic coil operated by a thermostat. The electric power and separate control circuits shall be protected by circuit breakers located on the boiler assembly.

3.6.5 Gas fired burners. When gas fired burners are required, the burners shall produce a clean, stable flame at all firing rates using the described gas fuel with the characteristics described in 3.6.1. The burner flame shape shall fit the furnace without impingement on or overheating of the

furnace walls. Burner parts shall be protected from overheating. The design of the system including safety interlocks, limit switches, control valves, and fuel gas piping for burners rated at greater than 12,500,000 Btu/hr (3 663 389 W) fuel input shall be in accordance with NFPA 8501. For burners rated at not greater than 12,500,000 Btu/hr (3 663 389 W) fuel input shall be in accordance with ASME CSD-1. Fuel gas piping shall withstand 1.5 times the maximum operating pressure of the fuel gas supply system without leakage. Partial premix burners shall be provided with an integral primary air fan, and the design shall incorporate an effective means of preventing flame propagation back into the mixing chamber or gas and air supply lines.

3.6.6 Combination gas and oil fired burners. When combination oil and gas burners are required, the burners shall consist of an oil burner and a gas burner each conforming to the requirements of 3.6.4 and 3.6.5, respectively. The two burners shall be constructed as an integral combination burner suitable for firing either fuel separately. Provisions shall be incorporated for withdrawing, shielding, or otherwise preventing the burner from plugging while operated on either fuel for extended periods. Except as otherwise specified herein, the fuel systems and fuel safety interlocks shall consist of separate systems. A fuel change shall require a shutdown to initiate. The burner shall be so designed that the flame failure, combustion, fuel cutoff limit switches and other applicable controls shall be transferred from one fuel to the other by a single manual selector switch.

3.6.7 Small burner control system. Burners with fuel inputs of less than 12,500,000 Btu/hr (3 663 389 W) shall be furnished with a control system in accordance with the applicable requirements of ASME CSD-1. The control system shall include the boiler combustion safeguard system and safety interlocks and shall govern the prefiring, light-off, operation, and shutdown cycles. The control system shall be integrated in combination with other system components to ensure the functional integrity of the total boiler system. The control system shall prove all limits upon start up before initiating the start up sequence. The start up sequence, including the purge and ignition timing cycles, shall not be able to be bypassed manually. All nonrecycling shutdowns shall require a manual reset of the control system. All safety interlocks and limit switches, including boiler and equipment limit switches, shall be wired on the hot side of the burner limit control circuit and not in any external circuits such as the pilot or fuel valve circuits. All control circuits shall be two-wire, one side grounded, not greater than nominal 120 volts, and be protected, with suitable fuses or circuit breakers.

3.6.7.1 Additional ASME CSD-1 requirements. The safety interlock switches and limit controls required by ASME CSD-1 shall be extended to include the following additions:

a. The safety shutdown caused by loss of combustion air on gas fired burners with an input greater than 2,500,000 Btu/hr (184 635 W) shall be extended to include gas fired burners with an input of 400,000 Btu/hr (29 542 W) and greater.

b. The safety shutdown caused by high and low pressure in the gas piping of gas fired burners with an input greater than 2,500,000 Btu/hr (732 678 W) shall be extended to include gas fired burners with an input of 400,000 Btu/hr (117 228 W) and greater.

c. The required fuel gas piping safety shut off valves for gas fired burners with an input greater than 5,000,000 Btu/hr (1 465 356 W) shall be furnished with all gas fired burners with an input of 400,000 Btu/hr (117 228 W) and greater.

3.6.7.2 Small burner combustion safeguard system. Each small burner shall be provided with a standard (nonproprietary) combustion safeguard system. The system shall have a repetitive self-checking circuit in conformance with 3.6.7.3. The system shall consist of a combustion detector connected to the control system for shutdown of the burner in the event of ignition failure or flame failure during light off and operation. The burner shall not be allowed to purge and recycle after ignition failure or main flame failure without manual reset. The combustion safeguard system shall de-energize the fuel shut off valves in not greater than 4.0 seconds after a flame failure occurs. The combustion detector shall be installed so as to not respond to ignition spark, hot refractory, or the reflection of flames on atomizing media or oil spray. The combustion detector for igniter flames shall detect only flames of sufficient intensity to safely light the main burner. Flame sensing elements shall be so connected as to prevent initiation of the start up cycle if flame is present or if the safeguard system has failed in the flame sensing position. The combustion safeguard system shall be designed so that the failure of any component prevents restart of the burner after shutdown. The combustion safeguard system shall self-check automatically at the beginning of each start up cycle and not have a manual bypass of this function.

3.6.7.3 Small burner repetitive self-checking circuit. The repetitive self-checking circuit shall automatically check all components of the combustion safeguard system including the flame detector. The component check of the detector is not required if the detector is fail-safe such as lead sulfide cells or flame rods. During burner operation the self-checking circuit shall test itself at intervals not greater than 6.0 seconds. Failure of any component to respond properly during this check shall cause an immediate shutdown of the boiler.

3.6.7.4 Small burner safety interlocks and limit switches. Each programmed control shall have provisions for the connection of any safety interlock or limit controls that are required on the boiler and burner to satisfy the applicable requirements of ASME CSD-1. All nonrecycling shutdowns shall require a manual reset of the programmed control system. All safety interlocks and limit switches, including boiler and equipment limit switches, shall be wired in the hot side of the burner limit control switches and not in any external circuits such as the pilot or fuel valve circuits.

3.6.7.5 Small burner control panel. The electrical control elements and indicators including operating switches, indicating lights, gages, alarms. motor starters, fuses, and control circuitry shall be mounted on a single control panel or free standing cabinet designed to be separately mounted away from the burner. The control panel or cabinet or the individual elements shall be mounted on a solid base and provided with enclosures conforming to NEMA ICS 6 type 12. The location of the panel shall be at the side of the boiler or in a remote, free standing control cabinet for mounting as specified (see 6.2). Terminal connections for control functions shall be segregated from power circuit terminals. Switches shall include burner start, fuel selection, manual-automatic combustion control, and fuel oil trim heater, as applicable. The indicating lights

of 3.6.7.6 and the status of other boiler functions normally supplied shall be mounted of the control panel. An audible alarm shall be not less than 10 decibels on the A weighted scale (dBA) above the ambient sound level specified (see 3.12).

3.6.7.6 Small burner indicating lights and alarms. The small burner control system shall, as a minimum, indicate the following occurrences with an indicating light. An audible alarm (see 3.6.7.5 and 3.12) shall also be activated if a shutdown caused by a safety interlock switch or limit control occurs (see 6.2).

a. Activation of power on.

b. Draft fan operation.

c. Pre-ignition purge cycle.

d. Trial for pilot ignition.

e. Detection of main flame.

f. Operating under automatic control.

g. Safety interlock switch.

3.6.8 Large burner control system. Burners with fuel inputs of greater than 12,500,000 Btu/hr (3 663 389 W) shall comply with the applicable requirements of NFPA 8501. The control sequence shall include the applicable boiler initiated fuel cutoff limit switches as required by NFPA 8501. The programmed control system shall include the boiler combustion safeguard system and safety interlocks and shall govern the preferring, light-off, operation, and shutdown cycles. The programmed control system shall be integrated in combination with other system components to ensure the functional integrity of the total boiler system. The programmed control system shall prove all limits upon start up before initiating the start up sequence. The start up sequence, including the purge and ignition timing cycles, shall not be able to be bypassed manually. Cam type programmers that can be manually advanced shall not furnished.

3.6.8.1 Large burner combustion safeguard system. Each large burner shall be provided with a standard (nonproprietary) combustion safeguard system. The system shall have a repetitive self-checking circuit in conformance with 3.6.8.2. The system shall consist of a combustion detector connected to the programming control system for shutdown of the burner in the event of ignition failure or flame failure during light off and operation. The burner shall not be allowed to purge and recycle after ignition failure or main flame failure without manual reset. The combustion safeguard system shall de-energize the fuel shut off valves in not greater than 4.0 seconds after a flame failure occurs. The combustion detector shall be installed so as to not respond to ignition spark, hot refractory, or the reflection of flames on atomizing media or oil spray. The combustion detector for igniter flames shall detect only flames of sufficient intensity to safely light the main burner. Flame sensing elements shall be so connected as to prevent initiation of the start up cycle

if flame is present or if the safeguard system has failed in the flame sensing position. The combustion safeguard system shall be designed so that the failure of any component prevents restart of the burner after shutdown. The combustion safeguard system shall self-check automatically at the beginning of each start up cycle and not have a manual bypass of this function.

3.6.8.2 Large burner repetitive self-checking circuit. The repetitive self-checking circuit shall automatically check all components of the combustion safeguard system including the flame detector. The component check of the detector is not required if the detector is fail-safe such as lead sulfide cells or flame rods. During burner operation the self-checking circuit shall test itself at intervals not greater than 6 seconds. Failure of any component to respond properly during this check shall cause an immediate shutdown of the boiler.

3.6.8.3 Large burner safety interlocks and limit switches. Each programmed control shall have provisions for the connection of any safety interlock switches or limit controls that are required on the boiler to satisfy the applicable requirements of NFPA 8501. All nonrecycling shutdowns shall require a manual reset of the programmed control system. All safety interlocks and limit switches, including boiler and equipment limit switches, shall be wired on the hot side of the burner limit control circuit and not in any external circuits such as the pilot or fuel valve circuits.

3.6.8.4 Large burner control panel. The electrical control elements and indicators including operating switches, indicating lights, gages, alarms, motor starters, fuses, and control circuitry shall be mounted on a single control panel or free standing cabinet designed to be separately mounted away from the burner. The control panel or cabinet or the individual elements shall be mounted on a solid base and provided with enclosures conforming to NEMA ICS 6 type 12. The location of the panel shall be at the side of the boiler or in a remote, free-standing control cabinet for mounting as specified (see 6.2). Terminal connections for control functions shall be segregated from power circuit terminals. Switches shall include burner start, fuel selection, manual-automatic combustion control, and fuel oil trim heater, as applicable. The indicating lights of 3.6.8.6 and the status of other boiler functions normally supplied shall be mounted on the control panel. An audible alarm shall be not less than 10 decibels on the A weighted scale (dBA) above the ambient sound level specified (see 6.2).

3.6.8.5 Large burner draft fan. The draft fan shall be for a pressurized system and shall be compatible with the burner. Oil reservoirs shall be equipped with an oil level sight glass and drain. The draft fan shall provide sufficient air to allow the boiler to meet the specified performance requirements. Adequate margin shall be included in the fan selection or design for maximum burner pressure drop, furnace pressure loss, combustion air temperature, and plant elevation.

3.6.8.6 Large burner indicating lights and alarms. The large burner programming control system shall, as a minimum, indicate the following occurrences with an indicating light. An audible alarm shall also be activated if a shutdown caused by a safety interlock switch or limit control occurs. Additional indicating lights shall also be as specified (see 6.2).

a. Activation of power on or start of blower motor.

b. Draft fan operation.

c. Pre-ignition purge cycle.

d. Trial for pilot ignition.

e. Detection of main flame.

f. Operating under automatic control.

g. Safety interlock switch or limit control shutdown.

3.6.8.7 Large burner electrical requirements. Electrical wiring design practices shall be in accordance with the applicable requirements of NFPA 70. The large burner and associated equipment shall obtain power from a circuit with a single master manual service disconnect switch and automatic circuit breaker for all boiler electrical equipment. All control circuits shall be two-wire, one side grounded, not greater than nominal 120 volts, and be protected with suitable fuses or circuit breakers. Motors shall be in accordance with the provisions of NEMA MG 1, shall be totally enclosed fan cooled and designed for operation on the voltage, phase, and frequency as specified (see 6.2). Unless otherwise specified (see 6.2), motors of 100 horsepower (74 600 W) and less shall be provided with magnetic across-the-line starters and overload protection. Motors over 100 horsepower (74 600 W) shall have reduced voltage starting. Motor starters shall conform to the requirements of NEMA ICS 1 and ICS 2. Motor starters and controls shall be enclosed in NEMA ICS 6 type 12 enclosures and may be installed in the control panel cabinet of 3.6.8.4.

3.6.9 Annunciator. When specified (see 6.2), a separate annunciator shall be provided with the control panel. Unless otherwise specified (see 6.2), the annunciator shall indicate all alarm conditions and nonrecycling burner shutdowns required in 3.6.7 and 3.6.7.4 for small burners or 3.6.8 and 3.6.8.6 for large burners. The annunciator shall sound an audible alarm as described in 3.6.7.4 and 3.6.8.6. The annunciator shall also have a manual reset button and the capability to indicate the first cause of a boiler shutdown. The annunciator shall not require special or additional limit devices, or change the sensitivity of limit switches, or annunciate without the limit device being actuated.

3.6.10 Combustion control systems. The combustion control system shall automatically regulate the firing cycle in accordance with the local demand. Small burners shall be provided with the combustion control system described in 3.6.10.1 through 3.6.10.3 as specified (see 6.2). The large burners shall be provided with the combustion control system described in 3.6.10.1 through 3.6.10.5 as specified (see 6.1.1 and 6.2). The combustion control system shall maintain an air-to-fuel mixture within the limits required for stable and efficient combustion throughout the required firing range and, as applicable, during changes in firing rates. The continuous maximum firing rate shall be as required to maintain the maximum boiler thermal capacity required in 3.7.1. The

combustion control system shall maintain the load within the following tolerance limits expressed as a percent of the set point values of the operating control. The percentage tolerances shall not be applied in a manner that would permit the high-fire input of the burner to be increased beyond the maximum rated input marked on the boiler assembly:

a. On-Off ± 6 percent of full scale.

b. High-Low-Off ± 5 percent of full scale.

c. Positioning ± 3 percent of full scale.

d. Metering ± 3 percent of full scale.

3.6.10.1 Fixed rate, on-off control. The fixed rate, on-off control system shall operate in response to load demand to cycle the burner on and off. A fixed relationship shall exist between the volume of air and fuel admitted to the burner. The air flow control damper shall be manually adjustable to permit changing of the air-to-fuel ratio when required by firing conditions. After the main flame is proven, units with on-off controls shall continue to fire until the load demand is satisfied.

3.6.10.2 Three position high-low-off control. The three position high-low-off control system shall automatically adjust the flow of the fuel and air to the burner, as required, to provide either a high or low firing rate in accordance with the load demand. The continuous high firing rate shall be as necessary to maintain the maximum boiler thermal capacity required in 3.7.1. The continuous low firing rate shall be as specified (see 6.2), but shall be not less than 33 percent of the continuous high firing rate.

3.6.10.3 Single point positioning control. The single point positioning control system shall permit the volumes of air and fuel delivered to the burner to be varied simultaneously and gradually in accordance with the load demand while maintaining the proper air-to-fuel ratio. Fuel flow rates shall be varied to the rate of air flow to maintain the proper air-to-fuel ratio. The air-to-fuel ratio shall be variable over the range of operation using an adjustable direct positioning mechanism such as a cam on the control valve linkages. Stable burner operation shall exist when the continuous firing rate is from 33 percent to 100 percent of the maximum required firing rate. The turndown of the burner shall be made during the normal firing cycle without interruption or change of burner components. An option for manual control shall be provided that allows a smooth transition between manual and automatic control.

3.6.10.4 Parallel positioning control. The parallel positioning control with air-to-fuel ratio control shall include a master proportional controller which shall be connected to the load to sense the changes in load. The output of the controller shall transmit a signal simultaneously to the forced-draft damper and fuel valve operators. A separate ratio-adjustment controller which has been calibrated for the system to prevent a fuel-rich mixture, shall be utilized in the line to the fuel valve and shall vary the signal for the fuel flow proportionally to the air flow. This action shall change the fuel flow to establish the optimum air-to-fuel ratio. A separate ratio-adjustment

controller shall be used for each fuel. The parallel positioning control shall be capable of offsetting variations in pressure-drop characteristics in final control elements, fuel viscosity, air temperature, or barometric pressure. Stable burner operation shall exist when the continuous firing rate is from 25 percent to 100 percent of the maximum required firing rate. The turndown of the burner firing rate shall be made during the normal firing cycle without interruption or change of burner components. A capability for manual control shall be provided that allows a smooth transition between manual and automatic control. All controller adjustment and calibrations of fuel feed and air flow shall be made at the front of the control cabinet or panel, with flush-mounted indicators provided to show adjustments and the results.

3.6.10.5 Metering control. The metering control system shall provide adequate means for automatic regulation of both fuel feed and air flow rates at the same time when a change in firing rate is initiated by the master controller. Actual rate of fuel and air flows shall be measured, and the signals linearized through signal processors that increase control system accuracy at low loads. The simultaneous modulation of the signals shall minimize the effects of surging, slugging, barometric conditions, pressure and air-to-fuel ratio over the entire operating range. Stable burner operation shall exist when the continuous firing rate is from 25 percent to 100 percent of the maximum required firing rate. The turndown of the burner firing rate shall be made during the normal firing cycle without interruption or change of burner components. All controller adjustments and calibrations of fuel feed, air flow, air-to-fuel ratio, and furnace draft or pressure shall be made at the front of the control and instrument panel with flush-mounted indicators provided to show the degree of adjustment. The metering system shall provide smooth operation when switching between automatic and manual operation. The metering system shall provide high-low limiting capability as follows:

a. On an increase in firing rate, the combustion air shall increase simultaneously with, or before, the burner fuel flow.

b. On a decrease in firing rate, fuel flow shall be reduced simultaneously with, or before, air flow.

c. Lack of combustion air due to fan stoppage and improper damper operation shall cause fuel flow to be reduced immediately to prevent a fuel-rich condition.

3.6.10.6 Oxygen compensation system. When specified (see 6.1.1 and 6.2), an oxygen compensation system or trim shall be provided with the modulating combustion control systems specified in 3.6.10.3, 3.6.10.4, or 3.6.10.5. The oxygen analyzer shall provide a feedback signal to the air-to-fuel ratio control system to maintain an adjustable preset percentage of excess oxygen in the flue gas. The controlling system shall be able to adjust the gain and offset of the feedback signal. Adequate safeguards shall be provided with the oxygen compensation control to prevent the oxygen compensation system from demanding a fuel rich mixture.

3.6.10.6.1 Oxygen compensation system with unburned combustible gas analyzer. When specified (see 6.1.1 and 6.2), the oxygen compensation system required in 3.6.10.6 shall be furnished with an unburned combustible gas analyzer. The unburned combustible gas analyzer

shall measure the concentration of carbon monoxide or hydrogen as specified (see 6.2), to determine the minimum level of oxygen required and transmit a corrective signal to the combustion control system. The unburned combustible gas analyzer shall be able to operate with oxygen present in the flue gas. The unburned combustible gas analyzer shall also be used to prevent the combustion control system from demanding a fuel rich mixture. An adjustable setpoint on the analyzer shall initiate an alarm and shall cause an immediate increase of the air to fuel ratio. The air-to-fuel ratio shall remain higher until the alarm condition no longer exists. The increase in the air demand signal during an alarm condition shall be not greater than 15 percent of the control position.

3.7 Performance. The thermal performance of the burner shall be based upon the ability of the boiler to produce the required thermal output when the burner is fired using the fuel specified in 3.6.1. Operation of the burner equipment shall be performed to the requirements of this specification.

3.7.1 Thermal capacity. The maximum thermal output requirement of the packaged boiler that the burner is to be installed in shall be as specified (see 6.2). The thermal capacity of the burner shall be sufficient to provide the required percentage of maximum boiler thermal capacity as described below.

3.7.1.1 Packaged boilers not fired in combination with coal. The burner for a packaged boiler fired on only gas, oil, or a combination of gas and oil shall be able to provide 100 percent of the maximum required boiler thermal output capacity.

3.7.1.2 Packaged boilers fired in combination with coal. The burner for a packaged boiler to be fired simultaneously on a combination of coal and either gas, oil, or a combination of gas and oil shall be able to provide the percentage of the maximum required boiler thermal output capacity as specified (see 6.2).

3.8 Cleaning. treatment. and painting. Bare steel surfaces shall be cleaned and a primer coat applied. Paint shall be applied to normally painted surfaces in good commercial practice.

3.9 Identification marking. Identification shall be permanently and legibly marked directly on the burner or on a corrosion-resistant metal plate. Identification shall include manufacturer's name, burner model and serial number, and year of manufacture. The Department of Defense contract number that this equipment is procured under shall also be marked on the burner or identification plate.

3.10 Spare parts. When specified (see 6.2), spare parts shall be furnished and shipped with each burner. When furnished, the spare parts required and the quantity thereof shall be as specified (see 6.2).

3.11 Factory start-up service. Unless otherwise specified (see 6.2), factory authorized service personnel shall be provided to supervise installation and start up of the burner for two 8-hour working days.

3.12 Environmental requirements. The emission requirements shall be met at the maximum required continuous output. The burner shall meet environmental rules and regulations. Possible emission requirements to be considered are opacity, particulate, oxides of nitrogen, sulfur dioxide, and carbon monoxide. Other emission requirements may be imposed. When specified (see 6.2), sound levels shall be not greater than 85 DBA when measured 4.5 feet (1.5 m) above the floor and 3 feet (1 m) horizontally from each surface of the smallest imaginary rectangular box which could completely enclose the entire unit which contains the sound source. Sound level limitations apply to the operation of the equipment at all loads within the equipment requirements. Sound level limitations apply to all burners, fans, blowers, pumps, compressors, control valves, pressure reducing valves, motors, turbines. Tests will be performed using a standard sound level meter on the "A" scale, slow response. At the option and expense of the procuring agency, a testing company may be employed to conduct tests using methods conforming ANSI S1.13. If sound levels exceed requirements, modify or replace the equipment as necessary to achieve required sound levels and other specified requirements.

a. Submit all proposed modifications or replacements for review prior to starting the work.
b. After completing the work, provide complete retest of equipment operation.

3.13 Workmanship. Workmanship shall be of such quality as to produce burners that meet the requirements of this specification and standards prevailing among manufacturers who normally produce this type of equipment.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract, 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 of the inspections set forth in the specification, where such inspections are deemed necessary to ensure that 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 document shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in this document shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

a. Quality conformance inspection (see 4.2.1).

b. On-site inspection (see 4.2.2).

4.2.1 Quality conformance inspection. This inspection shall be performed at the manufacturer's facilities. Unless otherwise specified (see 6.2), the quality conformance inspection shall include the examination of 4.3 and the test of 4.4.

4.2.2 On-site inspection. The on-site inspection shall be in addition to the quality conformance inspection performed at the manufacturer's facilities. Unless otherwise specified (see 6.2), on-site tests shall consist of the tests of 4.5. When specified by the contracting officer (see 6.2), all or part of the on-site inspection may be performed at the manufacturer's facilities.

4.3 Examination. Each burner and related equipment supplied under this specification shall be examined for compliance with the requirements specified in section 3 of this specification. Any redesign or modification of the contractor's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet specified requirements shall receive particular attention for adequacy and suitability.

4.4 Fuel system pressure test. The preassembled fuel system piping furnished integrally with the burner shall be checked for leakage. The fuel system piping shall be hydrostatically tested, or as an alternate, air may be used. The test shall run for 30 minutes at 1.5 times the maximum operating pressure without leakage.

4.5 On-site tests. Operational fire tests and auxiliary equipment tests shall be performed on each installed burner during the performance testing of the boiler it is installed on. The performance of the boiler shall be evaluated in accordance with the abbreviated efficiency test of ASME PTC 4.1 using the heat loss method. These tests shall be in addition to any manufacturer's standard fire test procedure, unless evidence of compliance provided by the burner manufacturer is accepted at the discretion of the contracting officer or his authorized representative. Acceptable fire test results from identical or similar burner equipment installed at the same site may be used at the discretion of the contracting officer as proof that equipment procured with this specification is in compliance with one or more of the tests of 4.5.1 through 4.5.8.

4.5.1 Operational fire tests. Each burner shall demonstrate control and operational conformance to the requirements of this specification under varying load conditions that range from the maximum required capacity to the minimum required capacity without on-off cycling. Burner capacity shall be adequate if the boiler it is installed in is able to meet the maximum thermal capacity and efficiency requirements. Oil fired burners shall be tested for the ability to cold start at the specified oil temperature (see 3.6.1) in accordance with the manufacturer's instructions. Burners that exhibit (1) excessive or unexplained loss of ignition, (2) nuisance shutdown due to faulty burner or control operation, (3) improper flame, (4) excessive carbon deposits, or

(5) necessity for frequent or difficult adjustments shall be rejected.

4.5.2 Sequencing. The burner shall start, operate, and stop in strict accordance with the specified operating sequence of the applicable requirements of ASME CSD-1 or NFPA 8501.

4.5.3 Flame failure. The operation of the flame failure control shall be verified by simulated flame and ignition failures. The igniter establishing period, the main-burner establishing period, flame-failure reaction time, and the safety-shutoff valve closing times shall be verified by stop watch.

4.5.4 Hot refractory test of combustion safeguard system. The installed burner shall be operated at high fire until the furnace attains steady state condition. The main fuel valve shall then be closed manually. The combustion safeguard shall drop out causing the safety shutoff valves to close within the specified flame-failure reaction time.

4.5.5 Minimum igniter test of combustion safeguard system. The fuel supply to the igniter flame shall be gradually reduced to the point where the combustion safeguard begins to drop out (sense "no flame") but holds in until the main fuel valve opens. At this point of reduced igniter fuel supply, the igniter flame shall be capable of safely igniting the main burner. If a small igniter flame can be maintained that satisfies the combustion safeguard system but is insufficient to safely light the main burner, the burner shall be rejected.

4.5.6 Spark rejection test. With the fuel supply to both the igniter and main flame closed, the ignition cycle shall be initiated. When the spark ignition comes on, the flame detector shall not be activated. If the flame detector can be activated, the burner shall be rejected.

4.5.7 Combustion controls. The accuracy range and smoothness of operation of the combustion controls shall be demonstrated by varying the load demand through the entire specified firing range, and in case of on-off controls, by further varying the load to require on-off cycling. The control accuracy shall be as specified in 3.6.10. The transfer of control from automatic to manual and from manual to automatic shall be performed on the overall system and independently performed on each automatic and manual subsystem. This transfer shall be smooth without the need for special adjustments to trim the combustion control devices. The air-to-fuel ratio controller shall be tested attempting to create a fuel rich operating condition below the manufacturer's pre-set limit.

4.5.8 Equipment tests. Control panels, annunciators, trim heaters, fuel pumps, air compressors, electric motors, and other burner related equipment shall be operated as part of the operational fire-test. The operation of this equipment shall be closely observed during the operational tests for possible defects or nonconformance. The action of mechanical devices shall be smooth without backlash.

5. PACKAGING

5.1 Packaging requirements. The preservation, packing, and marking shall be as specified by the contract or order.

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 burners covered by this specification are intended for use in packaged steam boilers or hot water generators. The burner class should be determined in accordance with the availability or economics of the fuel supply and the intended application. Multi-fuel burners should be specified in order to ensure economic and reliable operation within the constraints of fuel availability and applicable environmental regulations.

6.1.1 Selection factors. Selection factors and the best choice of options will vary depending on the size of the boiler that the burner is to be installed in. A spare burner should not be procured without knowing the specific boiler that it is intended to be used in. Variable fuel composition and boiler configuration information needed when specifying a burner must be known. The following boiler sizes are listed for decision purposes: size 2 boilers are defined as having a thermal output capacity between 320,001 and 10,000,000 Btu/hr (93 783 and 2 930 711 W); size 3 boilers are defined as having a thermal output capacity between 10,000,001 and 35,000,000 Btu/hr (2 930 712 and 10 257 489 W); size 4 boilers are defined as having a thermal output capacity between 35,000,001 and 125,000,000 Btu/hr (10 257 490 and 36 633 888 W). The following items should be considered in the selection of the burner and the exercise of options herein:

a. Size 2 and larger heavy oil fired boilers are usually capable of burning fuel oil grades no. 2, no. 4, no. 5 and no. 6 without difficulty. The pump and motor drive selected for each burner should be sized based on firing all fuel grades to be used (see 3.1).

b. This specification can be used for replacement or conversion installations to specify the procurement requirements for the burner. However, it should remain the responsibility of the contractor who is performing the boiler modifications to make the retrofitted boiler operate satisfactorily (see 3.1).

c. The break between ASME CSD-1 and NFPA 8501 requirements is at 12,500,000 Btu/hr (3 663 389 W) input firing rate. This corresponds to 10,000,000 Btu/hr (2 930 711 W) output boiler with an 80-percent thermal efficiency. Therefore, the break between ASME CSD-1 and NFPA 8501 requirements is about the same as the break between size 2 and size 3 boilers (see 3.3).

d. Propane is the preferred alternate pilot fuel compared to light oil. Oil igniters with direct spark ignition should be used only where natural gas or propane is unobtainable or

unfeasible (see 3.6.2).

e. Steam atomization is recommended only for boilers operating at greater than 100 pounds per square inch gage (689 kilopascals (gage)) pressure (see 3.6.4.1.1).

f. When No. 5 and no. 6 oil is to be fired, the burner should be provided with a preheater to reduce the oil viscosity. Preheaters are sometimes required for oil burners firing no. 4 oil (see 3.6.4.5).

g. The selection of a combustion control system should be based on anticipated fuel savings from the increased boiler efficiency. An approximate guideline for selection of a combustion control system is: Size 2 boilers can either be on-off, high-low-off, or positioning, size 3 boilers should be positioning, and size 4 boilers should be modulating or parallel metering (see 3.6.10).

h. Burner turndown ratios higher than those required for the combustion controls should not be specified. Pressure atomizing burners are usually limited to a minimum firing rate of 33 percent of the maximum firing rate and are generally used for size 2 or size 3 boilers fired on light oil. Most air atomizing burners equipped with modulating controls have minimum firing rates of 20 to 25 percent of the maximum firing rates. Size 3 and 4 boilers can be readily obtained with minimum firing rates of 20 percent of the maximum firing rate. In general, burner turndown ratios can only be controlled by controlling the excess air and this should change with alternate fuels (see 3.6.10).

i. The cost of flue gas analyzers for oxygen and unburned combustibles should be justified based on the anticipated fuel savings they should produce. They tend to be more economic on larger boilers with constantly changing loads and fuel quality and should be used only on size 3 or size 4 boilers. Typical excess air on a boiler without analyzers is from 10 to 25 percent. An oxygen compensator will reduce excess air to between 3 and 5 percent. A combination oxygen and carbon monoxide analyzer may reduce excess air up to between 1.5 to 5 percent (see 3.6.10.6 and 3.6.10.6.1).

j. Fungus resistant varnish conforming to MIL-V-173 should be used to coat electrical components and circuit elements, including terminal and circuit connections, when the boiler is to be installed in humid conditions. Components and elements inherently inert to fungi or in hermetically sealed enclosures or current carrying contact surfaces should not be coated.

k. Electromagnetic interference suppression (EMI), when required, should conform to the EMI suppression requirements and test limits for Class C3, Group I equipment as specified in MIL-STD-461. The boiler should be subjected to tests to determine conformance in accordance with MIL-STD-462.

6.1.2 Other fuels. The performance requirements specified herein may be based on other fuels providing the quantity on-site is sufficient for testing specified in section 4 and a guaranteed

ultimate analysis and higher heat content available at time of testing the burners. Corrections between the values of the analysis in section 3 of this specification and the guaranteed analysis and heating value should be made in accordance with ASME PTC-4.1. Referenced below are some of the most commonly used gas fuels with their average specific gravity and higher heat content:

Fuel	Average specific gravity	Average higher heat content
Natural gas	0.65	1,075 Btu/ft^3 (1 220 kJ/m^3)
Manufactured gases	0.38	535 Btu/ft^3 (607 kJ/m^3)
Mixed gas	0.50	800 Btu/ft^3 (908 kJ/m^3)
Liquefied petroleum gas	1.66	2,500 Btu/ft^3 (2 837 kJ/m^3)

6.2. Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Class and style of burner required (see 1.2).
c. Whether the burner is part of a new packaged boiler or a replacement or conversion on an existing boiler (see 3.1).
d. Fuel characteristics for fuel oil, if other than as specified (see 3.6.1).
e. Grade of fuel oil and fuel oil supply temperature when oil fired burners are required (see 3.6.1).
f. Fuel gas supply pressure, when gas burners are required (see 3.6.1).
g. Fuel characteristics for fuel gas, if other than as specified (see 3.6.1).
h. Pilot fuel or fuels for ignition system (see 3.6.2).
i. Installation site characteristics (see 3.6.3):
   (1) Site elevation in feet above sea level.
   (2) Anticipated maximum, minimum, and average ambient air temperature in °F (°C).
j. Type of fuel atomization system required (see 3.6.4.1).
k. When the necessary cold start piping and a cold start air compressor or auxiliary fuel pump is to be provided, if the fuel oil atomization system is of the steam atomization type (see 3.6.4.1.1).
l. When an air compressor system is required, if the fuel atomization system is of the air atomization type (see 3.6.4.1.3).
m. When a fuel oil pump is not required (see 3.6.4.2).
n. Fuel oil pressure to be available at the suction of the pump, when an oil pump is required (see 3.6.4.2).
o. When an auxiliary electric trim heater is required (see 3.6.4.5).
p. Location of control panel (see 3.6.7.5 and 3.6.8.4).
q. Audible alarm to be activated if a shutdown caused by a safety interlock switch or limit control occurs (see 3.6.7.6).
r. Ambient sound level (see 3.6.8.4).
s. Additional indicating lights required (see 3.6.8.6).
t. Required voltage, phase, and frequency for operation of motors (see 3.6.8.7).
u. When motors of 100 horsepower (74,600 W) and less are not to be provided with

magnetic across-the-line starters and overload protection (see 3.6.8.7).

v. When a separate annunciator is required (see 3.6.9).
w. When the separate annunciator, if provided, is to indicate conditions other than as specified (see 3.6.9).
x. Type of combustion control system required (see 3.6.10).
y. Continuous low firing rate required when a three position high-low-off combustion control system is provided (see 3.6.10.2).
z. When modulating combustion control is to be provided with an oxygen compensation system (see 3.6.10.6).
aa. When the oxygen compensation system, when provided, is to be furnished with an unburned combustible gas analyzer (see 3.6.10.6.1).
bb. Whether the unburned combustion analyzer, when furnished, is to measure the concentration of carbon monoxide or hydrogen (see 3.6.10.6.1).
cc. Maximum thermal output capacity of the boiler into which the burner is to be installed (see 3.7.1).
dd. Percentage of the maximum required boiler thermal output capacity that the burner fired simultaneously on a combination of coal and either gas, oil, or a combination of gas and oil is to provide (see 3.7.1.2).
ee. When spare parts are required, and when spare parts are required, the description and quantity of spare parts required (see 3.10).
ff. When provisions for factory authorized service personnel are other than as specified (see 3.11).
gg. When sound levels of not greater than 85 DBA as specified is required. (see 3.12)
hh. Quality conformance inspection, if other than as specified (see 4.2.1).
ii. On-site tests, if other than as specified (see 4.2.2).
jj. When all or part of the on-site inspection may be performed at the manufacturer's facilities (see 4.2.2).

6.3 Compliance. Prior to approval of shipment, the contractor should submit to the contracting officer or authorized representative satisfactory evidence that the proposed burner to be furnished under this specification meets the applicable requirements of the ASME CSD-1, NFPA 70, NFPA 8501, UL 296, UL 795, or FM.

6.3.1 ASME CSD-1 requirements. Acceptable evidence of meeting the requirements of the ASME CSD-1 should be the receipt of the manufacturer’s certificate of compliance, stating the equipment procured with this specification is in accordance with the applicable provisions of ASME CSD-1.

6.3.2 NFPA requirements. Acceptable evidence of meeting the requirements of NFPA 70 and NFPA 8501 is the receipt of the manufacturer’s certificate of compliance stating the equipment procured with this specification is in accordance with the applicable requirements of NFPA 70 and NFPA 8501.

6.3.3 UL requirements. Acceptable evidence of meeting the requirements of UL 353 is the certification symbol, or listing mark on the products, or a certified test report from a recognized

independent testing laboratory indicating the boiler controls have been tested and conforms to UL requirements.

6.3.4 FM requirements. Acceptable evidence of meeting the requirements of the FM approval Guide should be an FM listing or certification symbol or label, or a certified test report from a recognized independent testing laboratory indicating that the components have been tested and conform to FM requirements.

6.3.5 Large burner control panel. When a remote, free-standing mounted control cabinet is to be furnished, skid wiring or tubing should terminate in a skid mounted junction box and installation instructions covering the connection of the control panel should be provided (see 3.6.8.4).

6.3.6 Technical manuals. The manufacturer should provide two commercial technical manuals normally prepared and supplied with the boiler. Technical manuals should specify a parts list and part number for the equipment issued.

6.3.7 Burner tips. The contractor should provide an extra burner tip for each burner based on the fuel to be fired.

6.4 Definitions. Definitions used in this specification are in accordance with the ABMA Lexicon of Boiler and Auxiliary Equipment. Other terms used in this specification should be interpreted in accordance with the referenced national standards.

6.4.1 Replacement. A burner replacement is defined as the simple replacement of existing equipment without changing the fuel, thermal heat duty, or air pollution emissions (see 3.1).

6.4.2 Conversion. A burner conversion is defined as the replacement of existing equipment to change the type of fuel used, the thermal heat duty, the boiler air pollution emissions, or other significant operating variable (see 3.1).

6.5 Supersession data. This specification replaces Military Specification MIL-B-18796F dated 12 July 1990.

6.6 Part or Identifying Numbers (PINs). The specification number and class are combined to form PINs for burner units covered by this document (see 1.2). PINs for the burner units are established as follows:

FB2910 X

Federal Specification No. _____

Class _____

6.6.1 Class. The class of units (see 1.2) is identified by a single numerical character (see table I).

TABLE I. Code number to class.

Class	Code
1	1
2	2
3	3
4	4
5	5

6.7 Subject term (key word) listing.

Combination oil and gas fired
Gas fired
Oil fired

MILITARY INTERESTS:

Custodians:
Army - CE
Navy - YD1
Air Force - 99

Review Activities:
Navy - MC
Air Force - 84
DLA-CC

CIVIL AGENCY COORDINATING ACTIVITY:

GSA-FSS

Preparing Activity:
Navy - YD1

(Project 4530-0007)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing ac ty must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** F-B-2910	**2. DOCUMENT DATE (YYMMDD)** **980331**

3. DOCUMENT TITLE
BURNERS, SINGLE: OIL, GAS, AND GAS-OIL COMBINATION FOR PACKAGED BOILERS (320,001 TO 125,000,000 BTU/HR THERMAL OUTPUT CAPACITY)

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON *(if applicable)*	**7.DATE SUBMITTED** (YYMMDD)

8. PREPARING ACTIVITY

a. NAME DANNY MUI	b. TELEPHONE *Include Area Code)* (1) Commercial (805) 982-5666 (2) AUTOVON 551-5666
c. ADDRESS *(Include Zip Code)* COMMANDING OFFICER, NCBC CODE 15E2G 1000 23RD AVENUE PORT HUENEME, CA 93043-4301	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** DEFENSE QUALITY AND STANDARDIZATION OFFICE 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22401-3466 Telephone (703) 756-2340 AUTOVON 289-2340