
USACE / NAVFAC / AFCEA UFGS-11171 (August 2004)

Preparing Activity: NAVFAC Superseding
UFGS-11171N (August 2001)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated 22 December 2004

Latest change indicated by CHG tgs

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11171

PACKAGED INCINERATORS

08/04

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
 - 1.2.1 Waste Type
 - 1.2.1.1 Type 0, Trash
 - 1.2.1.2 Type 1, Rubbish
 - 1.2.1.3 Type 2, Refuse
 - 1.2.1.4 Type 3, Garbage
 - 1.2.1.5 Type 4, Pathological
 - 1.2.1.6 Type 5, Classified
- 1.3 SUBMITTALS
- 1.4 SPECIAL TOOLS

PART 2 PRODUCTS

- 2.1 INCINERATOR (MANUFACTURED UNITS)
- 2.2 CAPACITY
- 2.3 INCINERATION OF CLASSIFIED MATERIAL
- 2.4 STACK EMISSIONS
- 2.5 NOISE LEVEL
- 2.6 ELECTROMAGNETIC INTERFERENCE CONTROL
- 2.7 PRIMARY AND SECONDARY CHAMBERS
 - 2.7.1 Primary Chamber
 - 2.7.1.1 Insulation
 - 2.7.1.2 Refractory
 - 2.7.1.3 Doors
 - 2.7.1.4 Observation Ports
 - 2.7.1.5 Test Holes
 - 2.7.1.6 Solid Hearth
 - 2.7.1.7 Draft Equipment
 - 2.7.2 Secondary Chamber
- 2.8 BURNERS
- 2.9 CONTROLS AND INSTRUMENTS

- 2.9.1 Control Panel
- 2.9.2 Draft Gages
- 2.9.3 Pressure Gages
- 2.9.4 Thermocouples
- 2.9.5 Emissions Monitoring Instrumentation
- 2.10 STACK
- 2.11 CONNECTORS
- 2.12 CHARGING METHOD
 - 2.12.1 FIRING TOOLS

PART 3 EXECUTION

- 3.1 EQUIPMENT INSTALLATION
- 3.2 UTILITY SERVICES CONNECTIONS
- 3.3 FOUNDATION
- 3.4 FUEL SUPPLY
- 3.5 STACK SUPPORT
- 3.6 LUBRICATION
- 3.7 TREATMENT AND PAINTING
- 3.8 IDENTIFICATION
- 3.9 FIELD QUALITY CONTROL
 - 3.9.1 General
 - 3.9.2 Tests
 - 3.9.2.1 Fuel Systems
 - 3.9.2.2 Performance
 - 3.9.2.3 Control
 - 3.9.2.4 Shell Temperature

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA UFGS-11171 (August 2004)

Preparing Activity: NAVFAC Superseding
UFGS-11171N (August 2001)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 22 December 2004

Latest change indicated by CHG tgs

SECTION 11171

PACKAGED INCINERATORS 08/04

NOTE: This guide specification covers the requirements for furnishing, installing, adjusting, and testing of a packaged incinerator of the controlled air type complete with required controls and accessories.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: The packaged incinerator is intended to burn waste materials for residential and nonresidential structures in batch burning applications. Waste includes combustible material, rubbish, garbage, pathological waste, and classified materials.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is

**recommended for projects based on older guide
specifications.**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 210 (1999) Laboratory Methods of Testing Fans
for Aerodynamic Performance Rating

AMCA 99 (1999; R 2003) Standards Handbook

ASME INTERNATIONAL (ASME)

ASME B40.1 (1991) Gauges - Pressure Indicating Dial
Type - Elastic Element

ASTM INTERNATIONAL (ASTM)

ASTM A 319 (1971; R 2001) Gray Iron Castings for
Elevated Temperatures for Non-Pressure
Containing Parts

ASTM A 36/A 36M (2004) Carbon Structural Steel

ASTM A 569/A 569M (1998) Steel, Carbon (0.15 Maximum
Percent), Hot-Rolled Sheet and Strip,
Commercial

ASTM C 195 (2000) Mineral Fiber Thermal Insulating
Cement

ASTM C 196 (2000) Expanded or Exfoliated Vermiculite
Thermal Insulating Cement

ASTM C 612 (2004) Mineral Fiber Block and Board
Thermal Insulation

ASTM D 396 (2004) Fuel Oils

FM GLOBAL (FM)

FM P7825 (2003) Approval Guide

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2003) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (2003) Chimneys, Fireplaces, Vents, and
Solid Fuel-Burning Appliances

NFPA 31 (2001) Installation of Oil Burning
Equipment

NFPA 54 (2002) National Fuel Gas Code
NFPA 82 (2004) Incinerators and Waste and Linen
Handling Systems and Equipment

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-15024 (Rev F) Plates, Tags and Bands for
Identification of Equipment
MIL-STD-461 (Rev E) Requirements for the Control of
Electromagnetic Interference
Characteristics of Subsystems and Equipment

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-59222 (Basic) Fans, Centrifugal, Draft, Forced
and Induced

UNDERWRITERS LABORATORIES (UL)

UL 50 (1995; Rev thru Sep 2003) Enclosures for
Electrical Equipment

1.2 DEFINITIONS

1.2.1 Waste Type

1.2.1.1 Type 0, Trash

A mixture of highly combustible waste such as paper, cardboard cartons, wood boxes, and floor sweepings from commercial and industrial activities. The mixture consists of up to 10 percent by weight plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags, and plastic or rubber scraps. This type of waste contains up to 10 percent moisture and not more than 5 percent non-combustible solids, and has a heating value of 19,805 kJ/kg 8,500 BTU per pound as fired.

1.2.1.2 Type 1, Rubbish

A mixture of combustible waste such as paper, cardboard cartons, wood scraps, foliage, and floor sweepings from domestic, commercial, and industrial activities. The mixture consists of up to 20 percent by weight restaurant waste, but contains little or no treated paper, plastic, or rubber wastes. This type of waste contains up to 25 percent moisture and not more than 10 percent incombustible solids, and has a heating value of 15,145 kJ/kg 6,500 BTU per pound as fired.

1.2.1.3 Type 2, Refuse

An approximately even mixture of rubbish and garbage by weight. This type of waste, common to apartment and residential occupancy, consists of up to 50 percent moisture and not more than 7 percent incombustible solids, and has a heating value of 10,019 kJ/kg 4,300 BTU per pound as fired.

1.2.1.4 Type 3, Garbage

Garbage such as animal and vegetable wastes from restaurants, hotels, hospitals, markets, and similar installations. This type of waste contains

up to 70 percent moisture and up to not more than 5 percent incombustible solids, and has a heating value of 5825 kJ/kg 2,500 BTU per pound as fired.

1.2.1.5 Type 4, Pathological

Human and animal remains, such as organs, animal carcasses, and solid organic wastes from hospitals, laboratories, slaughterhouses, animal pounds, and similar sources. This type of waste contains up to 85 percent moisture and not more than 5 percent incombustible solids, and has a heating value as low as 2330 kJ/kg 1,000 BTU per pound as fired.

1.2.1.6 Type 5, Classified

A mixture of highly combustible waste such as paper, plastics, or other items that have been used for intelligence purposes, or deemed sensitive to completing a sensitive mission on behalf of our National security. This mixture consists of up to 10 per cent by weight plastic bags, coated paper, laminated paper, and plastic products. This type waste has approximately zero percent moisture content and non-combustible solids, and has a heating value of 16,310 to 23,300 kJ/kg 7,000 to 10,000 BTU per pound as fired.

1.3 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment installation

SD-03 Product Data

Incinerator

Controls and instruments

SD-06 Test Reports

Instrument readings

Computations

Methods

Performance

SD-07 Certificates

Incinerator

SD-10 Operation and Maintenance Data

Incinerator, Data Package 4; G, [_____]

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.4 SPECIAL TOOLS

Equipment specified under this section requiring special tools for assembly, adjustment, setting, or maintenance thereof shall be furnished as standard accessories.

PART 2 PRODUCTS

2.1 INCINERATOR (MANUFACTURED UNITS)

NOTE: Do not use incinerators for crematory purposes without the approval of public health authorities.

Provide packaged type controlled-air incinerator capable of burning Type [_____] waste suitable for [indoor installation] [outdoor installation including totally enclosed electric motors, and corrosion and moisture protection], and equipped for [manual] [mechanical] loading and operation.

2.2 CAPACITY

Burn rate shall be not less than [_____] kg per second pounds per hour. Ash removal shall be an entire clean-out. Incinerator shall require no more than three ash clean-outs per week. Burnout and cool-down for ash removal shall be accomplished in not more than 72 hours after first ignition and in not more than 20 hours after final load addition during the weekly time period specified herein.

2.3 INCINERATION OF CLASSIFIED MATERIAL

**NOTE: Delete this paragraph if the incinerator is
not to be used for burning classified material.**

Incinerator shall reduce paper content to ash. Oxidize or melt other materials containing classified information, to prevent recovery of information for intelligence purposes. Screening ash, manual stoking, manual agitation, or opening of incinerator doors will not be allowed.

2.4 STACK EMISSIONS

**NOTE: Contact the local Environmental Protection
Agency (EPA) in the project area and insert
appropriate data.**

The incinerator shall conform to [_____] .

2.5 NOISE LEVEL

Noise level at one foot from each incinerator component shall not exceed [84] [_____] decibels, A scale.

2.6 ELECTROMAGNETIC INTERFERENCE CONTROL

**NOTE: This paragraph, electromagnetic interference
control, should be used only for projects located in
electromagnetic sensitive areas.**

Equipment shall conform to Class IIIC electromagnetic interference control and test limit requirements specified in MIL-STD-461.

2.7 PRIMARY AND SECONDARY CHAMBERS

Incinerator shall consist of a primary combustion chamber for partial burning and conversion of combustible material to gas and a secondary combustion chamber that shall consume combustible gases and entrained combustible particles. Preassemble and mount incinerator in accordance with the manufacturer's instructions. Packaged unit shall include a combustion air fan, primary and secondary burners, air distribution controls, and burner controls. Unit shall be ready for immediate mounting and ready for attachment of fuel, electrical, [and] vent [and water supply] connections. Provide lifting eyes.

2.7.1 Primary Chamber

Construct primary chamber casing of steel supported by a steel frame and provided with insulation and refractory. Casing shall be not less than 4.76 mm 3/16 inch sheet steel conforming to ASTM A 569/A 569M and reinforced to withstand internal pressures without deflection or damage to refractory or other components. Construct frame and reinforcing members of steel conforming to ASTM A 36/A 36M. Frame shall be free standing and support the weight of incinerator components, including doors, burners, breeching, stack connections, and appurtenant assemblies without binding or warping. Provide access doors and ports with seals to prevent emission of smoke or admission of significant amounts of air during incinerator operation. Primary chamber shall have no grates, ash clean-out doors, or other openings which would permit leakage of waste fluids.

2.7.1.1 Insulation

NOTE: The values for minimum thickness of insulation are in the following table:

INSULATION THICKNESS VS. CAPACITY

Capacity (grams per second)	Min. Insulation Thickness (mm)
For Walls	
Up to 63	50.80
63 to 252	63.50
For Hearths	
Indoors	
Up to 63	63.50
63 to 252	101.60
Outdoors	38.10

INSULATION THICKNESS VS. CAPACITY

Capacity (pounds per hour)	Min. Insulation Thickness (inches)
For Walls	
Up to 500	2
500 to 2,000	2 1/2
For Hearths	
Indoors	
Up to 500	2 1/2
500 to 2,000	4
Outdoors	1 1/2

Class 5 block conforming to ASTM C 612, containing no asbestos material, and of such thickness to prevent damage to the foundation due to excessive heat. Minimum insulation thickness of shall be [_____] mm inches for walls. Insulating cement shall conform to ASTM C 195 or ASTM C 196.

2.7.1.2 Refractory

NOTE: Values for minimum thickness of refractory:

REFRACTORY THICKNESS VS. CAPACITY

Capacity (grams per second)	Min. Refractory Thickness (mm)
For Walls	
Up to 63	108
63 to 252	108
For Hearths	
Indoors	
Up to 63	114
63 to 252	114
Outdoors	63.50

REFRACTORY THICKNESS VS. CAPACITY

Capacity (pounds per hour)	Min. Refractory Thickness (inches)
For Walls	
Up to 500	4 1/4
500 to 2,000	4 1/4
For Hearths	
Indoors	
Up to 500	4 1/2
500 to 2,000	4 1/2
Outdoors	2 1/2

Heat-resistant non-asbestos containing clay, plastic or castable type. Minimum thickness shall be [_____] mm inches for walls and [_____] mm inches for hearths. Attach refractory walls to casing with alloy steel or refractory anchors to form a monolithic structure which will resist heat and support walls with a safety factor of 4.

2.7.1.3 Doors

NOTE: Require locks and keys only for incinerators that burn classified material.

Provide doors for stoking, clean-out, and charging areas of the incinerator. Construct doors and door frames of [cast iron conforming to ASTM A 319] [or] [steel conforming to ASTM A 569/A 569M or ASTM A 36/A 36M]. Line doors exposed to flame or direct heat of combustion gases with the same type and thickness of refractory and insulation used in the combustion chamber. Attach refractory to doors to prevent sagging. Refractory shall have tapered edges to clear door frames during movement of swinging doors. Weld alloy steel hooked bars to the door cover to anchor the refractory. Doors shall be safely operable by one person. Temperature of door handles shall permit operation of door without gloves or other protective devices.

Interlock charging doors with burners and air supply so that burners and blowers disconnect when door opens. Door closure gasket shall be non-asbestos high-temperature resistant material capable of withstanding expected temperatures. Vertically operated doors shall be counterweighted to require a manual operating force of 134 N 30 pounds maximum. Guillotine type doors shall lift completely off the seals prior to movement. Provide full swing type doors with an integral smaller feed door having a minimum rectangular clear opening of 610 by 610 mm 24 by 24 inches or a minimum circular clear opening of 762 mm 30 inches diameter. Provide doors with hasps or brackets to permit locking. [Furnish a lock and two keys for each door on classified waste incinerators.]

NOTE: Full swing type doors are recommended for batch feeding; guillotine type doors for continuous feeding.

- a. Manual Charging Doors: [Full swing] [Guillotine] type, with minimum size of 610 by 610 mm 24 by 24 inches.
- b. Mechanical Charging Doors: Guillotine type or sweep type. Provide an inner and outer door. The inner or charging door shall open with operation of the charger. Interlock the inner and outer doors to prevent simultaneous opening during operation of incinerator. Insulate door to combustion chamber of incinerator. Line door with refractory material and anchor as specified herein for refractory. Construct outer door of same materials as exterior casing of incinerator. Provide doors with means for manual operation.
- c. Clean-out Doors: Clean-out doors shall provide access for total clean-out and visual inspection of the entire interior of the incinerator and shall not permit leakage of waste fluids.

2.7.1.4 Observation Ports

NOTE: Requirements for observation ports and test holes depend upon the specific project including competence and availability of operating and maintenance personnel, type of material to be burned. Check with regulatory agency having jurisdiction at location.

Provide two observation ports [_____] mm inch diameter in the primary combustion chamber. Furnish ports with a heat-resistant glass cover or angular steel frame and closure plate with handle for operation without gloves or other protective devices. Ports shall extend from casing exterior to not less than one-half the thickness of the refractory lining. Observation ports shall be gas tight.

2.7.1.5 Test Holes

NOTE: Requirements for observation ports and test holes depend upon the specific project including competence and availability of operating and

maintenance personnel, type of material to be burned. Check with regulatory agency having jurisdiction at location.

Fit test holes with standard weight, [50] [100] mm [2] [4] [_____] inch diameter, black steel pipe sleeve welded to casing. Extend sleeve from casing exterior to not less than one-half the thickness of the refractory lining. Form refractory opening from the pipe sleeve end to the interior wall surface to shield the sleeve end from reflected heat. Fit sleeve with a brass screw cap.

2.7.1.6 Solid Hearth

NOTE: Require solid hearth for incinerators burning pathological wastes.

Construct of non-asbestos heat-resistant clay, plastic or castable type. Provide refractory of sufficient thickness and strength to prevent heat transfer to casing or foundation, not less than 114 mm 4 1/2 inches in thickness and able to withstand temperatures of 1649 degrees C 3000 degrees F. Hearth shall support not less than twice the hourly burn rate load and shall not permit leakage of waste fluids.

2.7.1.7 Draft Equipment

Capability of providing the correct amount of air to permit controlled combustion through operating range. Equipment shall include forced draft fans, draft gages, dampers, damper actuators, and linkage.

- a. Air Ducts: Introduce air for combustion to the primary chamber below the waste material through perforated under-fire air pipes or ducts. Over-fire air shall be controlled with automatic modulating air intake ports for completing combustion of combustible materials in gases, or for reducing operating temperatures. Ducts shall be constructed of sheet steel conforming to ASTM A 569/A 569M. Seams shall be air tight.
- b. Fan: Forced draft, multi-blade, forward curved, centrifugal type conforming to FS A-A-59222. Fan shall comply with standards of AMCA 99, applicable to centrifugal furnace fans, and rated for flow rate, pressure, power, speed of rotation, and efficiency in accordance with AMCA 210.
- c. Damper: Controller-actuated to regulate air to the fan. Construct of wrought sheet steel conforming to ASTM A 569/A 569M, and no less than 1.59 mm 1/16 inch thick. Damper shall operate without noise or flutter. Actuators shall be electric motor operated, 115 volts ac.

2.7.2 Secondary Chamber

Provide with an exterior casing not less than 4.76 mm 3/16 inch steel conforming to ASTM A 569/A 569M. Refractory lining shall be same type and thickness required for primary chamber walls. Insulation shall be of the same class and thickness used in the primary chamber. Minimum retention time of [one] [_____] second shall be allowed for conditions within normal

operating limits.

2.8 BURNERS

NOTE: Insert appropriate fuel oil or gas specification section(s) associated with this project. Only allow direct electric spark ignition for burners up to 732,500 watt 2,500,000 BTU/hour. Values of minimum burner input capacity:

SIZE OF BURNERS, (x1000) Watts

Primary Burners

Capacity of Incinerator, (grams/sec)	2490 Min. kJ/kg Refuse	1905 Min. kJ/kg Refuse	1260 Min. kJ/kg Refuse	733 Min. kJ/kg Refuse	293 Min. kJ/kg Refuse	Secondary Burners All Refuse
6.30	350	350	582	815	990	466
12.60	466	466	1282	1631	1980	699
18.90	582	559	1514	2330	3262	932
31.50	699	699	1748	2680	3728	1514
63.00	1282	1282	2563	3845	5126	2330
94.50	1748	1748	3495	5242	6990	3029
126.00	2097	2047	3961	5592	7223	3961
189.00	2563	2563	5126	7689	10252	4893
252.00	3728	3728	7689	11650	15378	6291

SIZE OF BURNERS, (x1000) BTU/Hr

Primary Burners

Capacity of Incinerator, (lb/hr)	8500 Min. BTU/lb Refuse	6500 Min. BTU/lb Refuse	4300 Min. BTU/lb Refuse	2500 Min. BTU/lb Refuse	1000 Min. BTU/lb Refuse	Secondary Burners All Refuse
50	150	150	250	350	425	200
100	200	200	550	700	850	300
150	250	240	650	1,000	1,400	400
250	300	300	750	1,150	1,600	650
500	550	550	1,100	1,650	2,200	1,000
750	750	750	1,500	2,250	3,000	1,300
1,000	900	900	1,700	2,400	3,100	1,700
1,500	1,100	1,100	2,200	3,300	4,400	2,100
2,000	1,600	1,600	3,300	5,000	6,600	2,700

NOTE: Insert appropriate Section number and title in blank below using format per UFC 1-300-02.

Provide [gas] [oil] [combination gas and oil] burners for the primary and secondary combustion chambers. Design burners for [natural type gas] [or] [No. 2 fuel oil conforming to ASTM D 396]. [Fuel oil] [Gas] piping is covered in [_____]. Each burner shall be a complete burner assembly including fuel, control systems, and accessories. Primary burner shall

have an input capacity of not less than [_____] watt BTU per hour. Secondary burner shall have a minimum capacity of [_____] watt BTU per hour and capable of maintaining a minimum continuous temperature in the secondary chamber of [871 degrees] [1,600 degrees F] [_____]. Minimum continuous temperature of [760 degrees C] [1,400 degrees F] [_____] shall be maintained at the roof near the exit of the primary chamber. Burners shall be [interrupted type with gas-electric] [or] [electrically spark-ignited] and regulated by a variable set point indicator-controller adjustable from zero to 1649 degrees C 3000 degrees F to operate within temperature limits recommended by the manufacturer. Controllers shall be actuated by a thermocouple. Mounting, flame shape, and characteristics of each burner shall be suitable for the incinerator chamber in which the burner is installed. Flame impingement on the incinerator wall will not be permitted. Each burner shall be Factory Mutual listed in FM P7825 and furnished with flame failure protection. Flame safeguard sensor shall be sighted to detect only the burner flame for which it is designed. Furnish burners with manufacturer recommended appurtenances, for a complete installation. Burners shall be removable for inspection, cleaning, adjustment, and maintenance. Locate thermocouples in the primary and secondary chambers capable of operating at a maximum temperature of 1649 degrees C 3000 degrees F.

2.9 CONTROLS AND INSTRUMENTS

Control equipment and instruments shall include burners and fan controls, time clocks, relays, operating switches, indicating lights, gages, motor starters, fuses, alarms, circuit elements of control system, and other instruments required for operation. Mount controls and instruments on a single control panel. Control system shall provide [on-off control] [or] [proportioning control of the primary air supply and fuel supply to the secondary burner]. Temperature indicator shall provide a visual indication for safe loading of the incinerator and excessive high temperature conditions which may require control by the operator. Interlock control circuit systems to prevent hazardous conditions, air pollution, and made fail safe.

2.9.1 Control Panel

Sheet steel, weather tight, conforming to UL 50. Flush mount controls, instruments, and other equipment at the factory and test the assembly prior to shipment. Furnish a lock and two keys. Identify controls and instruments with nameplates conforming to MIL-DTL-15024. [Provide a heater to prevent condensation].

2.9.2 Draft Gages

ASME B40.1, diaphragm or bellows actuating system and circular scale. The gages shall have a zero adjustment screw. Provide shut-off cocks.

2.9.3 Pressure Gages

ASME B40.1, single Bourdon tube style, suitable for measuring air pressure.

2.9.4 Thermocouples

Provide to measure gas passage temperatures and control burner operation. Provide thermocouples which operation up to 1649 degrees C 3000 degrees F, and accurate within one-half percent of the operating and indicating temperature range.

2.9.5 Emissions Monitoring Instrumentation

Provide incinerator and stack monitoring instrumentation for acceptance tests, emissions tests, and monitoring.

2.10 STACK

NOTE: Depending on requirements at location and possibility of contact by personnel, temperature of the casing can be 66 to 93 degrees C 150 to 200 degrees F.

Stack shall meet local building and fire protection codes, including local, state, and federal regulations conforming to NFPA 211. Attach a corrosion-resistant steel spark arrestor not less than No. 18 gage, and with 15 mm 1/2 inch mesh wire screen extending to top of stack and a corrosion-resistant steel weather cap. Provide tests ports for acceptance testing [and] [or] emissions testing and monitoring.

2.11 CONNECTORS

Provide to connect the incinerator to the stack in accordance with NFPA 211. Locate the connector at a minimum clear vertical distance of 2.45 mm eight feet above the [floor] [ground].

2.12 CHARGING METHOD

NOTE: Choose one of the following options.
Incinerators having a capacity of 38 grams per second 300 pounds per hour or more should be mechanically charged. Charging chambers should have a capacity of not less than 0.765 cubic meter one cubic yard for capacities above 13 grams per second 100 pounds per hour and not less then 0.382 cubic meter one-half cubic yardsfor capacities below 13 grams per second 100 pounds per hour.

[Incinerator shall be manually charged. Manual charger shall include a front loading door with minimum dimensions of 610 by 610 mm 24 by 24 inches. Combustion chamber shall operate at negative air pressure when the loading door is open to prevent injury to the operator and the escape of smoke and gases. Provide an interlock to prevent operation of the charger when a predetermined safe operating temperature is exceeded. Locate the charger on the [end] [side] [top] of the incinerator.]

[Provide an automatic mechanical loading device compatible with the incinerator. Flange loader to incinerator. Construct loading device of plate steel conforming to ASTM A 36/A 36M. The loader shall include a [single] [dual] hydraulic power pack driven by an electric motor conforming to NEMA MG 1. Loader shall include a guillotine type fire door lined with the same thickness refractory as the combustion chamber. The charging chamber shall have a capacity of not less than [0.76] [0.38] [_____] cubic meter[one-half] [one] [_____] cubic yard. Locate charging chamber access door on top of the loader and hinged. Provide a temperature actuated

automatic sprinkler device located inside the loader. Integrate operation of the automatic loader with the control system. An indicating light shall indicate when the incinerator can be charged. Mount light on control box, visible to the operator. When charging chamber door is closed and light on; indicating the incinerator can be charged, the following sequence shall take place when the loader is actuated in the charge mode: (1) fire door opens, (2) ram pushes material into the incinerator, (3) ram retracts, (4) fire door closes, (5) indicator light signals the loader is ready to be charged. When loader is in the automatic mode of operation, fire door and charging chamber door shall not be allowed to open at the same time. Provide a manual override system so that ram, fire door, or charging chamber door can be operated independently.]

2.12.1 FIRING TOOLS

NOTE: Use if required and when manual charging is specified. Location of tools shall be shown on the drawings.

Provide firing tools, including shovel, hoe, rake, slice bar, used for firing the incinerator, and firing tool rack. Locate as indicated. Rack shall be steel and include hooks or other means for storing tools.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

NFPA 82, as applicable. Combustion air supply and ventilation shall be in accordance with [NFPA 54] [NFPA 31].

3.2 UTILITY SERVICES CONNECTIONS

NOTE: Utilities shall be shown on the drawings.

Connect to utility services as indicated.

3.3 FOUNDATION

NOTE: Insert appropriate concrete section associated with this project.

Foundation shall be of size and strength to support incinerator and extend not less than one meter 3 feet beyond incinerator sides, and not less than 2.45 meters 8 feet on front or side where ashes are removed.

3.4 FUEL SUPPLY

[Install gas appliances and piping in accordance with NFPA 54, as applicable.] [Install oil burning equipment to conform to the applicable requirements of NFPA 31.]

3.5 STACK SUPPORT

**NOTE: Wind loads shall be in accordance with
Military Handbook 1002/2 of September 1988, "Loads."**

Stack support shall be in accordance with paragraph entitled "Stack" of this section, NFPA 82 and NFPA 211, as applicable. Adequate vertical and lateral supports for exterior chimneys shall withstand wind forces of [171 km per hour] [106 miles per hour] [_____].

3.6 LUBRICATION

Provide lubrication means for parts of equipment normally requiring lubrication. Where use of high pressure will damage grease seals or other parts, provide pressure release fittings.

3.7 TREATMENT AND PAINTING

Provide manufacturer's standard factory applied finish suitable for exterior service.

3.8 IDENTIFICATION

Fasten an aluminum, brass, or corrosion-resistant steel nameplate to the equipment in a visible location by means of rivets or sheet metal screws. The nameplate shall contain data such as the manufacturer's name, model, or series number; electrical requirements; and serial number. The information shall be indented or embossed in the metal. The nameplate shall not be painted over.

3.9 FIELD QUALITY CONTROL

3.9.1 General

Upon delivery to the job site, equipment and materials shall receive a preliminary inspection by the Contracting Officer. Inspection will be continued during installation, after installation, and during tests. Inspections shall be made to assure equipment and installation comply with local, state, federal, and utility requirements for equipment, air pollution, and safety. Furnish labor, equipment, apparatus, and materials for testing, except waste materials used for testing. The Government will supply [waste material,] [fuel oil,] [gas,] [water,] [and] [electricity]. Rectify defects disclosed by tests, and repeat tests. Two instruction manuals shall be available during tests. Perform tests under direct supervision of the start-up engineer employed by the Contractor. The Contracting Officer shall be present for tests. Reports certifying instrument readings indicated are actual, computations required for testing are accurate, acceptable methods were used, and units satisfactory performed in accordance with requirements shall be furnished.

3.9.2 Tests

3.9.2.1 Fuel Systems

Remove gages and apparatus that may be damaged by test pressure from the system prior to testing. Maintain required test pressure for not less than two hours to provide sufficient time for inspection of joints and

connections. Correct defects which develop during testing and retest piping system until system shows no defects or weakness.

- a. Oil: Test oil piping systems with a hydrostatic pressure of one and one-half times the maximum working pressure.
- b. Gas: Pneumatically test gas piping systems tested at operating pressure. Use the soap bubble method to verify the tightness of the system.

3.9.2.2 Performance

Preheat incinerator for [four] [_____] hours to reach the firing temperature of [982 degrees C] [1800 degrees F] [_____]. Weigh the waste charges and provide a record of the total charge weight. Charge incinerator with Government provided waste at rated capacity in kg/sec lb/hr for a period of [four] [_____] hours. Operate incinerator in accordance with manufacturer's written instructions. Waste shall be reduced to a fine ash residual. Follow normal burnout procedure. Weigh residue after incinerator has cooled. Weight of residue shall not exceed [5.0] [_____] percent charge weight.

**NOTE: Delete requirements within brackets if
incinerator will not be used for burning classified
material.**

- a. Clean-out: [Residue from burning classified material shall be hand sorted or screened into three categories; totally oxidized white or off-white ash, unburned materials, and blackened or partially burned paper fragments. Clean-out and sorting shall be witnessed by the Contracting Officer. Inspect materials to verify that the requirements in paragraph entitled "Incineration" of Classified Materials, are met.] After clean-out, inspect incinerator for deterioration such as slagged or spalling refractory, warping of parts, and discolored exterior paint. Unit will be rejected until these conditions are repaired and do not recur in retesting. Such procedures that may create respirable dust shall require use of a OSHA certified dust respirator.

3.9.2.3 Control

Test incinerator under actual firing conditions. Test shall verify controls function within maximum and minimum limits for temperature or timing. Simulate actual unsafe conditions such as high temperatures and flame failure by reducing settings for the activation of limit and safety controls.

3.9.2.4 Shell Temperature

Operate incinerator under normal load conditions for not less than [four] [_____] hours. Record temperature readings of the outer shell at not less than five random locations of the secondary chamber. [Shield incinerators installed outdoors from direct rays of the sun.]

-- End of Section --