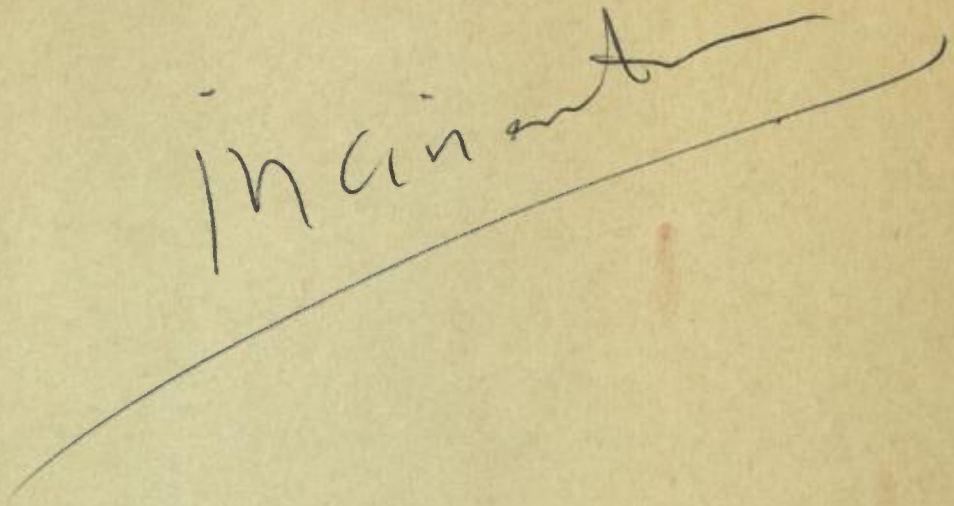

INTERSTATE SANITATION COMMISSION

New York • New Jersey • Connecticut

APC

THE CITY OF NEW YORK
DEPARTMENT OF
Air Pollution Control
15 PARK ROW, NEW YORK 38, N. Y.
TELEPHONE: WORTH 4-0495

Arthur J. Benline, P.E., R.A.
Commissioner

APR - 4 1960

April 1, 1960

Gentlemen:

We are sending you, herewith, a copy of "Criteria Used in the Examination of Applications for Permits to Install Direct Fed Incinerators in the City of New York." These have been compiled by the Engineering Bureau of this Department for the use of our Engineering Staff in examining plans for installations of such equipment.

The requirements are in conformity with sound engineering practice and are based upon careful consideration of the design elements necessary for operation of this type of equipment without nuisance.

We would be pleased to have you review these criteria and let us have your comments by May 1. We believe the time used in this will be profitably spent whether you are an air pollution control official, an incinerator manufacturer, an architect or otherwise interested in the installation of Direct Fed Incinerators.

We will indeed be most grateful for your comments and criticism. They will be given due consideration in preparing the final draft of these criteria.

Very truly yours,

Arthur J. Benline, P.E.,R.A.
Commissioner

LFF:gd

Not for Publication
For review and comment only

THE CITY OF NEW YORK
ROBERT F. WAGNER, MAYOR

Criteria Used in the Examination of Applications for Permits to Install

DIRECT FED INCINERATORS In the City of New York

DEPARTMENT OF AIR POLLUTION CONTROL

First Draft - for review, consideration and comment only

March 1960

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DEPARTMENT OF AIR POLLUTION CONTROL

Arthur J. Benline, P.E., R.A., Commissioner

Compiled by the Bureau of Engineering
Leo P. Flood, M.E., P.E., Chief Engineer
Harold G. Meissner, M.E., P.E.

First Draft - for review, consideration and comment only

March 1960

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PREFACE

Since the creation of the Department of Air Pollution Control as a separate department of the New York City government, the engineers of the Department have been examining applications and plans for many kinds of installations of fuel and refuse burning equipment at a rate of more than 400 plans per month. Prominent among these applications are those for the installation of direct fed incinerators.

The purpose of plan examination is to make certain that well designed installations are made. While these criteria were developed originally for the guidance of our engineers, they are now being published for the information of architects, engineers, installers, and others who are required to file plans with this department.

These are the criteria the Department uses in examining applications. They are based on over ten years of intensive experience with many installations as well as the recommendations and standards of the Incinerator Institute of America, National Board of Fire Underwriters, Air Pollution Control Association, various engineering textbooks, the catalogues and brochures of various contractors and manufacturers, the rules and regulations of the New York City Department of Air Pollution Control and the rules of other similar regulatory bodies.

Improvements in the art of burning rubbish and garbage efficiently, effectively and without nuisance are under continuing development. In order to preclude prohibition of meritorious improvements not in compliance with these criteria, the Commissioner may consider alternate designs. From time to time the criteria will be reviewed and may be revised.

The rules of the Department require that the seal and certification of a Registered Architect or Professional Engineer be impressed on its application form (APC5) as authentication of the accuracy of the information submitted.

These criteria are necessary for the protection of the public in general and the purchaser of equipment in particular so that nuisances are not created nor illegal installations made. They shall not apply to existing approved installations.

Those filing applications with the Department shall ensure that the information submitted is accurate and complete, and contractors, likewise, shall build in accordance with the approved application. Failure to do so leads to costly delays and changes, and in some cases punitive action.

It is the hope of the Department that by proper use of these criteria and conformity with the rules and regulations of the Department, examination of plans will be expedited, installations will be improved and air pollution will be minimized.

NOTE: The criteria include those now being used by the Department <u>plus</u> certain others not now being enforced but which we believe are desirable and concerning which we ask the advice of all interested parties.

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TABLE OF CONTENTS

FILING

APPLICATION AND PLANS - Applications shall include all essential data pertaining to the equipment to be installed. Where necessary, additional specification sheets may be submitted. All necessary plans shall be filed in triplicate and none shall be smaller than 8½ by 11 inches. One set of these plans, if approved, will be so stamped and initialed by the examiner and returned with the work permit. Plans must comply with Rule 4 of the Department's Rules and Regulations and each shall bear the seal of a Professional Engineer or Registered Architect. Plans and application shall be certified by the same person. The plot plan shall indicate the building location and dimensions, flue location and the location, distances and heights of all buildings within 100 feet of the flue. Drawings shall include an incinerator room layout clearly indicating the incinerator, its location in relation to the surrounding enclosure, the source and size of fixed ventilation to the outer air. The combustion chambers, gas burner, clean-out doors, separation chamber, main breeching gate, dampers, breeching, etc., must be shown by plan and elevation cross-sections so that all details are clear and so that calculations may be made from the drawings.

Installers are cautioned that they must also comply with the applicable provisions of Chapter 26 of the Administrative Code.

Only one type of equipment may be included on one application. For example: An incinerator and boiler may not be included on one application.

FEES

A fee schedule is given in the Rules and Regulations. Fees are based on the horizontal projected area of the primary combustion chamber.

DIRECT FED INCINERATOR STANDARDS AND CRITERIA

Capacity Range - 100 to 5,000 lbs. per hr. nominal capacity.
600,000 to 30,000,000 Btu per hr design capacity.

The procedure followed herein is similar to that used for the design and performance of furnaces for burning other solid as well as liquid and gaseous fuels, that is, the refuse to be burned is first converted into heat units, from which the combustion air, flue gas weight, furnace size and other criteria shall be determined.

The reasons for using this procedure in preference to the refuse weight basis are apparent when we realize that the air required to burn a wide variety of combustible materials, including most of the ingredients in normal refuse, is almost identical per million Btu fired.

The appended list of unit heat values of common refuse components shows that the Btu per lb varies widely. For example the heat produced from burning 100 lbs of paper may be 766,000 Btu, while that from burning 100 lbs of vinyl scrap is 1,750,000 Btu, or almost 2.3 times as much. In other words an incinerator designed to burn 100 lbs per hr of paper would be good for only 44 lbs per hr of vinyl, whereas a similar furnace designed for 100 lbs per hr of vinyl scrap would burn satisfactorily 230 lbs per hr of paper.

To design the incinerator and determine performance criteria we must therefore first calculate the total Btu to be fired per hour. The lbs of refuse delivered per day is divided by the hours of operation, which will depend largely on the type of building or plant concerned. The refuse is then checked for ingredients, to determine the relative amounts of paper, wood and similar products, as well as the presence of the more highly combustible plastics and other synthetic refuse, as shown on attached list. With a little experience, and knowledge of the local conditions, a reasonable approximation of the probable refuse heating value can be made.

The primary furnace shall be designed large enough so that ignition and combustion will be completed therein, rather than in the secondary chamber. The latter is planned as a settling or separation chamber, to remove a large proportion of the fly ash before it enters the stack.

Temperature in the primary furnace shall be maintained at a minimum of 1500 to 1600 F, which is necessary to assure ignition and complete combustion, to CO_2 with no CO.

Combustion air for both undergrate and overfire use shall be introduced in the primary furnace. About 200% excess or 300% total air is required to hold the furnace temperature at not over 1600 F, which is considered desirable for furnaces of this type, to avoid excessive slag deposits on the refractory.

DIRECT FED INCINERATOR STANDARDS AND CRITERIA

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Auxiliary burner

Auxiliary burner if required shall be installed in primary furnace, and used for preheating before startup, and when the refuse is abnormally wet.

Capacity range

Table A-100 2-60 covers the size range for which this type of incinerator is suitable, for Type 1 and Type 2 waste per Table No. 1 in IIA incinerator Standards. Use linear interpolation for intermediate sizes, or read from attached curves.

Combustion Air

All combustion air shall be supplied to the refuse in the primary combustion chamber through openings in the grate and by overfire air jets. The amount of air supplied shall be controlled by dampers, adjus able to full closed position.

Overfire Air

Overfire air shall be supplied to the primary chamber by means of openings above the firing doors of the incinerator. These openings shall be adjustable from full open to closed position to compensate for the varying conditions of incinerator operation. The overfire air shall comprise from 50% to 70% of the total combustion air.

Secondary Separation Chamber

A secondary separation chamber shall be located adjacent to the primary chamber and shall be designed to separate a large percentage of the entrained fly ash from the combustion gases, by means of baffles and collection hoppers as outlined in Dr. -A-1003-60 and A-1004-60, attached. Scrubbers or other types of separation chambers may be acceptable.

Auxiliary Heat Device

This burner shall be used to preheat the furnace, and shall be operated whenever necessary to maintain a temperature of at least 1500 F in the primary chamber. The burner shall have a maximum capacity of 334,000 Btu per million Btu input per hr for No. 2 refuse, and a minimum capacity of 150,000 Btu per million Btu input per hr for No. 1 refuse.

Barometric Damper

An automatic barometic draft adjuster open to the atmosphere shall be provided, the size of which shall be as given in Table A-1002-60. The mechanism shall be designed to operate automatically from a full open to a full closed position with equal efficiency.

Manual Damper

A manual damper shall be provided in the breeching ahead of the barometric damper. A counter-balanced guillotine type, faced with refractory and with guides protected from the gas stream and capable of withstanding 2000 F without distortion is preferred. It shall be provided with an indicator showing the position of the damper from closed to open. It shall be readily operable from the incinerator room floor, and shall be provided with a hydraulic, pneumatic, mechanical or other device for easy operation.

Breeching

The size of the breeching shall be as given in Table A-1002-60 attached.

Clean-out Doors

Doors shall be provided so that all parts of the incinerator can be cleaned. They shall be provided in the ash pit of the primary chamber, at the bottom of the secondary separation chamber and in the breeching. Ashpit and separation chamber doors and door frames shall be of cast iron with frames securely fastened to the masonry or steel of the incinerator. By-pass flue cleanout ports shall be lined with refractory to withstand the high temperature of the gases. Doors shall latch securely and fit tightly.

Fixed Ventilation

Fixed ventilation shall be provided by means of a louvred or screened opening in the incinerator room wall or door, and shall be sized in accordance with Table A-1002-60. This opening must be connected to the outside air. If a duct is used, clean-out ports must be provided.

The selection and checking procedure is outlined on following pages for the information of all concerned.

DIRECT FED INCINERATORS STANDARDS AND CRITERIA

SELECTION PROCEDURE

ITEM NUMBERS REFER TO TABLE A-1002-60

1. Charging rate - lbs per hour - Divide daily average refuse weight by hours of incinerator operation. Refuse must be charged at uniform rate for satisfactory performance.

2. Heat input - Btu per hour - Select component heat values from list attached or from IIA Waste Classification, and calculate Btu per hour fired.

3. Grate heat release - Btu per sq ft per hour - Permissable rate varies with charging rate as shown on Curve A-1001-60 attached.

4. Grate area in sq ft - Divide heat input by grate heat release, or read from Curve-A-1001-60.

5. Grate length - See Curve-A-1001-60 for approximate length. Divide grate area by length to determine width to nearest commercial size.

6. Furnace heat release - Use 20,000 Btu per cu ft per hour for all sizes, to provide ample primary furnace volume. Combustion shall be substantially completed in this furnace.

7. Furnace volume - Divide heat input by furnace heat release (20,000) to get volume in cu ft.

8. Arch height above grate - Divide grate heat release by furnace heat release to determine height in ft.

9. Gas weight - or combustion products in lbs per hour - based on 200% excess air and 20% moisture in refuse, which corresponds to 1600 F furnace temperature heat input in million Btu X 2050 gives gas weight in lbs per hour.

10. Flame port area - see Table A-1002-60.

11. Separation chamber port area - ditto.

12. Breeching - stack - barometric damper area - ditto

Items 11 and 12 shall be determined on mass flow in lbs per sq ft per hr rather than gas velocity, which depends on temperature. For item 11 divide gas weight by 2500. For item 12 divide gas weight by 3200.

13. Combustion air weight is calculated at 200% excess air as noted above. To determine air weight multiply heat input in million Btu by 1875 which gives air in lbs per hour.

14. Air volume at 80 F - To convert air weight to volume for fan selection, multiply air weight in lbs per hr by 0.227

15. Overfire vs undergrate air proportion - Use 70% of total air above the fire, and 30% thru the grate, approximately. Introduce all combustion air in primary furnace. Use natural draft for smaller sizes, and forced draft fan for both undergrate and overfire air for larger furnaces. Locate overfire jets as shown on drawing A-1001-60 and A-1004-60 for in-line and retort incinerators respectively.

16. Areas of overfire air inlets based on furnace draft and fan pressures respectively are given in Table A-1002-60.

17. Auxiliary burners - Locate in primary furnace - Use for preheating furnace before startup or for maintaining required temperature when refuse is wet. Normal operation should not require auxiliary fuel. Burner capacity per Table A-1002-60.

18. Fixed ventilation for combustion air into furnace room must have area same as that of breeching per Table A-1002-60.

19. Stacks and flues - Each incinerator shall be provided with separate flue to top of stack. No other furnace shall be connected to this flue. The stack shall be high enough to clear any buildings within a 100 ft radius. A plot plan shall be furnished showing the structures within this radius.

20. Furnace temperature of at least 1500 F is required to assure ignition and complete combustion. Ignition temperatures of major solid and gaseous components are shown below:

Carbon.	765 to 1115 F
Hydrogen	1005 to 1095 F
Methane	1170 to 1380 F
Carbon monoxide	1130 to 1215 F

21. Furnace designs for in-line and retort type incinerators are shown on drawings A-1003-60 and A-1004-60 respectively. Use retort type for capacities from 600,000 to 6,000,000 Btu per hour and the in-line type for 6,000,000 Btu per hour and higher capacities.

22. Separation chamber is designed for maximum use of centrifugal force combined with gravity to separate dust from gas. Sudden high speed reversal under baffle has been found to be about 8 times as effective as simple low velocity separation. Floor baffles show act as "snow fences" to hold the fly ash and prevent its re-entrainment. The collected fly ash should be wet down and removed at least daily, as collection chambers are not effective once they are allowed to fill up.

23. Charging door location - Shall be at front of primary furnace, and at or close to grate level, rather than high in the furnace, so that the furnace cannot be filled with refuse more than 2 or 3 ft thick on grate. There shall be ample furnace volume above the refuse to permit free flow of the overfire air, and combustion of the volatile matter.
Side or top charging doors shall not be used.

24. Furnace draft in the primary furnace shall be limited to .1" to.2" of water by means of a manual or barometric damper in the breeching. Close draft control is necessary, both to avoid blow back in the furnace, and excessive air leakage into the furnace.

Charging door shall be kept closed except when refuse is being fed into the furnace as air flow thru this door when open is highly variable, and chills the furnace so that ignition and combustion are not completed as noted above.

25. Waste materials classification - This type incinerator is suitable for wastes Types 1, 2 and 6 as listed below. Refuse - Types 3, 4 and 5 require special consideration. See page 10 for heating values of components.

Incinerator Institute of America Classification of Waste Materials

Type 1 Waste - Rubbish, consisting of combustible waste such as paper, cartons, rags, wood scraps, sawdust, foliage, and floor sweepings from domestic, commercial and industrial activities.

This type of waste may contain up to 10% incombustible solids, up to 25% moisture, and have a heating value of about 6500 Btu per lbs as fired.

Type 2 Waste Refuse, consisting of an approximately even mixture of rubbish and garbage by weight. This type of waste is common to apartment and residential occupancy. Heating value 4500 Btu per lb.

Type 3 Waste Garbage, consisting of animal and vegetable wastes from restaurants, cafeterias, hotels, hospitals, markets, and like installations.

This type of waste may contain up to 70% moisture, up to 5% incombustible solids, and have a heating value as low as about 3500 Btu per lb. as fired.

Type 4 Waste Human and animal remains, consisting of carcasses, organs and solid organic wastes from hospitals, laboratories, abattoirs, animal pounds and similar sources.

Type 5 Waste By-Product waste, gaseous, liquid or semi-liquid, noxious or contaminated, of density and viscosity that will be consumed through air or pressure atomizing burner equipment. Btu values must be set on individual materials to be destroyed.

Type 6 Waste By-Product waste, semi and solid, toxic or otherwise. Btu values must be set on indicidual materials to be destroyed.

OPERATING INSTRUCTIONS

The following instructions are the recommended procedures for the effective operation of direct fed incinerators.

(a) Ignite gas burner; bring furnace temperature up to red heat before igniting refuse. Burner may then be shut off unless refuse is very wet.

(b) Ignite refuse at various points.

(c) Close main firing door, open ash pit door slightly to allow air to pass through refuse bed. Caution - Excess under fire air will increase the dust emission.

(d) Adjust overfire air as necessary to promote complete combustion.

(e) Adjust setting of manual damper to control velocity of gases produced in the primary combustion chamber.

(f) Slice fire and adjust overfire air as necessary.

(g) When burning is completed, extinguish burner if still in use close manual damper, remove residue from grate, ash pit and separation chambers, anc close all doors to retain heat.

MAINTENANCE INSTRUCTIONS

The following outline of maintenance procedures will assist the operator in maintaining efficient operation.

DAILY

(a) Remove residue from primary and separation chambers and ash pit.

(b) Inspect for proper operation: Gas burner; manual and barometric dampers; and dump grates.

(c) Check condition of all cleanout doors.

WEEKLY

(a) Remove accumulated fly ash from base of stack.

(b) Inspect all doors for tightness of fit.

(c) Inspect spark arrestor for cleanliness and repair.

(d) Inspect condition of all refractory; effect repairs as necessary.

NOTE: Any malfunctioning of equipment or deterioration should be reported to owner/agent for corrective action.

DEFINITIONS

Auxiliary Heat Device

Equipment to preheat the furnace or to supply additional heat, by means of a gas burner, to obtain temperatures high enough for complete combustion of the smoke, combustible solids, vapors and gases from the refuse being burned.

Baffle

Any refractory or metal construction intended to change the direction of flow of the products of combustion.

Separation Chamber

A chamber designed to promote the settling out of fly ash and coarse particulate matter by changing the direction and velocity of the gases produced by the combustion of the refuse and providing hoppers and cleanout doors for fly ash removal.

Barometric Damper

An automatic damper open to the atmosphere to compensate for variations in draft due to changes in weather conditions, and maintain a uniform draft in the combustion chamber during burning periods.

Bridge Wall

A partial wall between the primary and secondary chambers over which the products of combustion are required to pass.

Curtain Wall

A refractory construction or baffle with an opening at its base which serves to deflect the gases from the primary combustion chamber in a downward direction.

Grate

The surface in the primary combustion chamber that supports the refuse while it is being burned. It shall be designed with suitable openings to permit the entrance of primary combustion air beneath the burning refuse and to permit the removal of unburned residue.

Hearth

Refractory floor in combustion chamber that supports the refuse, but thru which no air passes.

Manual Damper

A damper, the setting of which is controlled manually, regulating the flow of gases in the breeching.

Overfire Air

Air introduced into the primary combustion chamber above the refuse bed to provide turbulence and assist in the combustion process.

Primary Air

Combustion air which mixes intimately with the refuse and partly controls the rate of burning.

Primary Combustion Chamber

Chamber within an incinerator in which waste material is dried or volatilized, ignited, and completely or partially burned.

Primary Combustion Chamber Height

The vertical distance, within the primary combustion chamber, from the grate level to the roof of the chamber. If the grate or hearth is sloping the mean distance shall be taken.

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Operating and Maintenance Instructions

Operating and maintenance instructions shall be permanently and conspicuously mounted in the incinerator room and shall include full instructions for the operation and maintenance of the gas burner, dampers, and other devices.

Accessibility

Sufficient space must be provided around the incinerator and its appurtenances so it can be readily serviced and cleaned out.

C A U T I O N

Ventilating Fans

Architects and engineers should carefully consider the effect on incinerator operation of ventilating fans, particularly of the exhaust type, which produce a negative pressure in the interior of a building.

I N T E R P R E T A T I O N S

The Rules and Regulations of the Department of Air Pollution Control shall govern in the case of any conflict between these criteria and the Rules and Regulations of the Department.

APPENDIX

GENERAL REFERENCES

1. "I. I. A. Incinerator Standards." Incinerator Institute of America 420 Lexington Avenue, New York

2. "Air Pollution Handbook," by Magill, Holden and Ackley - McGraw-Hill

3. "Standards for Incinerators," National Board of Fire Underwriters, (N.B.F. #82) 85 John Street, New York

4. Administrative Building Code Article 12
   Sub Article 2 - Incinerator Combustion Chamber
   Sub Article 3 - Chimneys

5. Ibid - D 26 - 3.11

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Municipal & Industrial Refuse

Heating Values of Components

Domestic Refuse	Moisture	BTU as fired
Paper, cardboard, cartons bags	3	7,660
Wood crates, boxes, scrap	7	7,825
Brush, branches	17	7,140
Leaves	30	4,900
Grass	50	3,820
Garbage	75	1,820
Greenstuff	50	3,470
Greens	50	4,070
Rags-cotton-linen	10	6,440

Industrial Scrap Refuse

Boot, shoe trim & scrap	8,500
Sponge waffle & scrap	8,500
Butyl soles scrap	11,500
Cement wet scrap	11,500
Rubber	12,420
Tire cord scrap	12,400
Rubber scorched scrap	19,700
Tires, bus & auto	18,000
Gum scrap	19,700
Latex coagulum	19,700
Latex waste, coagulum waste	12,000
Leather scrap	10,000
Waxed paper	12,000
Cork scrap	12,400
Paraffin	16,803
Oil waste, fuel oil residue	18,000

Plastic & Synthetic Refuse

Cellophane plastic	12,000
Poly-ethylene	19,840
Polyvinyl chloride	17,500
Vinyl scrap	17,500
Aldehyde sludge	18,150
Solvent naptha	18,500
Carbon disulphite	8,000
Benzine	10,000

Miscellaneous

Carbon to CO2	14,093
" " CO	4,347
Sulfur	3,983
Methane	23,879

March 1960

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DIRECT FED INCINERATOR - STANDARDS AND CRITERIA — TABLE - A - 1002-60

1-Charging rate-nominal capacity lbs/hr	100	167	500	1,000	2,000	3,000	4,000	5,000
2-Heat input from refuse burning-Btu/hr (Based on 6000 Btu/lb. refuse)	600,000	1,000,000	3,000,000	6,000,000	12,000,000	18,000,000	24,000,000	30,000,000
3-Grate heat release -Btu/sq ft/hr	100,000	133,000	162,000	180,000	200,000	210,000	216,000	222,000
4-Grate area including hearth -sq ft	6.0	7.5	18.5	33.3	60.0	85.6	111.0	135.0
5-Grate length & width-approximate-ft	4.0x1.5	5.0x1.5	6.7x2.3	7.6x4.4	8.7x6.9	9.7x8.8	10.5x10.5	11.8x11.5
6-Furnace heat release Btu/cu ft (primary furnace)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
7-Furnace volume-primary furnace-cu ft	30	50	150	300	600	900	1200	1500
8-Arch height above grate-minimum -ft	5.0	6.6	8.1	9.0	10.0	10.5	10.8	11.1
9-Gas weight for 200% excess air & 20% moisture -lbs/hr	1,225	2,040	6,120	12,240	24,500	36,700	48,900	61,200
10-Flame port area-in-line type -sq ft	3.75	5.0	9.45	19.80	34.5	46.6	56.8	64.5
" " " -retort " "	2.47	3.0	6.25	13.1	22.8			
11-Separation Chamber port area-sq ft.	0.5	0.82	2.5	5.0	10.0	15.0	20.0	25.0
12-Breeching,stack,baro-damper area sq ft	0.40	.64	1.93	3.85	7.70	11.53	15.4	19.2
13-Air weight at 200% excess air-lbs/hr	1125	1875	5,620	11,240	22,500	33,700	45,000	56,200
14-Air volume at 80 F -CFM	255	425	1,275	2,550	5,110	7,650	10,200	12,500
15-Overfire air at 70% of total -CFM	179	298	890	1,780	3,560	5,350	7,150	8,920
16-Openings or nozzles for OFA -area for -.2" furnace draft-sq in	17.3	29	85	173	345	520	690	865
for + 2.0 fan pressure-sq in	5.75	9.2	27.3	57.5	110	164	220	275
17-Auxiliary burners in primary furnace heat output-Btu/hr	200,000	334,000	1,000,000	2,000,000	4,000,000	6,000,000	8,000,000	10,000,000
18-Fixed ventilation for air to furnace room -sq ft	.40	.64	1.93	3.85	7.70	11.53	15.4	19.2

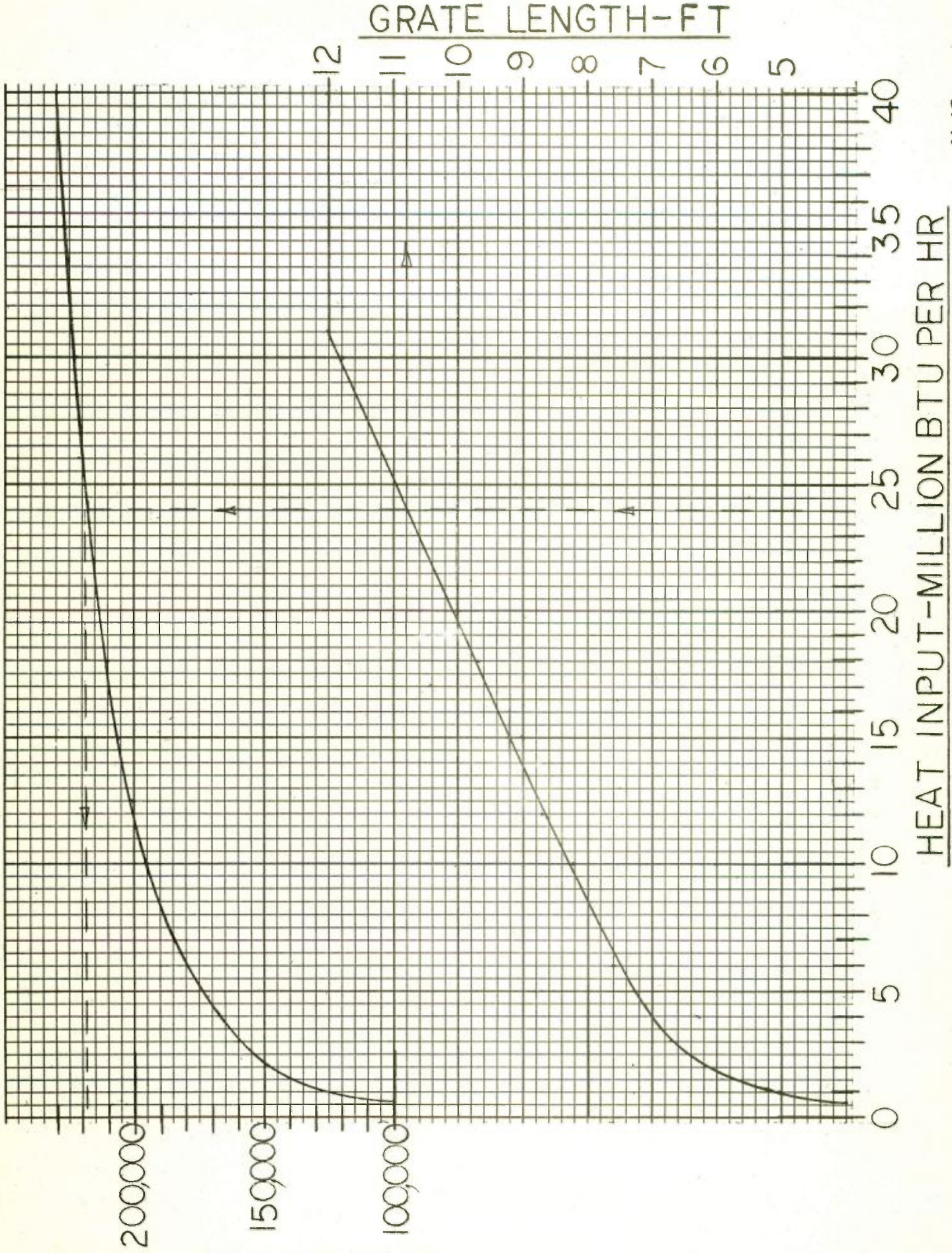
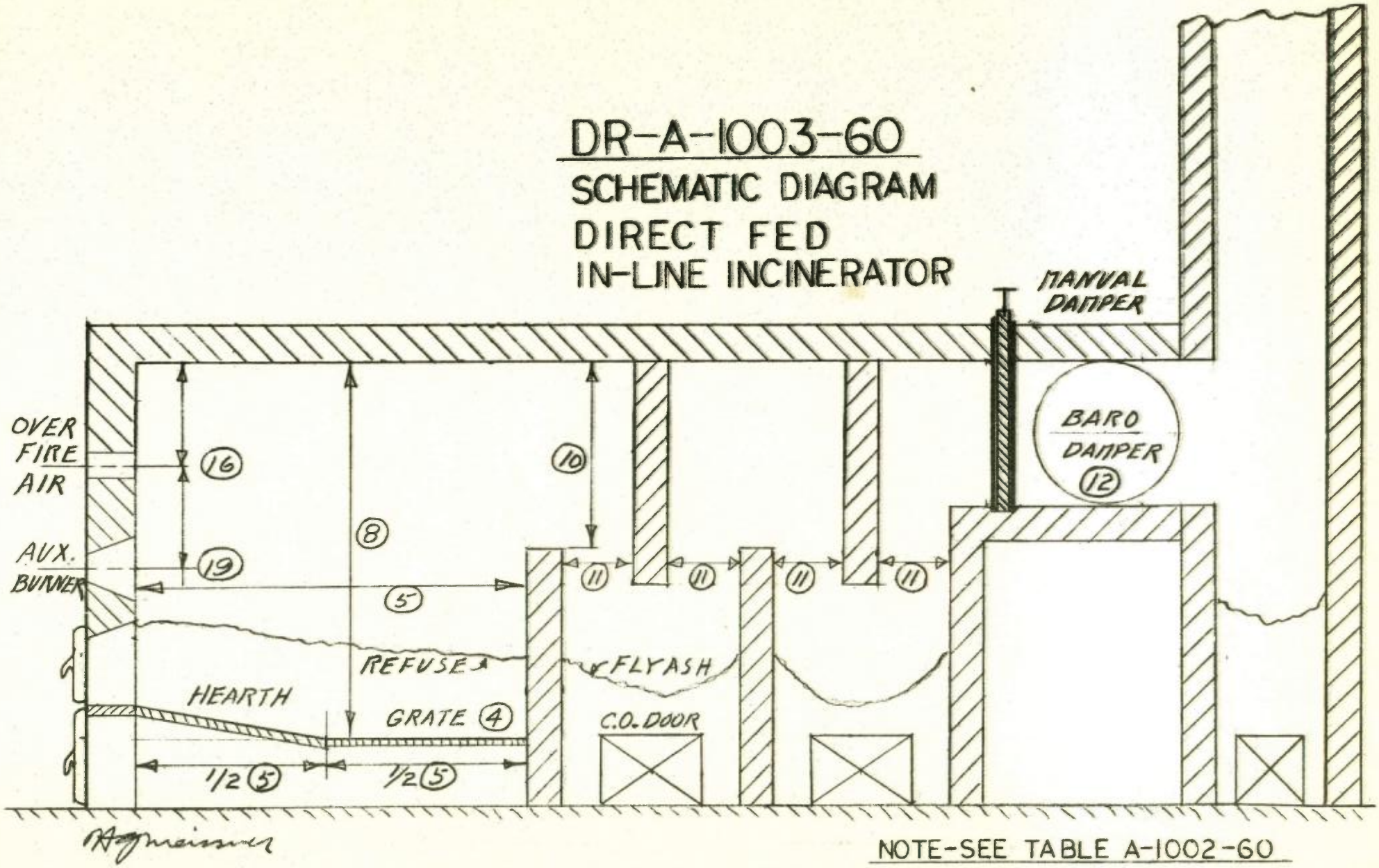

GRATE LENGTH-FT
12
11
10
9
8
7
6
5
HEAT INPUT-MILLION BTU PER HR
0
5
10
15
20
25
30
35
40
200,000
150,000
100,000
GRATE HEAT RELEASE

FIG-A-1001-60

DR-A-1003-60

SCHEMATIC DIAGRAM
DIRECT FED
IN-LINE INCINERATOR

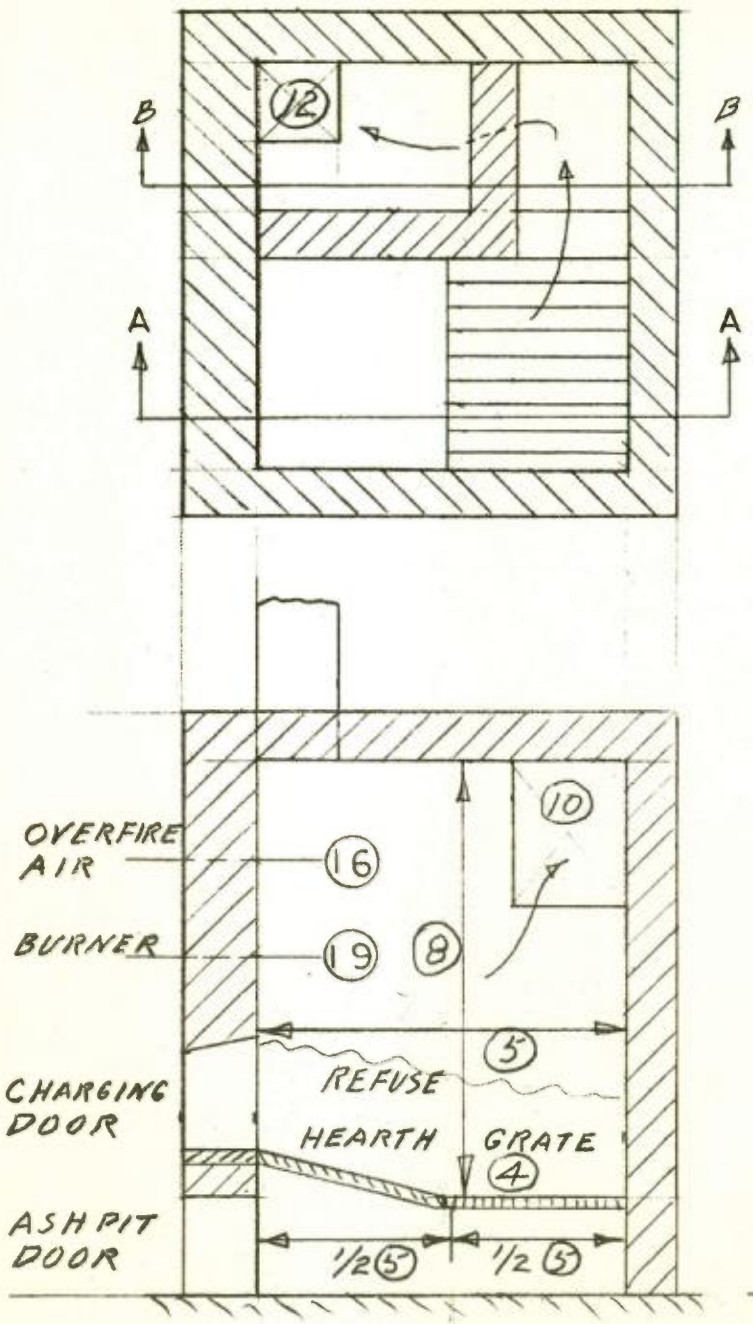


NOTE-SEE TABLE A-1002-60

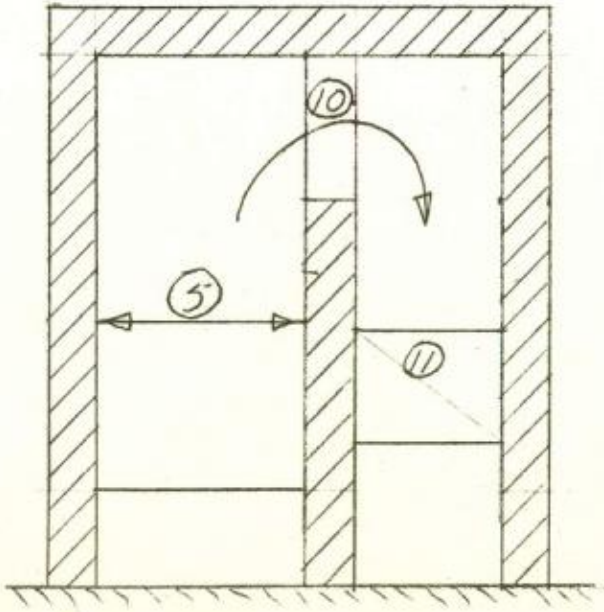
DR-A-1004-60

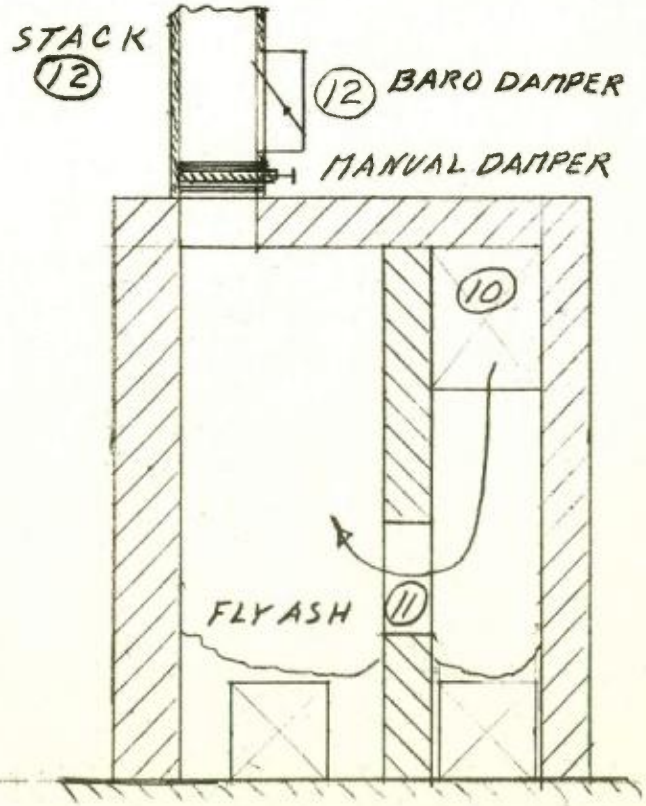
SCHEMATIC DIAGRAM
DIRECT FED
RETORT INCINERATOR

NOTE-SEE TABLE-A-1002-60



SECTION A-A



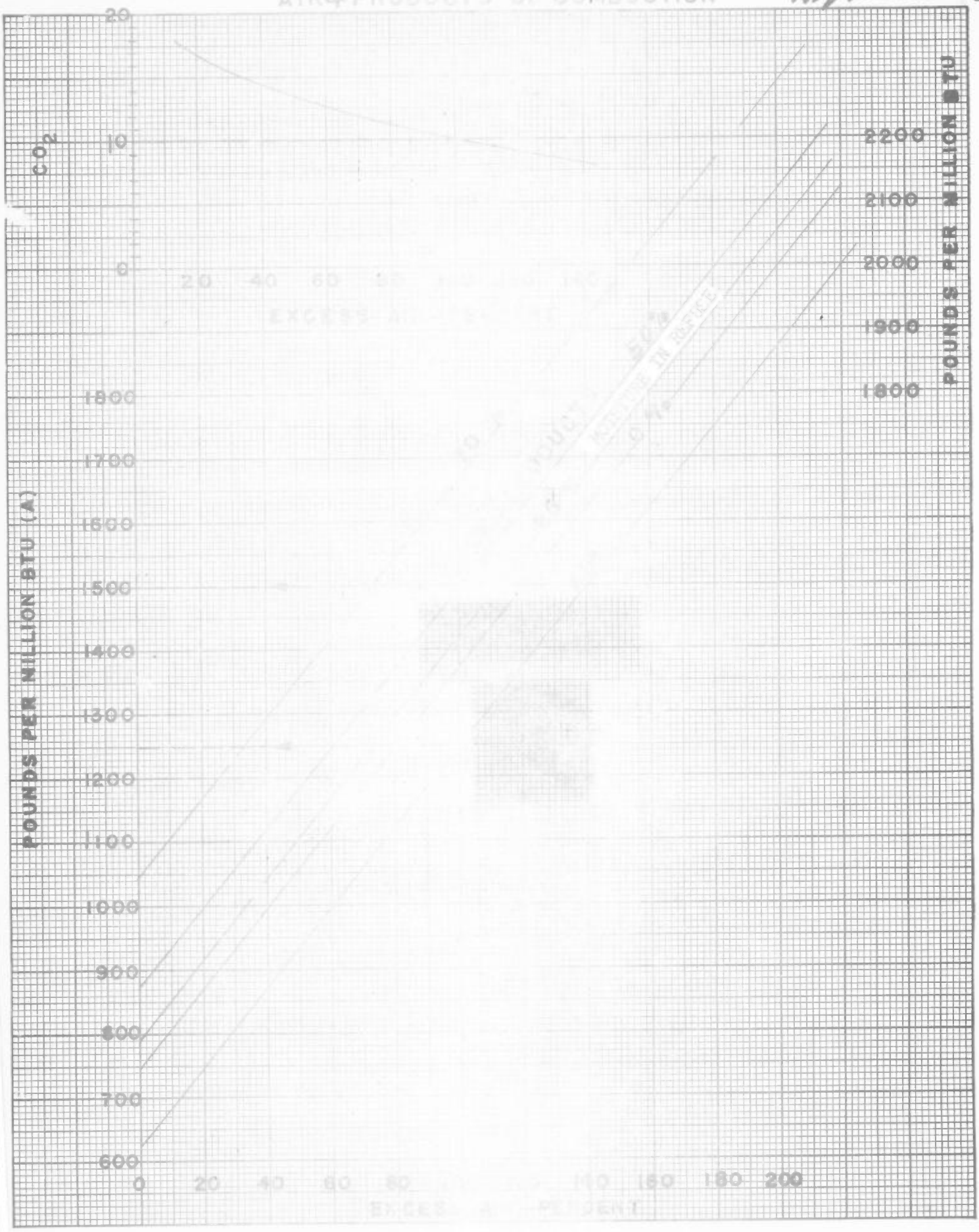


SECTION B-B

H. Meissner 1/20/60 REV-3/3/60

FIG-A-1009-60

AIR & PRODUCTS OF COMBUSTION




DUCT PRESS. IN. WATER
2 3 4 5 6 7 8 9 10
CFM PER SQ FT AT 60° F
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
4000
3000
2000
1000
0
CFM PER SQ FT AT 80° F
1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
FURNACE DRAFT - IN. WATER
AIR FLOW PER SQ FT
ORIFICE CONSTANT = 1.0
1/22/60
ORIFICE CONSTANTS →
1.0
.82
.90

FIG.-A-1008-60