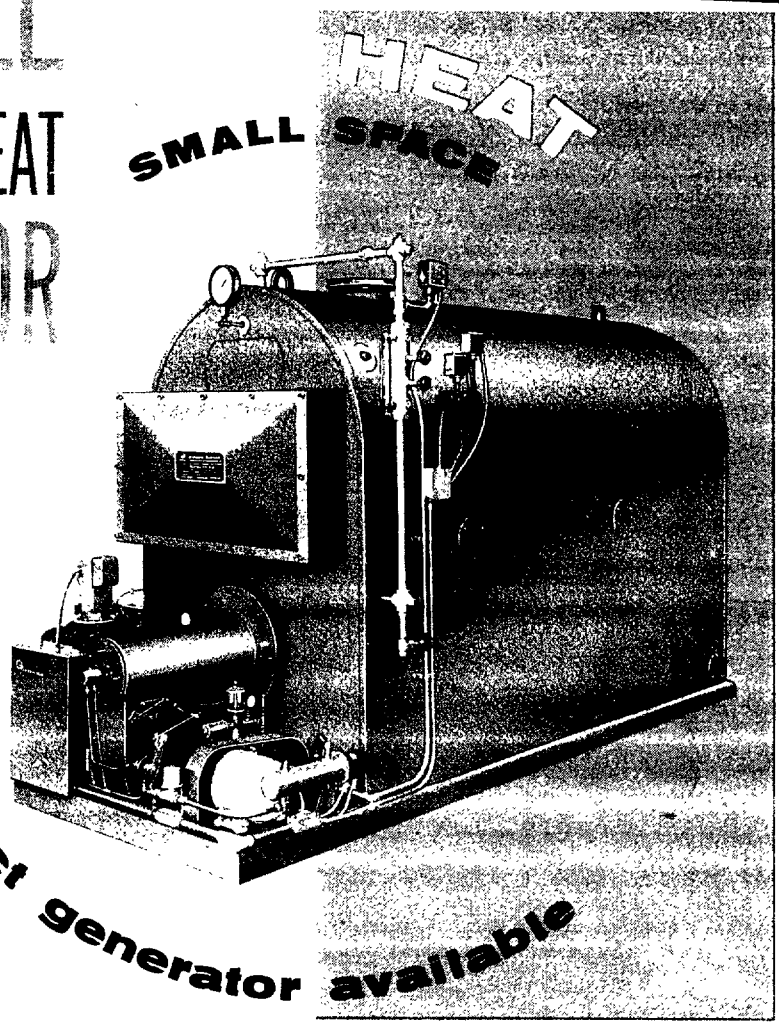
AMERICAN-STANDARD

PLAINTIFF'S EXHIBIT

ASI-1200

KEWANEE

SQUARE-HEAT GENERATOR



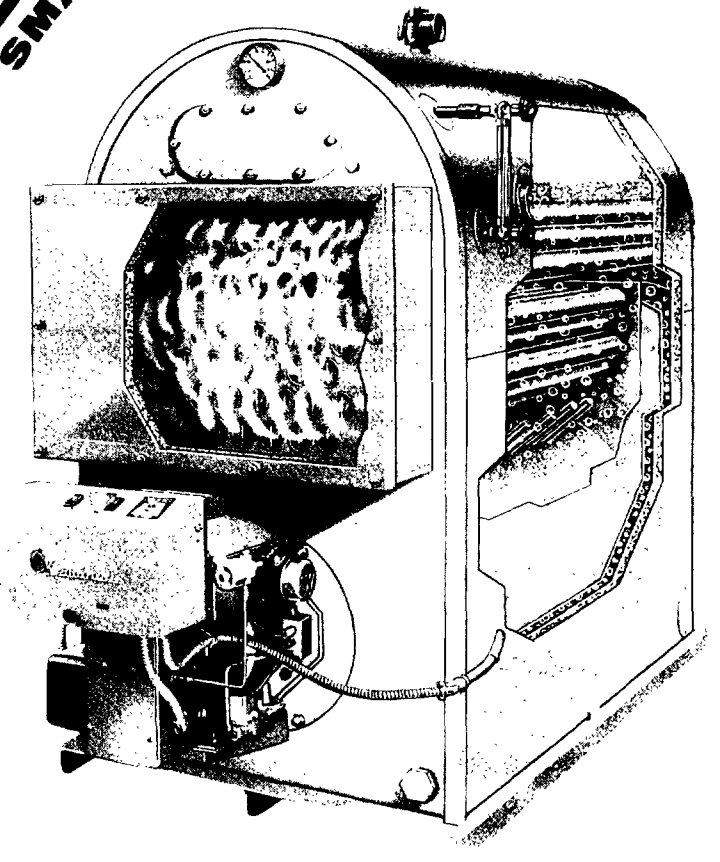
low pressure steam
or hot water
450,000 to 5,050,000 Btuh

No. 5 or lighter oil
. . . gas . . .
combination gas-oil

28541

BIG HEAT SMALL SPACE

KEWANEE SQUARE-HEAT



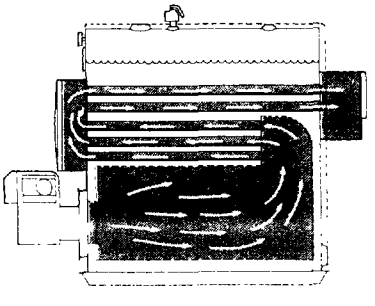
This new steam generator is ideal for office and store buildings, schools, motels, hospitals, small factories, apartments and other buildings of medium size.

Intensive research, added to nearly a century of boiler experience, produced this modern Square-Heat Generator with amazing compactness, plus highest efficiency, plus Kewanee Time-Proved structural features.

The secret of this remarkable design, which results in highest efficiency, top-quality performance, and long dependable service, is . . . exceptionally high proportion of primary (direct) heating surface which is many times more efficient than secondary (indirect) heating surface . . . plus . . . extra large furnace volume for complete combustion, smooth starts, clean firing, quiet operation, unrestricted gas flow and low heat release.

The entire unit is listed by Underwriters' Laboratories, Inc.

THREE PASS DESIGN



Assures maximum heat transfer with low stack temperature . . . highest operating efficiency. The large firebox with arched upright crown sheet provides thorough mixing of fuel and air . . . complete combustion before hot gases enter fire tubes. The second pass is rear to front through the direct fire tubes . . . the third from front to rear in the return tubes. Gas travel is longer and there are no refractory baffles to burn out and permit short circuiting of gases.

HIGH EFFICIENCY HEATING SURFACE

Primary heating surface (exposed directly to the flame) is 4 to 15 times more effective than secondary heating surface (exposed only to hot gases). The Square-Heat Generator design utilizes nearly 50% greater ratio of primary to secondary heating surface than competitive units. Square-Heat Generators provide MORE more effective heat transfer surfaces, and LESS less effective heat transfer surfaces.

LARGE FURNACE VOLUME

For complete combustion with smooth starts . . . clean firing . . . unrestricted gas flow . . . quiet operation . . . heat release averages 50% less than competitive units.

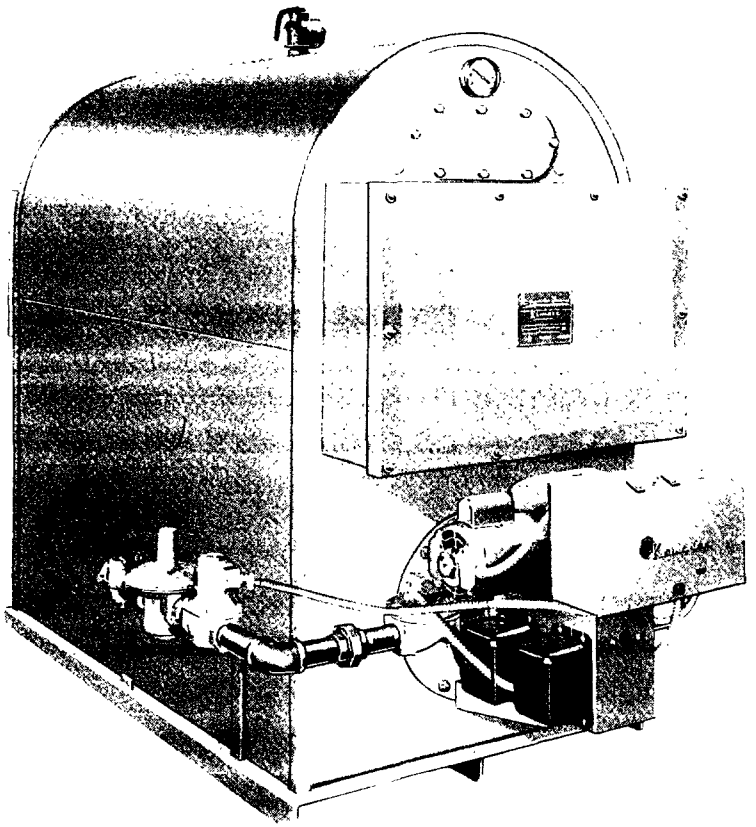
FORCED-DRAFT OPERATION

Provides ample combustion air for stub stack applications. Only a vent to the outside is needed. Special assemblies available for high altitude installations.

Copyright 1962 by American Radiator & Standard Sanitary Corporation

GENERATOR

MORE ENERGY PER SQUARE FOOT OF OCCUPIED FLOOR SPACE THAN ANY OTHER COMPARABLE UNIT





COMPACT

This Kewanee is the most compact generator you can buy. For example, you can have 80 hp in 42.7 square feet of occupied floor space. Two principal competitive 80 hp generators require 72.7 square feet and 78.0 square feet, respectively. The illustration above shows the contrast. Head room also is minimum.

LARGE STEAM SPACE
Combined with abundant, unbroken disengaging area and ample water content assures steady water line and a plentiful reserve of dry steam.

TUBES ROLLER EXPANDED
All tubes are secured to tube sheets by roller expander—none are welded to tube sheets.

WELDED STEEL
Flange quality plate. All welded integral construction for strength and durability. Gas tight throughout.

SKID TYPE BASE
Refractory filled, provides ventilation under the unit and distributes weight evenly.

INSULATED STEEL JACKET
Heavy gauge steel jacket with attractive smooth enamel finish. Glass or mineral fiber insulation minimizes heat loss.

WATER HEATING COILS
Standard Kewanee "KI" (instantaneous) and "KT" (tank)) coils available for all units. Coil opening at front of boiler avoids interference with controls, wiring or breeching.

EASY ACCESS TO TUBES
Steel flue access cover with insulation securely keyed in place provides easy access to flues without disturbing fuel burning equipment.

TESTED—APPROVED
ASME Boiler Construction Code requirements have been followed to the last detail . . . and the Kewanee name assures design and performance above and beyond any code requirements. These generators have Underwriters' Laboratories listing.

COMPLETELY ASSEMBLED
With burner and all accessories—may be moved in by fork truck, hoist, or rollers. Only service connections are needed to place unit in operation.

KEWANEE SQUARE-HEAT GENERATOR

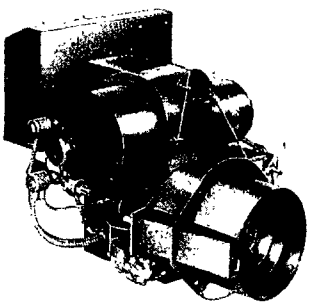
Kewanee Square-Heat Generators are available for oil, gas, or combination gas-oil firing. Each Kewanee Forced Draft Burner is custom engineered for the generator it fires, assuring long, dependable and economical service.

Two series of Kewanee Forced Draft Burners cover the entire range of boiler capacities and fuels

The Kewanee KR Burner fires light oil (No. 2 CS12-48), gas, and combination gas-light oil in Units M-45 thru M-265. The oil burner is of the high pressure mechanical atomizing type, and the gas burner is of the multiple jet flame retention type.

Units M-45 thru M-175 with the KR burner feature on-off operation (with low fire start on oil-fired Units M-135 thru M-175). Combustion air is regulated by a fixed position damper in addition to an adjustable primary-secondary air shutter.

Units M-205 thru M-265 with the KR burner feature on-off operation with controlled low fire start. Fuel and air supply are regulated for both high and low firing by a two position motor. This provides smooth starting and top efficiency.

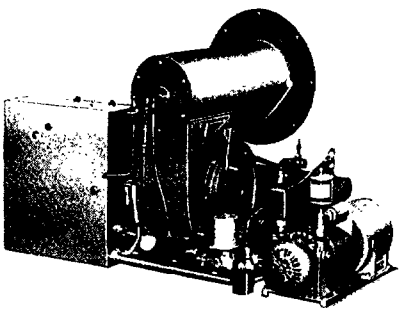


The Kewanee Master Burner (Pressure Atomizing) fires light oil (No. 2 CS12-48), gas, and combination gas-light oil in Units M-335 thru M-505. The oil burner is of the high pressure mechanical atomizing type, and the gas burner is of the radial jet flame retention type.

The Kewanee Master Burner (Air Atomizing) fires No. 5 or lighter oil, gas, and combination gas-oil in Units M-175 thru M-505. The oil burner is of the low pressure air atomizing type, and the gas burner is of the radial jet flame retention type.

Units M-175 thru M-265 with the Master burner feature two-stage firing with proved low fire start. Fuel and air supply are regulated at both high and low firing rate by a two position motor controlled by a boiler mounted pressure or temperature operating control.

Units M-335 thru M-505 with the Master burner feature full modulation with proved low fire start. Fuel and air supply are regulated throughout the firing range by a modulating motor controlled by a boiler mounted pressure or temperature modulating potentiometer



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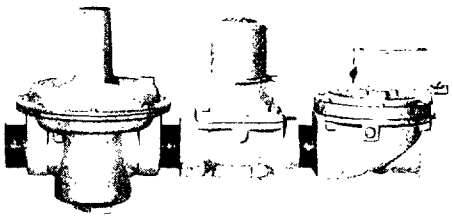
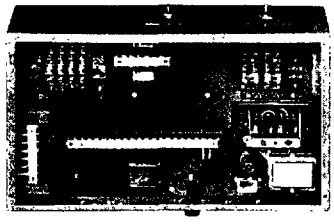
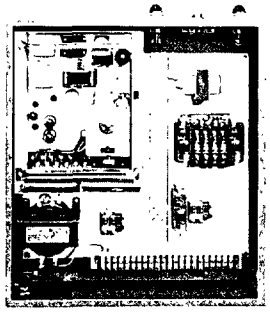


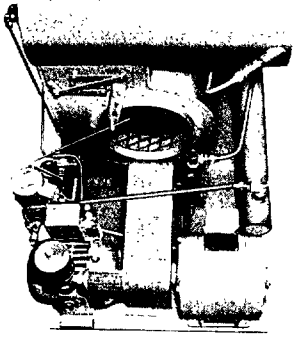
Dual automatic main gas valves (on units over 1000 MBh input) provide added protection. Boiler passages are purged of combustible gases before and after each firing cycle. Combustion is continuously monitored by an electronic flame safeguard.





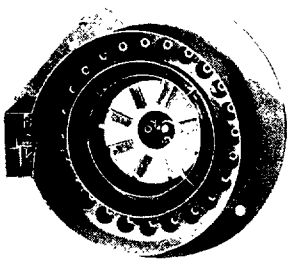
CONTROL CABINET

Master programming and flame safeguard relays, switching relays, motor magnetic starter (if required), numbered terminal strips, indicating lights for major operations, and fuel selector switch—all mounted and wired in a heavy-gauge steel, dustproof control cabinet mounted on the boiler unit. Wiring is ready for connection to a source of power.



AIR-OIL UNIT

The air-oil unit assembly of the Master burner includes air compressor, oil pump, valves, belt drive, motor, and all necessary accessories to provide the fine oil atomization required for clean, efficient oil firing. A thermostatically controlled electric oil heater maintains uniform oil temperature to compensate for varying viscosities of residual oils. The multi-louvered opposed-blade air damper provides accurately measured air supply to match fuel supply for top operating efficiency at all firing rates.





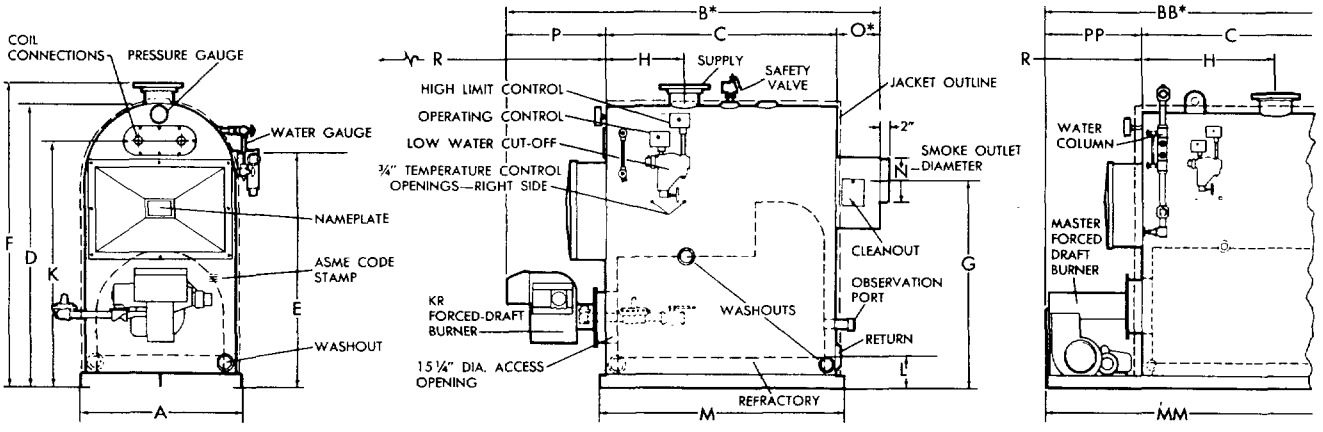
BURNER FIRING HEAD

Exclusive design of burner firing heads provides quiet, stable combustion of gas or oil at all inputs. The intimate fuel and air mixture gives clean, efficient firing, smooth light off, low fuel consumption, and maximum safety.

28545

BIG HEAT
SMALL SPACE

KEWANEE SQUARE-HEAT



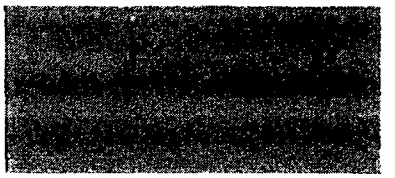
KEWANEE DIMENSIONS inches

	M-45	M-55	M-65	M-75	M-95	M-115	M-135	M-155	M-175	M-205	M-235	M-265	M-335	M-425	M-505
A—Boiler maximum width	32½	32½	32½	32½	37	37	37	37	44	44	44	44	54	54	54
—Jacket width	31½	31½	31½	31½	35½	35½	35½	35½	42½	42½	42½	42½	53	53	53
B—Length overall—KR burner	65½	71½	77½	83½	77½	85½	93	102	92	101	109	116	—	—	—
BB—Length overall—Master burner	—	—	—	—	—	—	—	—	96	104	112	119	131	152	172
C—Boiler length	30½	36½	42½	48½	42½	50½	58	67	56	64	72	79	91	112	132
—Jacket length	31½	37½	43½	49½	43½	51½	59	68	57	65	73	80	95	116	136
D—Boiler height	55	55	55	55	62	62	62	62	71	71	71	71	78	78	78
—Jacket height from floor	56	56	56	56	63	63	63	63	72	72	72	72	80	80	80
E—Water line height	44½	44½	44½	44½	52	52	52	52	59½	59½	59½	59½	64½	64½	64½
F—Steam or water supply height	55½	55½	55½	55½	63	63	63	63	75	75	75	75	83	83	83
G—Smoke outlet height	35½	35½	35½	35½	40½	40½	40½	40½	47¼	47¼	47¼	47¼	52	52	52
H—Steam or water supply	10	12	14	16	14	17	19	22	16	18	20	24	27	38	48
K—Coil connection height	46½	46½	46½	46½	54	54	54	54	61½	61½	61½	61½	66½	66½	66½
L—Return height	6½	6½	6½	6½	7	7	7	7	7	7	7	7	7	7	7
M—Base length—KR burner	33½	39½	45½	51½	45½	53½	61½	70	59½	67½	75	82½	—	—	—
MM—Base length—Master burner	—	—	—	—	—	—	—	—	89½	97½	105½	112½	121½	142½	162½
N—Vent diameter	6	6	6	6	8	8	8	8	10	10	10	10	16	16	18
O—Smokebox	8	8	8	8	8	8	8	8	9	9	9	9	12	12	12
P—Burner to boiler—KR burner	27	27	27	27	27	27	27	27	27	28	28	28	—	—	—
PP—Burner to boiler—Master burner	—	—	—	—	—	—	—	—	31	31	31	31	28	28	28
R—Required tube replacement length	33	39	45	51	45	53	61	69	58	66	74	81	93	114	134

*Add 5½ for Top Smoke Outlet

28546

GENERATOR



RATINGS and DATA

		M-45	M-55	M-65	M-75	M-95	M-115	M-135	M-155	M-175	M-205	M-235	M-265	M-335	M-425	M-505
Rating—MBh		450	550	650	750	950	1150	1350	1550	1750	2050	2350	2650	3350	4250	5050
—horsepower		13.4	16.4	19.4	22.4	28.4	34.4	40.3	46.3	52.3	61.2	70.0	80.0	100.0	126.9	150.8
—steam per hour 212°F	lbs	464	567	670	773	979	1186	1392	1598	1804	2113	2423	2732	3452	4380	5204
—steam (gross)	sq ft	1875	2291	2708	3125	3958	4792	5625	6458	7292	8542	9791	11042	13958	17708	21042
—steam (MCA net)	sq ft	1410	1723	2036	2349	2976	3603	4230	4855	5483	6422	7362	8302	10490	13110	15733
Firing rate—gas, 1000 btu/cu ft		563	688	813	938	1188	1438	1688	1938	2188	2563	2937	3313	4181	5312	6312
—oil, 140,000 btu/gal		4.0	4.9	5.8	6.7	8.5	10.3	12.1	13.8	15.6	18.3	21.0	23.6	30.0	38.0	45.0
—oil, 150,000 btu/gal		—	—	—	—	—	—	—	—	14.6	17.1	19.5	22.0	27.9	34.8	41.7
Heating surface—total	sq ft	63	78	92	107	127	154	180	209	239	275	309	343	450	562	675
—primary	sq ft	19.0	21.1	23.2	25.4	30.8	34.2	37.6	41.4	47.6	51.9	55.9	59.9	86.3	100.2	112.9
Furnace volume	cu ft	8.8	10.4	12.0	13.5	17.2	20.1	23.0	26.3	32.6	37.0	41.1	45.3	72.0	88.1	103.4
Safety valve capacity—steam per hour	lbs	450	550	650	750	950	1150	1350	1550	1750	2050	2350	2650	3350	4250	5050
Vent diameter	in	6"	6"	6"	6"	8"	8"	8"	8"	10"	10"	10"	10"	16"	16"	18"
Supply size	in	4"	4"	4"	4"	4"	4"	4"	4"	6"*	6"*	6"*	6"*	8"*	8"*	8"*
Return size	in	3"	3"	3"	3"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"
Approx. dry wt.—KR burner	lbs	1900	2050	2200	2350	2600	2950	3300	3650	4000	4450	4900	5300	—	—	—
—Master burner	lbs	—	—	—	—	—	—	—	—	4600	4900	5300	5700	7900	9300	10,850

*150 lb. American Standard Flange.

REVISED BURNER DATA

	M-45	M-55	M-65	M-75	M-95	M-115	M-135	M-155	M-175	M-205	M-235	M-265	M-335	M-425	M-505
Input—gas—1000 btu/cu. ft.	563	688	813	938	1188	1438	1688	1938	2188	2563	2937	3313	4181	5312	6312
—oil—140,000 btu/gal.	4.0	4.9	5.8	6.7	8.5	10.3	12.1	13.8	15.6	18.3	21.0	23.6	30.0	38.0	45.0
—oil—150,000 btu/gal.	—	—	—	—	—	—	—	—	14.6	17.1	19.5	22.0	27.9	34.8	41.7
KR BURNER—For Gas—No. 2 Oil—Combination Gas-No. 2 Oil															
Fuel control—gas	←				On-Off				→ ←		Low Fire Start	→	—	—	—
—oil	←				On-Off		→ ←				Low Fire Start	→	—	—	—
Air control	←				Fixed				→ ←		Two Position	→	—	—	—
Programming & flame safeguard control	←				T-1A Pre-Purge and Post-Purge Timer with RA890E							→	—	—	—
Gas controls—min. inlet press.	6"	6"	6"	6"	6"	6"	6"	6"	6½"	6½"	6½"	6½"	—	—	—
—size	1"	1"	1¼"	1¼"	1¼"	1½"	2"	2"	2"	2"	2"	2"	—	—	—
Motor—HP	⅓	⅓	⅓	⅓	½	½	½	½	¾	1	1	1	—	—	—
—electrical characteristics	←			115-60-1				→	230-60-1	←	208/220/240-60-3	→	—	—	—
MASTER BURNER—For No. 5 or Lighter Oil—Combination Gas-No. 5 or Lighter Oil—Gas Only (M-335 thru M-505)															
Fuel control—gas	—	—	—	—	—	—	—	—	←		High-Low-Off	→ ←		Modulating	→
—oil	—	—	—	—	—	—	—	—	←		High-Low-Off	→ ←		Modulating	→
Air control	—	—	—	—	—	—	—	—	←		Two Position	→ ←		Modulating	→
Programming & flame safeguard control	—	—	—	—	—	—	—	—	←			Fireye FP-2			→
Gas control—min. inlet press	—	—	—	—	—	—	—	—	6½"	6½"	6½"	6½"	7"	8"	8"
—size	—	—	—	—	—	—	—	—	2"	2"	2½"	2½"	2½"	3"	4"
Motors—Fan—HP	—	—	—	—	—	—	—	—	½	¾	¾	1	1	1½	2
—voltage	—	—	—	—	—	—	—	—	←		208/220/240-60-3				→
—oil pump—press atom.—HP	—	—	—	—	—	—	—	—	—	—	—	—	⅓	⅓	⅓
—voltage	—	—	—	—	—	—	—	—	—	—	—	—	←	230-60-1	→
—air-oil unit—air atom.—HP	—	—	—	—	—	—	—	—	1	1	1	1	1½	1½	1½
—voltage	—	—	—	—	—	—	—	—	←		208-220/240-60-3				→
Electric preheater—watts	—	—	—	—	—	—	—	—	2000	2000	2000	2000	3000	3000	4000
—voltage	—	—	—	—	—	—	—	—	←		208/220/240-60-1				→

*No. 4 and No. 5 oil only—requires separate fused disconnect switch by others

28547

KEWANEE
SQUARE-HEAT

STANDARD AND OPTIONAL EQUIPMENT

STANDARD EQUIPMENT	OPTIONAL EQUIPMENT

ALL UNITS

STANDARD EQUIPMENT	OPTIONAL EQUIPMENT
1. Three-Pass ASME Code Boiler	1. Explosion Relief Door
2. Refractory Filled Skid Type Base	2. Vertical Discharge (Top) Vent
3. Gas-Tight Insulated Front Smokebox	3. Instantaneous or Tank Type Hot Water Coils
4. Pyrex Observation Ports (Front and Rear)	4. Flue Gas Temperature Gauge
5. 2" Firetubes—Roller expanded	5. Room Thermostat Control
6. Gas-Tight Rear Smokebox with Horizontal Discharge (Rear) Vent	6. Alarm Bell
7. Wrap-around Insulated Steel Jacket	7. Circuit Breaker
8. Lifting Loops (Units M-335 thru M-505)	8. Other Than Standard Voltages
9. Washout Plug Socket Wrench and Flue Cleaner with Handle	9. One Year Service Period
10. Forced Draft Operation	
11. Operating Limit Control	
12. Safety High Limit Control	
13. Control Voltage—115 V, 60 cy, 1 ph. Includes Reduced Voltage Transformer where required	
14. Control Cabinet Including: Electronic Flame Safeguard, Programming Control, Control Circuit Fuse, Burner Switches, Indicating Lights (2), Numbered Terminal Strip, Color Coded Wiring, Engraved Nameplates, and Necessary Relays, Magnetic Starters, and Transformers	
15. Listed Standard and Selected Optional Equipment Mounted, Piped, Wired, Ready for Field Connection to Fuel, Water, Steam, and Electricity (Exceptions: Items shipped separately to prevent shipping damage)	
16. Starting Service	

STEAM UNITS

1 No. 767 Low Water Cut-Off	1. Combination Low Water Cut-Off and Pump Control
2. Kewanee Water Column (Units M-335 thru M-505)	2. Combination Water Feeder, Low Water Cut-Off, and Alarm Switch
3. Safety Valve(s)	3. Second Low Water Cut-Off
4 Compound Steam and Vacuum Gauge	4. Surface Blow-Off
5. Water Gauge and Glass	

HOT WATER UNITS

1. No. 764 Low Water Cut-Off	1. Combination Water Feeder, Low Water Cut-Off, and Alarm Switch
2. Relief Valve(s)	2. Second Low Water Cut-Off
3. Combination Altitude Gauge and Thermometer	

PRESSURE ATOMIZING OIL UNITS M-45 thru M-265

1. High Pressure Mechanical Atomizing Oil Burner for No. 2 Oil	*1. Fireye Flame Safeguard System
2 Two-Stage Oil Pump direct connected to Burner Motor	2 DC Voltmeter for Fireye System
3. Motor Horsepower and Voltage—	3. High-Low-Off Firing Sequence (Units M-95 thru M-265)
⅓ HP, 115 V, 60 cy, 1 ph. (Units M-45 thru M-75)	*4. Modulating Firing Sequence (Units M-135 thru M-265)
½ HP, 115 V, 60 cy, 1 ph. (Units M-95 thru M-155)	5. Manual Potentiometer for Modulating Fire Control
⅘ HP, 230 V, 60 cy, 1 ph. (Unit M-175)	6. Oil Controls for FM
1 HP, 208/220/240 V, 60 cy, 3 ph. (Units M-205 thru M-265)	*7. Oil Controls for FIA
4. On-Off Firing Sequence (Units M-45 thru M-115)	**8 Oil Controls for Local Code Requirements
On-Off Firing Sequence with Low Fire Start (Units M-135 thru M-265)	9 Factory Firetest
5 Fixed Position Air Supply (Units M-45 thru M-175)	
Two-Position Air Supply Controlled by Modutrol Motor (Units M-205 thru M-265)	
6 RA-890 Flame Safeguard with Photocell Flame Detector	
7. T-1A Timer for Pre-Purge and Post-Purge Timing	
8. Oil Atomizing Nozzle (Dual Nozzles on Units M-95 thru M-265)	
9. Oil Solenoid Valve (Dual Valves on Units M-135 thru M-265)	
10. Direct Spark Electric Ignition	
11. Oil Filter	
12 Factory Component and Control Check	

PRESSURE ATOMIZING OIL UNITS M-335 thru M-505

1. High Pressure Mechanical Atomizing Oil Burner for No. 2 Oil	1. DC Voltmeter for Fireye System
2. Two-Stage Oil Pump Assembly with Gauge, Relief Valve, ⅓ HP, 230 V, 60 cy, 1 ph motor	2. Manual Potentiometer
3. Motor Horsepower and Voltage—	3. Direct Spark Electric Ignition
1 HP, 208/220/240 V 60 cy 3 ph. (Unit M-335)	4. Oil Controls for FM
1½ HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-425)	5. Oil Controls for FIA
2 HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-505)	**6. Oil Controls for Local Code Requirements
4 Modulating Firing Sequence with Low Fire Start	
5 Modutrol Motor with Low Fire Interlock to Control Air and Fuel Supply	
6 Operating Control for Modutrol Motor (Boiler Mounted)	
7 Fireye FP-2 Flame Safeguard System with Lead Sulphide Flame Detector	
8 Air Flow Safety Switch	
9 Variable Capacity Oil Nozzle	
10. Oil Solenoid Valve	
11. Oil Metering Valve	
12 Gas-Electric Ignition Assembly	
13 Oil Filter	
14 Factory Firetest	

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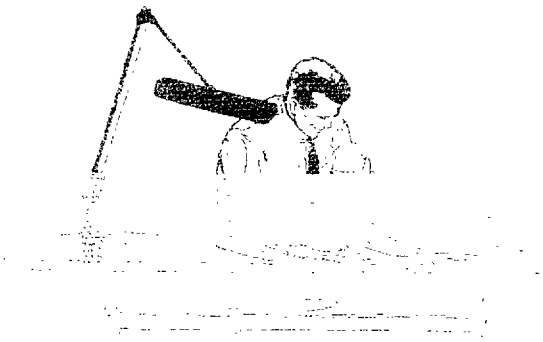

STANDARD EQUIPMENT — OPTIONAL EQUIPMENT

AIR ATOMIZING OIL UNITS M-175 thru M-505

1. Low Pressure Air Atomizing Oil Burner for No. 5 or Lighter Oil
2. Air-Oil Unit Consisting of: Air Compressor, Motor, Inlet Air Filter, Air Pressure Regulating Valve, Check Valve, Air Proving Safety Switch, Air Gauge, and Oil Pump Assembly with Gauge and Internal Relief Valve
3. Air-Oil Unit Motor Horsepower and Voltage—
   1 HP, 208/220/240 V, 60 cy, 3 ph. (Units M-175 thru M-265)
   1½ HP, 208/220/240 V, 60 cy, 3 ph. (Units M-335 thru M-505)
4. Blower Motor Horsepower and Voltage—
   ½ HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-175)
   ¾ HP, 208/220/240 V, 60 cy, 3 ph. (Units M-205 thru M-235)
   1 HP, 208/220/240 V, 60 cy, 3 ph. (Units M-265 thru M-335)
   1½ HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-425)
   2 HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-505)
5. High-Low-Off Firing Sequence with Low Fire Start (Units M-175 thru M-265)
   Modulating Firing Sequence with Low Fire Start (Units M-335 thru M-505)
6. Modutrol Motor with Low Fire Interlock For Fuel-Air Control—
   Two-Position (Units M-175 thru M-265)
   Modulating (Units M-335 thru M-505)
7. Operating Control for Modutrol Motor (Boiler Mounted)—
   Two-Position (Units M-175 thru M-265)
   Modulating (Units M-335 thru M-505)
8. Fireye FP-2 Flame Safeguard System with Lead Sulphide Flame Detector
9. Air Flow Safety Switch
10. Air-Oil Nozzle
11. Oil Metering Valve
12. Air Purge Relay and Valve
13. Thermostatically Controlled Electric Oil Heater—
    2,000 Watts (Units M-175 thru M-265)
    3,000 Watts (Units M-335 thru M-425)
    4,000 Watts (Unit M-505)
14. Gas-Electric Ignition Assembly
15. Oil Strainer
16. Factory Firetest

1. DC Voltmeter for Fireye System
2. Modulating Firing Sequence (Units M-175 thru M-265)
3. Manual Potentiometer for Modulating Fire Control
4. Omit Electric Heater for No. 2 Oil
5. Oil Controls for FM
6. Oil Controls for FIA
**7. Oil Controls for Local Code Requirements

GAS UNITS M-45 thru M-265

1. Multiple-Jet Flame Retention Type Gas Burner
2. Motor Horsepower and Voltage—
   ⅓ HP, 115 V, 60 cy, 1 ph. (Units M-45 thru M-75)
   ½ HP, 115 V, 60 cy, 1 ph. (Units M-95 thru M-155)
   ¾ HP, 230 V, 60 cy, 1 ph. (Unit M-175)
   1 HP, 208/220/240 V, 60 cy, 3 ph. (Units M-205 thru M-265)
3. On-Off Firing Sequence (Units M-45 thru M-175)
   On-Off Firing Sequence with Low Fire Start (Units M-205 thru M-265)
4. Fixed Position Air and Fuel Supply (Units M-45 thru M-175)
   Two Position Air and Fuel Supply Controlled by Modutrol Motor (Units M-205 thru M-265)
5. RA-890 Flame Safeguard with Flame Rod Flame Detector
6. T-1A Timer for Pre-Purge and Post-Purge Timing
7. Air Flow Safety Switch
8. UL Gas Control Group Including: Automatic Operating Gas Valve; Automatic Safety Gas Valve (Units M-95 thru M-265 only); Gas Volume Control Valve (Units M-205 thru M-265 only); Gas Pressure Regulator; and Manual Gas Cock
9. Gas-Electric Ignition Assembly
10. Factory Component and Control Check

*1. Fireye Flame Safeguard System
2. DC Voltmeter for Fireye System
3. High-Low-Off Firing Sequence (Units M-95 thru M-265)
*4. Modulating Firing Sequence (Units M-95 thru M-265)
5. Manual Potentiometer for Modulating Fire Control
6. Automatic Safety Gas Valve (Units M-45 thru M-75)
7. Gas Controls for Other Than Standard Pressures
8. Gas Controls for FM
9. Gas Controls for FIA
**10. Gas Controls for Local Utility Requirements
11. Factory Firetest

GAS UNITS M-335 thru M-505

1. Radial-Jet Flame Retention Type Gas Burner
2. Motor Horsepower and Voltage—
   1 HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-335)
   1½ HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-425)
   2 HP, 208/220/240 V, 60 cy, 3 ph. (Unit M-505)
3. Modulating Firing Sequence with Low Fire Start
4. Modutrol Motor with Low Fire Interlock to Control Air and Fuel Supply
5. Operating Control for Modutrol Motor (Boiler Mounted)
6. Fireye FP-2 Flame Safeguard System with Lead Sulphide Flame Detector
7. Air Flow Safety Switch
8. UL Gas Control Group Including: Automatic Operating Gas Valve; Automatic Safety Gas Valve; Gas Volume Control Valve; Gas Pressure Regulator; Gas Pressure Gauge; and Manual Gas Cock
9. Gas-Electric Ignition Assembly
10. Factory Firetest

1. DC Voltmeter for Fireye System
2. Manual Potentiometer
3. Gas Controls for Other Than Standard Pressures
4. Gas Controls for FM
5. Gas Controls for FIA
**6. Gas Controls for Local Utility Requirements

1 Manual Fuel Changeover Switch
2 Standard Equipment Listed Above by Unit Size for Each Fuel
3. Voltage, Flame Safeguard System, and Firing Sequence for Combination Unit Same as Listed Above for Oil Firing

1 Automatic Fuel Changeover Switch
2 Optional Equipment as Listed Above by Unit Size and Fuel

*Requires Special Control Cabinet — **On Special Application Only

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KEWANEE SQUARE-HEAT GENERATOR

FOR ALL UNITS M-45 THRU M-505

The contractor shall furnish and install Model No. Square-Heat Generator(s) for (No. (2) (4) (5) oil), (gas), (combination gas-No. (2) (4) (5) oil) firing. The unit(s) shall be three-pass compact firebox design with arched upright crown sheet and two passes of firetubes, and constructed in accordance with the ASME Code for (15 lbs. steam) (30 lbs. water).

Unit(s) shall have not less than total square feet of waterside heating surface including a minimum of square feet of primary or direct heating surface.

Unit(s) shall contain not less than cubic feet of furnace volume and shall have a gross output rating of not less than MBh. Heat release shall not exceed 74,000 Btu per cubic foot of furnace volume.

Normal water line of unit(s) shall not exceed inches. A pyrex observation port shall be provided at the rear of the firebox. Front flue access cover, with refractory securely keyed in place and of a size permitting easy access to all fire tubes, shall be mounted on a gas-tight, insulated front smokebox. Gas-tight rear smokebox shall be provided with a (rear) (top) outlet.

Unit(s) shall be provided with a wrap-around steel jacket with glass or mineral fiber insulation and smooth enamel finish. All tubes shall be set with a roller expander at each end. No welding of tubes to the tube sheets nor use of refractory baffling to provide the second or third pass will be permitted.

Unit(s) shall be assembled and wired, with burner, controls, trim, insulated steel jacket, and refractory filled skid type base installed at the factory.

Fuel burning equipment shall be forced draft type: Factory assembled, wired, mounted, and tested. The entire unit shall bear the Underwriters' Laboratories label and shall be ready for field connection to power and fuel supply. Equipment shall include forced draft fan with air damper; dual high limit controls; flame sensing device; and control cabinet containing electronic flame safeguard and programming timer, burner switch, control circuit fuse, two indicating lights for major operations, numbered terminal strips, color-coded wiring, engraved nameplates, and necessary relays, starters and switches for automatic operation.

All motors shall be for volts, cycle, phase operation. Controls shall be 115 volt, 60 cycle, single phase. Magnetic motor starters with thermal overload protection and a step-down control circuit transformer shall be provided in the control cabinet when other than 115 volt motors are specified.

Fuel burning equipment shall be set and adjusted by a factory authorized representative to burn G.P.H. of No. (2) (4) (5) oil (and) (or) C.F.H. of Btu/cu. ft. (natural) (manufactured) (L.P.) gas having a sp. gr. with inches w.c. pressure at inlet of burner manual gas cock. Unit efficiency, based on flue gas analysis, shall be not less than 80%. *NOTE: Specify job altitude if over 2,500 ft. above sea level.* Owner's representative shall be present to receive instructions in care and maintenance of the unit at the time it is started up by the service representative. Contractor shall provide a free service period of 90 days after start-up.

NOTE: Select applicable paragraphs below according to fuel and unit size. The following equipment conforms to UL requirements. Specify additional controls if FM or FIA insured, or subject to special utility requirements.

FOR PRESSURE ATOMIZING OIL UNITS M-45 THRU M-175

Oil burner shall be of the high pressure mechanical atomizing type for No. 2 oil, with a two-stage oil pump direct connected to the blower motor. Burner shall include oil atomizing nozzles, oil solenoid valves; 10,000 volt ignition transformer; T-1A Timer for pre-purge and post-purge; RA-890E flame safeguard with photocell flame detector; and all necessary controls for "on-off" type of operation. Air control shall be by fixed position air inlet damper and adjustable primary-secondary air shutter.

FOR PRESSURE ATOMIZING OIL UNITS M-205 THRU M-255

Oil burner shall be of the high pressure mechanical atomizing type for No. 2 oil, with a two-stage oil pump direct connected to the blower motor. Burner shall include dual oil atomizing nozzles; dual oil solenoid valves; 10,000 volt ignition transformer; T-1A Timer for pre-purge and post-purge; RA-890E flame safeguard with photocell flame detector; and all necessary controls and linkage for "on-off" type of operation with controlled low fire start. Fuel-air control shall provide two-position regulation of the air inlet damper and the high fire oil solenoid valve by means of a modutrol motor.

FOR PRESSURE ATOMIZING OIL UNITS M-335 THRU M-505

Oil burner shall be of the high pressure mechanical atomizing type for No. 2 oil, with a two-stage oil pump assembly with internal relief valve mounted on the boiler base. Burner shall include variable-flow oil atomizing nozzle; oil solenoid valve; oil metering valve; gas-electric ignition assembly with ring-type pilot burner, 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock; air flow safety switch; Fireye FP-2 flame safeguard system with lead sulphide flame detector; low fire interlock; and all necessary controls and linkage for modulated firing with proved low fire start. Fuel-air control shall provide modulated regulation of the air damper and the oil metering valve by means of a modutrol motor.

FOR AIR ATOMIZING OIL UNITS M-175 THRU M-505

Oil burner shall be of the low pressure air atomizing type for No. 5 or lighter oil with an air-oil unit consisting of air compressor, motor, air pressure regulating valve, inlet air filter, check valve, air proving safety switch, air gauge, oil pump assembly, and relief valve mounted on the boiler base. Burner shall include air-oil atomizing nozzle; oil solenoid valve; oil metering valve, air purge relay and valve, thermostatically controlled electric heater *(omit for No. 2 oil)*; gas-electric ignition assembly consisting of a ring-type pilot burner; 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock; air flow safety switch; Fireye FP-2 flame safeguard with lead sulphide flame detector; low fire interlock, and all necessary controls and linkages for (modulated) (two-position) firing with proved low fire start. Fuel-air control shall provide (modulated) (two-position) regulation of the air damper and the oil metering valve by means of a modutrol motor.

FOR GAS UNITS M-45 THRU M-175

Gas burner shall be of the multiple-jet flame retention type including a main gas control group consisting of an automatic diaphragm gas valve, automatic safety gas valve on inputs over 1,000 MBh, gas pressure regulator and manual gas cock; gas-electric ignition assembly consisting of a 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator and manual gas cock, air-flow safety switch, T-1A Timer for pre-purge and post-purge, RA-890E flame safeguard with flame rod flame detector, and all necessary controls for "on-off" type of operation. Air control shall be by fixed position air inlet damper and adjustable primary-secondary air shutter.



TYPICAL SQUARE-HEAT GENERATOR SPECIFICATIONS

FOR GAS UNITS M-205 THRU M-265

Gas burner shall be of the multiple-jet flame retention type, including a main gas control group consisting of an automatic diaphragm gas valve, automatic safety gas valve, gas volume control valve, gas pressure regulator, and manual gas cock; gas-electric ignition assembly consisting of a 6,000 volt ignition transformer; automatic gas valve, gas pressure regulator, and manual gas cock, air-flow safety switch; T-1A Timer for pre-purge and post-purge; RA-890E flame safeguard with flame rod flame detector; and all necessary controls and linkage for "on-off" type of operation with controlled low fire start. Fuel-air control shall provide two-position regulation of the air inlet damper and the gas volume control valve by means of a modutrol motor.

FOR GAS UNITS M-335 THRU M-505

Gas burner shall be of the radial-jet flame retention type including a main gas control group consisting of an automatic motorized gas valve, automatic safety gas valve, gas volume control valve, gas pressure regulator, gas gauge, and manual gas cock; gas-electric ignition assembly consisting of a ring-type pilot burner, 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock; air flow safety switch; Fireye FP-2 flame safeguard with lead sulphide flame detector; low fire interlock; and all necessary controls and linkage for full modulated firing with proved low fire start. Fuel-air control shall provide modulated regulation of the air damper and the gas volume control valve by means of a modutrol motor.

FOR COMBINATION GAS-PRESSURE ATOMIZING OIL UNITS M-45 THRU M-125

Gas-oil burner shall consist of a combination multiple-jet flame retention type gas burner and a high pressure mechanical atomizing oil burner for No. 2 oil, including all necessary controls for "on-off" type of operation. Gas controls shall include a main gas control group consisting of an automatic diaphragm gas valve, automatic safety gas valve on inputs over 1,000 MBh, gas pressure regulator, and manual gas cock; gas-electric ignition assembly consisting of a 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock; and flame rod flame detector. Oil controls shall include a two-stage oil pump direct connected to the blower motor; oil atomizing nozzles; oil solenoid valves; 10,000 volt ignition transformer; and photocell flame detector. Controls for both fuels shall include T-1A Timer for pre-purge and post-purge; RA-890E flame safeguard; and air-flow safety switch. Air control shall be by fixed position air inlet damper and adjustable primary-secondary air shutter. Changeover from one fuel to the other shall be accomplished by means of a manual fuel selector switch in the control cabinet. No changes in linkage, burner position, or mechanical adjustment shall be necessary when changing fuels. The fuel selector switch shall provide, through the combustion control relay, proper ignition timing for the fuel being burned.

FOR COMBINATION GAS-PRESSURE ATOMIZING OIL UNITS M-205 THRU M-265

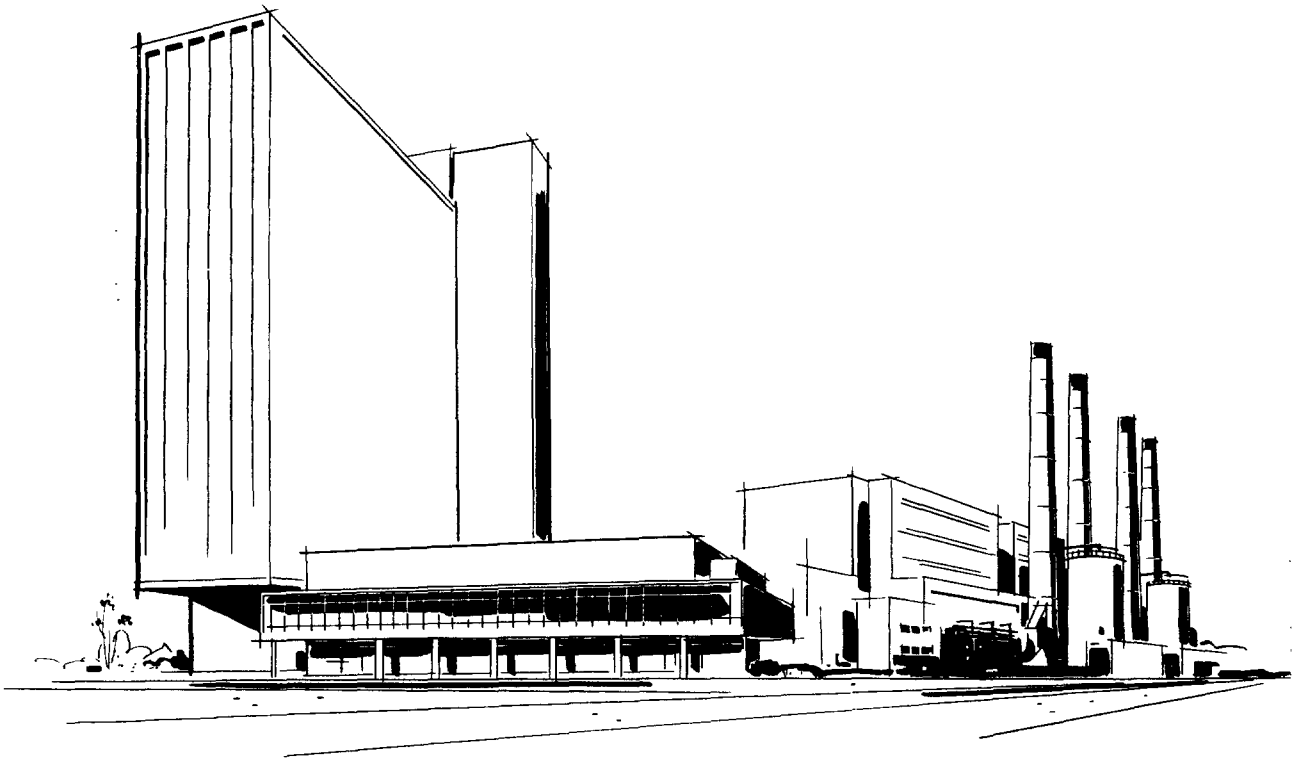
Gas-oil burner shall consist of a combination multiple-jet flame retention type gas burner and high pressure mechanical atomizing oil burner for No. 2 oil, including all necessary controls for "on-off" type of operation with controlled low fire start. Gas controls shall include a main gas control group consisting of an automatic diaphragm gas valve, an automatic safety gas valve, gas volume control valve, gas pressure regulator, and manual gas cock; gas-electric ignition assembly consisting of a 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock; and flame rod flame detector. Oil controls shall include a two-stage oil pump direct connected to the blower motor; dual oil atomizing nozzles; dual oil solenoid valves; 10,000 volt ignition transformer; and photocell flame detector. Controls for both fuels shall include T-1A Timer for pre-purge and post-purge; RA-890E flame safeguard; and air-flow safety switch. Fuel-air control shall provide two-position regulation of the air inlet damper, the gas volume control valve, the high fire oil solenoid valve by means of a modutrol motor. Changeover from one fuel to the other shall be accomplished by means of a manual fuel selector switch in the control cabinet. No changes in linkage, burner position, or mechanical adjustment shall be necessary when changing fuels. The fuel selector switch shall provide, through the combustion control relay, proper ignition timing for the fuel being burned.

FOR COMBINATION GAS-PRESSURE ATOMIZING OIL UNITS M-335 THRU M-505

Gas-oil burner shall consist of a combination radial-jet flame retention type gas burner and high pressure mechanical atomizing oil burner for No. 2 oil, including all necessary controls for modulated type of operation with proved low fire start. Gas controls shall include a main gas control group consisting of an automatic motorized gas valve, an automatic safety gas valve, gas volume control valve, gas pressure regulator, gas gauge, and manual gas cock; Oil controls shall include a two-stage oil pump assembly with internal relief valve; variable-flow oil atomizing nozzle; oil solenoid valve; oil metering valve. Controls for both fuels shall include Fireye FP-2 flame safeguard with lead sulphide flame detector; air flow safety switch, low fire interlock; and gas-electric ignition assembly consisting of a ring-type pilot burner, 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock. Fuel-air control shall provide modulated regulation of the air damper, the gas volume control valve, and the oil metering valve by means of a modutrol motor. Changeover from one fuel to the other shall be accomplished by means of a manual fuel selector switch in the control cabinet. No changes in linkage, burner position, or mechanical adjustment shall be necessary when changing fuels. The fuel selector switch shall provide, through the combustion control relay, the proper ignition timing for the fuel being burned.

FOR COMBINATION GAS-PRESSURE ATOMIZING OIL UNITS M-175 THRU M-505

Gas-oil burner shall consist of a combination radial-jet flame retention type gas burner and low pressure air atomizing oil burner for No. 5 or lighter oil with all necessary controls for (modulated) (two-position) type of operation with proved low fire start. Gas controls shall include a main gas control group consisting of an automatic motorized gas valve, automatic safety gas valve, gas volume control valve, gas pressure regulator, gas gauge, and manual gas cock. Oil controls shall include an air-oil unit consisting of an air compressor, motor, air pressure regulating valve, inlet air filter, check valve, air proving safety switch, air gauge, oil pump assembly and relief valve, air-oil atomizing nozzle; oil solenoid valve, oil metering valve, air purge relay and valve; thermostatically controlled electric oil heater *(omit for No. 2 oil)*. Controls for both fuels shall include Fireye FP-2 flame safeguard with lead sulphide flame detector, air flow safety switch; low fire interlock; and gas-electric ignition assembly consisting of a ring-type pilot burner, 6,000 volt ignition transformer, automatic gas valve, gas pressure regulator, and manual gas cock. Fuel-air control shall provide (modulated) (two-position) regulation of the air damper, the gas volume control valve, and the oil metering valve by means of a modutrol motor. Changeover from one fuel to the other shall be accomplished by means of a manual fuel selector switch in the control cabinet. No changes in linkage, burner position, or mechanical adjustment shall be necessary when changing fuels. The fuel selector switch shall provide, through the combustion control relay, proper ignition timing for the fuel being burned.



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