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Power

Instrumental Control

Environmental Management

Prime Movers and Electric Generation

Air Control and Pollution

Automation and Control

Heating, Cooling, Air Conditioning Control

Plant Electric Systems

Steam Generation

Boilers and Steam and Lubrication

1970 ENERGY SYSTEMS DISTRIBUTION

Central Stations

Substations

Transmission Lines

Electric Distribution

Power Cables

Power Conditioning

Power Quality, Safety, Reliability, Economic Operation



Equipment and Design Aids Roundup

Presenting a condensation of one of the most useful and popular features the year-round. Equipment News items and Manufacturers' Data announcements appearing each month call for careful sifting through several hundred releases coming across our desks or collected during our visits to manufacturing facilities and engineering convention shows. Selection of

announcements for each issue followed review by each editor of those items falling within his particular area of technical expertise, so that both departments—Equipment News and Manufacturers' Data—represented a balanced selection of material covering the entire spectrum of interest of our readers. Brief descriptions highlighted for you the significant features worth noting.

By Robert G. Schwieger, Assistant Editor

In this age of burgeoning population, every large U.S. industry seems to have one major crisis each year. Electric utilities are no exception. If it is not tight money holding back new plant construction, or a shortage of trained personnel to design, construct or operate plants, it is some other problem that has yet to emerge.

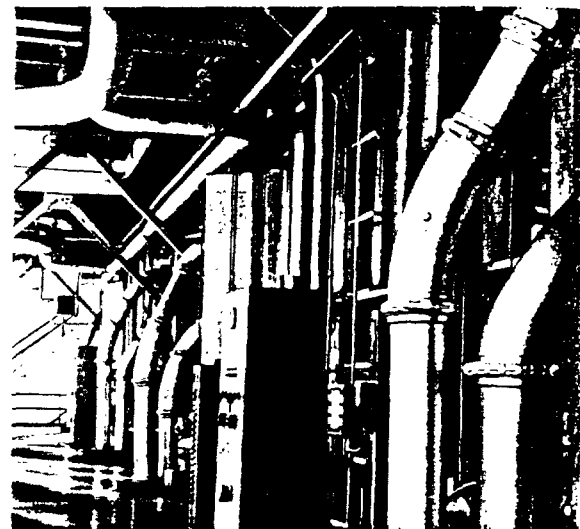
In recent years environmentalists have applied the pressure, clamoring for antipollution legislation. They hoped to curtail the number of new fossil-fueled plants and also reduce pollution from existing installations. Their intentions, sincere in most cases, attracted much public support and eventually the necessary legislation was enacted.

Unfortunately, however, the environmentalists' panacea appears to have contributed to two new crises: power shortages and, more serious, an energy shortage. Although selected U.S. projects in this year's survey of fossil-fueled central stations (next four pages) have a combined potential of 21,400 MW—an impressive figure in almost every other country—it is not enough to satisfy the ever-growing demand of American industry and the public.

Delays in plant construction resulting from public intervention will undoubtedly foster power shortages in major cities for years to come. This becomes obvious when you realize it takes 3.5 to 5 years to install a large plant.

Pressed by local authorities to reduce sulfur-oxide pollution, utilities and large industrial companies have been converting their coal-burning boilers to handle oil and/or gas (POWER, April 1970, pp 27-31). This has placed further pressure on oil and gas suppliers to increase production of low-sulfur fuel, already in short supply.

Just how long the oil crisis will last depends on several variables. Among them: (1) Time involved in proof-testing

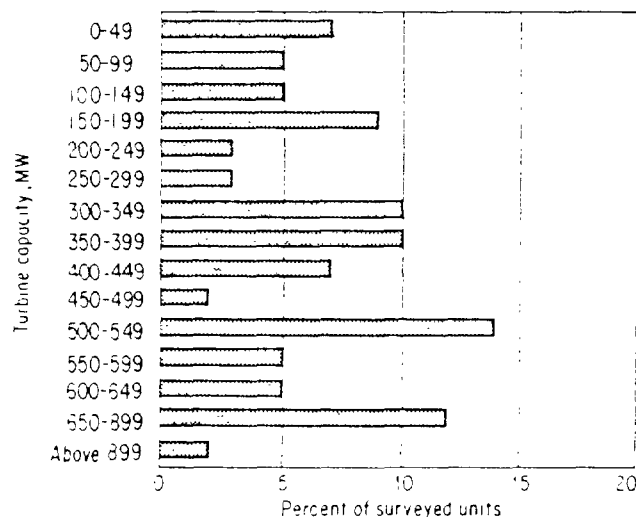


Burner level in a typical pulverized-coal-fired central station shows some of the controls needed in most modern plants.

and modifying prototype stack-gas sulfur-removal systems. These will permit burning of high-sulfur coal and without adding to pollution. (2) Availability of low-sulfur oil from the large Mideast reserves. (3) Rapidly changing technology which large-scale oil-desulfurization plants can be installed. (4) Number of oil-fired stations that will be committed in future years.

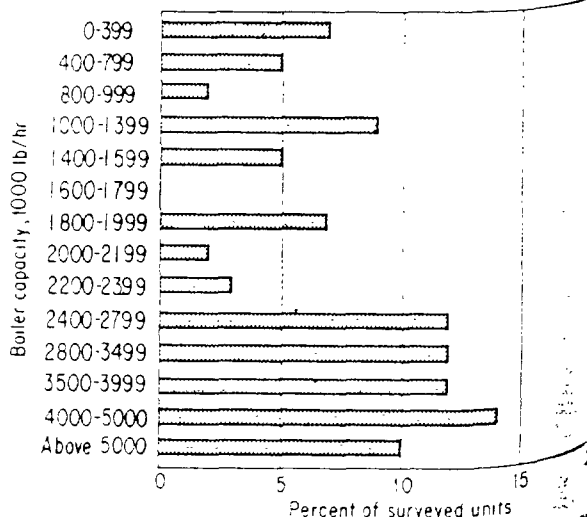
Gas shortages result from different problems. Shrinking gas reserves (known U.S. reserves will last only 12-14 yr) and availability only on an interruptible basis eliminate gas as a base fuel for most utilities, which must design units for 30-yr life and project generation potential.

Turbine size



Distribution of turbine sizes shows 40% of the units exceed 500 MW. All new installations have only one turbine/generator

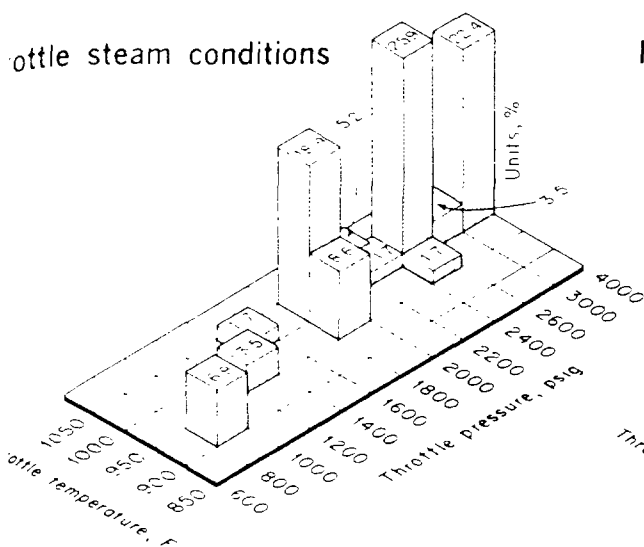
Capacity of boilers



Boiler ratings reflect the central station's turbine/generator capacity. Larger steam generators loom on the horizon.

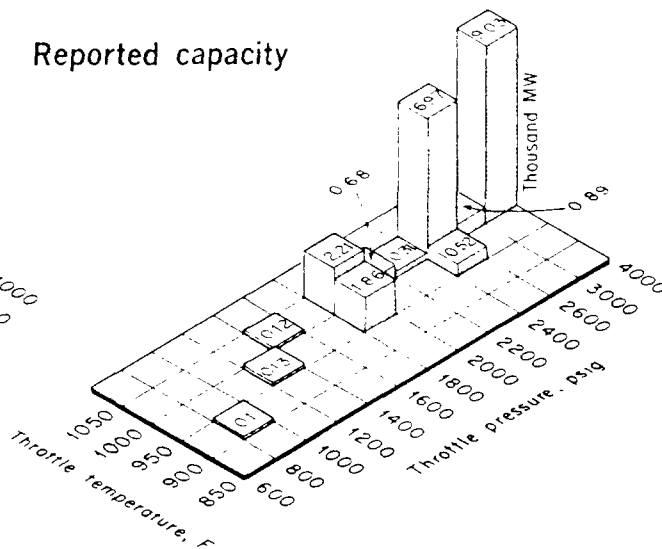
Where will the fuel come from?

Boiler steam conditions



Boiler steam conditions survey reveals many units currently on order to be operating within the supercritical-pressure region

Reported capacity



Capacity tabulated this year amounts to nearly 23,000 MW. Municipal and cooperative plants account for 10% of total

in advance. Suppliers attribute this shortage to stringent government price controls.

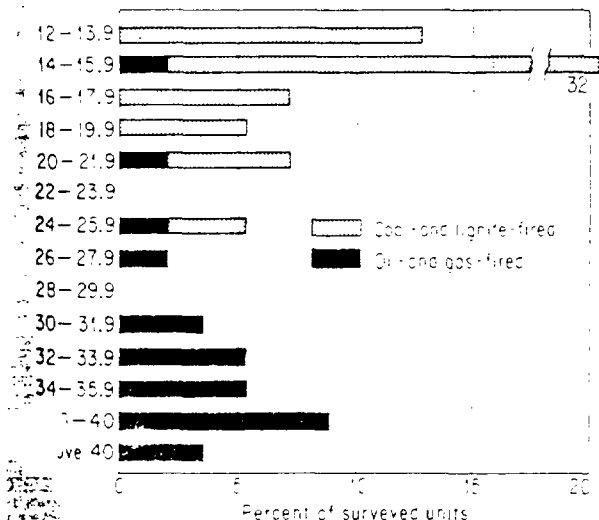
Should coal supplies be taken for granted. Even if coal could be burned in some areas, it would be difficult to obtain. For example, Tennessee Valley Authority reported a two-week supply as of early August. Problems from the recently enacted mine safety laws. As a result, several companies have found it more economical to close older mines than to equip them to meet new standards. Further, mine openings are being delayed by tight money and labor problems.

Should coal production fail to keep pace with demand in

coming years, supply problems will get worse. Note the large number of coal- and lignite-fired units represented in the survey—36 in all, roughly 62% of the projects.

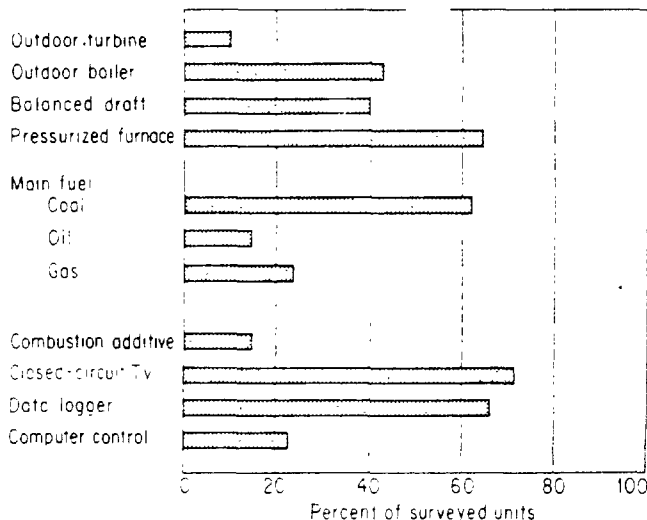
Data on instrumented control, theme of the 1970 survey, are accented with a gray tint (p S-6). Since final selection of control equipment is generally firmed up later in the design phase, manufacturers' names are not available in all cases. Note the trend to increased reliance on instruments and controls. Examples: Thirty-four of the 51 projects reported will employ data loggers, far above last year's 18%. And varying degrees of computer control will be employed in about 23% of the plants, a 7% increase over 1969.

Boiler heat release



Boiler heat release rates show a wide spread between oil- and gas-fired units and those that use lignite or bituminous coal

Plant features



Design philosophy is reflected in the choice of equipment. In many cases, major plant controls are yet to be selected

FOSSIL-FUELED CENTRAL STATIONS

Materials limitations

Each project listing covers four pages

PROJECT	COMPANY	PLANT NAME	LOCATION	CONSULTING ENGINEER	Unit number	Year first commercial operation	Unit capacity, MW	BOILERS			
								Capacity, 1000 lb./hr.	Throttle pressure, psig	Throttle temp., F	Subcool temp., F
1	Duke Power Co.	Bellevue Creek	Wainut Cove, N.C.	Black & Veatch	1,2,3	74-75	1080	7258	1500	1000	1000
2	Kansas City Power & Light Co.	La Crosse	La Crosse, Kan.	Black & Veatch	73	73	307	5513	2840	1010	1005
3	Conocochee Gas & Electric Co.	Conocochee	Conocochee, Ohio	Black & Veatch	73	73	770	1000	1500	1000	1000
4	Detroit Edison Co.	Monroe	Monroe, Mich.	Black & Veatch	1,2	70-73	752	5717	2650	1000	1000
5	Southern California Edison Co.	Diamond Beach	Diamond Beach, Calif.	Bechtel Corp.	1,2	71-73	750	5600	3590	1005	1000
6	Alabama Power Co.	Barry	Bucks, Ala.	Southern Services, Inc.	5	71	700	4650	3500	1000	1000
7	Florida Power & Light Co.	Rosario	Rosario, N.C.	Brown & Root, Inc.	3	73	685	5165	2510	1000	1000
8	Allegheny Power System, Inc.	Harrison	Harrison, N. Va.	Gibbs & Hill, Inc.	1,2,3,4	72-73, 75	550	4800	2500	1000	1000
9	Duke Power Co.	Marshall	Tarboro, N.C.	Bechtel Corp.	4	70	547	4210	2500	1000	1000
10	Duke Power Co.	Marshall	Tarboro, N.C.	Commonwealth Associates, Inc.	7	71	523	4630	2735	1005	1005
11	The Dayton Power & Light Co.	J.M. Stuart	Aberdeen, Ohio	Edasco Services Inc.	4	74	500	4400	2500	1000	1000
12	Fort Worth Electric Co.	Lucas	Bridge City, Texas	Mid-Valley, Inc.	4	72	586	4011	2675	1000	1000
13	Union Electric Co.	Lucas	Franklin County, Mo.	Bechtel Corp.	1,2,3,4	70-71, 72-73	571	4080	2400	1000	1000
14	Duke Power Co.	Lucas	Franklin County, Mo.	Bechtel Corp.	7	71	570	4080	2400	1000	1000
15	Allegheny Power System, Inc.	Harrison	Masonville, Pa.	United Engineers & Constructors, Inc.	1,2	70-71	540	3315	2500	1000	1000
16	Texas Electric Service Co.	Perryman Basin	Monahans, Texas	United Engineers & Constructors, Inc.	5	71	540	2600	2400	500	1000
17	Michigan Electric Power Service Co.	Michigan City	Michigan City, Ind.	Sargent & Lundy	7	71	523	2735	2500	1005	1005
18	Dallas Power & Light Co.	Lake Mead	Dallas, Texas	Bechtel Corp.	7	71	523	2735	2500	1005	1005
19	Massachusetts Electric Co.	Shant	Shant, Ky.	Sargent & Lundy	7	71	523	2735	2500	1005	1005
20	The Hydro-Electric Power Commission of Ontario	Van Ouse	Port Dover, Ont., Can.	Sargent & Lundy	7	72	500	2600	2450	500	1000
21	The Hydro-Electric Power Commission of Ontario	Lambton	W. of Sarnia, Ont., Can.	Sargent & Lundy	1,3,4	70-71	500	2600	2450	500	1000
22	Mississippi Power Co.	Jack Watson	Jack Watson, Miss.	Southern Services, Inc.	5	71	523	2735	2500	1005	1005
23	New England Power Co.	Newton Point	Newton, Mass.	Charles T. Mann, Inc.	4	72	480	2500	2500	1000	1000
24	Indiana Power & Light Co.	Union Station	Union Station, Ind.	Brown & Root, Inc.	3	72	440	2200	2500	1000	1000
25	Kentucky Electric Co.	E.W. Brown	Burgin, Ky.	Sargent & Lundy	3	71	398	2025	2400	1000	1000
26	Long Island Lighting Co.	Northport	Northport, N.Y.	Edasco Services, Inc.	7	71	380	2550	2500	500	1000
27	Baltimore Gas & Electric Co.	Harriet A. Wagner	Harriet A. Wagner, Md.	Edasco Services, Inc.	7	72	378	2732	2500	500	1000
28	Connecticut Light & Power Co.	Monroville	Monroville, Pa.	Bechtel Corp.	6	71	365	2306	2500	500	1000
29	Texas Electric Service Co.	Engle Mountain	Engle Mountain, Texas	Gibbs & Hill, Inc.	3	71	356	2195	2500	500	1000
30	Alabama Power Co.	Barry	Bucks, Ala.	Southern Services, Inc.	4	70	350	2569	2400	500	1000
31	Public Service Co. of Colorado	Domahone	Domahone, Colo.	Stearns-Rover Corp.	7	71	350	2514	2400	500	1000
32	San Juan Gas & Electric Co.	San Juan	San Juan, N.M.	Stearns-Rover Corp.	7	71	345	2510	2400	500	1000
33	Minnesota Power & Light Co.	Quincy	Quincy, Minn.	Edasco Services, Inc.	7	71	345	2510	2400	500	1000
34	Central Power & Light Co.	Nueces Bay	Nueces Bay, Texas	Sargent & Lundy	7	71	345	2510	2400	500	1000
35	Cincinnati Gas & Electric Co.	Mull Creek	Kosmosville, Ky.	P. Green Service & Engineering Co.	7	71	345	2510	2400	500	1000
36	Dubuque Power Ltd.	Sundance	Lake Wabamun, Alb., Can.	Montreal Engineering Co. Ltd.	1,2	70-71	308	2365	2250	1005	1005
37	Phonac Electric Power Co.	Benning	Benning, N.C.	Bechtel Corp.	6	72	288	2211	2255	500	1000
38	Southern Indiana Gas & Electric Co.	Coville	Newburgh, Ind.	Brown & Root, Inc.	7	71	275	2100	2500	1000	1000
39	Empire District Electric Co.	Astoria	Astoria, Mo.	Black & Veatch	1	70	270	2100	2500	1000	1000
40	Indiana Power & Light Co.	Greenville	Greenville, N.C.	Brown & Root, Inc.	7	71	265	2000	2500	1000	1000
41	Delaware Power & Light Co.	Indian River	Millboro, Del.	United Engineers & Constructors, Inc.	3	70	260	2061	2500	1000	1000
42	Newfoundland & Labrador Power Commission	McLoud	McLoud, Nfld., Can.	Shawmut Resources Joint Venture	1,2	70	260	2061	2500	1000	1000
43	Turkey Creek Power Corp.	Quincy	Quincy, N.Y.	Montreal Engineering Co. Ltd.	7	71	260	2061	2500	1000	1000
44	Public Service Co. of Colorado	Domahone	Domahone, Colo.	Stearns-Rover Corp.	7	71	260	2061	2500	1000	1000
MUNICIPAL AND COOPERATIVE INSTALLATIONS											
45	San Antonio Public Service Board	Calveras	San Antonio, Texas	Black & Veatch	7	71	240	2014	2500	1000	1000
46	San Antonio Public Service Board	Calveras	San Antonio, Texas	Black & Veatch	7	71	240	2014	2500	1000	1000
47	San Antonio Public Service Board	Calveras	San Antonio, Texas	Black & Veatch	7	71	240	2014	2500	1000	1000
48	Austin Electric Department	Eller	Austin, Texas	Black & Veatch	7	71	240	2014	2500	1000	1000
49	Austin Electric Department	Eller	Austin, Texas	Black & Veatch	7	71	240	2014	2500	1000	1000
50	Kansas City Board of Public Utilities	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
51	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
52	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
53	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
54	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
55	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
56	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
57	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
58	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
59	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
60	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
61	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
62	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
63	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
64	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
65	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
66	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
67	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
68	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
69	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
70	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
71	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
72	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
73	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
74	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
75	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
76	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
77	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
78	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
79	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
80	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
81	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
82	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
83	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
84	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
85	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
86	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
87	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
88	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
89	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
90	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
91	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
92	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
93	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
94	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
95	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
96	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
97	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
98	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
99	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000
100	Donora Electric Power, Inc.	Donora	Donora, Kan.	Burns & McDonnell	7	72	240	2014	2500	1000	1000

MANUFACTURERS

See project listings

See project listings

See project listings

See project listings

See project listings

See project listings

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See project listings

See project listings

See project listings

See project listings

See project listings

See project listings

INDUCED-DRAFT FANS

PROJECT

[illegible]

Each project listing covers four pages

1. Other heating value of 85.0
 2. All other efficiency of 85.0
 3. Data not yet available
 4. In control with 85.0
 5. Brummond's oil
 6. Jointly owned with Compton
 7. Of N. Inc and Augustus
 8. Drilling condenser
 9. Drilling value of oil
 10. 8.750 and 18.425
 11. One and a half
 12. Main pump with 18.425
 13. Main pump data
 14. Main pump data
 15. Main pump data
 16. Main pump data
 17. Main pump data
 18. Main pump data
 19. Main pump data
 20. Main pump data

1990-1991

1

[illegible]

1000-cc, 10-burner for natural gas
and burners for which the data are provided is rated at
100% capacity. Two motor-driven unit
reach provide 25 x capacity manufactured
by Cummins 2200 gpm at 2500 psi. GE is supplying
the 5500-hp motor.

1000-cc, 10-burner in front of IE in rea
tion, owned with Kansas Gas & Electric Co
in Kansas. The type burner

Shows latest thinking for control systems

BOILER FEED PUMPS										HEATERS				FUEL AND EXHAUST										PROJECT
Capacity of each, gpm	Discharge pressure, psig	Manufacturer	Flow control	Drive type	Drive hp, each	Drive manufacturer	Number	Final feedwater temp., F	Max. discharge pressure, psia	Manufacturer	Type	Fuel				Sootblower		Dust						
												Calorific value, 1000 Btu/lb or Btu/cu ft	Design heat rate, Btu/lb	Max sulfur content, %	Combustion additive	Additive introduction	Type of unit and working fluid	Manufacturer	Stock height, ft above ground	Collector type	Manufacturer			
4315	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4634	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4881	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4170	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
5245	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2660	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4630	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4526	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
6000	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4510	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4417	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3058	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3019	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
6332	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2575	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
4571	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2900	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3175	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
274	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3100	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2840	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1300	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3071	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2579	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2815	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2230	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2440	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2462	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3544	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
3066	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
20	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
100	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2200	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2500	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2640	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2465	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2400	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2450	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2530	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2530	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2800	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2800	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2502	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2511	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2526	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2125	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1680	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2750	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1600	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
2200	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1460	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1180	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1500	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		
1400	100	IF			1000	GE	1	100	33	AE SWE	C	100	7425 ³⁴	0.2	N		Ret. St.	DF	600	E	RC	16		

3 GAS TURBINES

Popularity of gas turbines continues to climb

By Robert G Schwieger, Assistant Editor

The large number of gas turbines sold to industrial and utility companies during the past year indicates the continuing popularity of these prime movers. This trend, according to McGraw-Hill's DMS Aircraft Studies Group, is certain to continue throughout the 1970-74 period.

POWER's survey of recent orders supports the DMS projection with design data on specific projects (pp S-14-15). Installations surveyed highlight the primary uses of gas turbines, including base-load, intermittent or peaking, and standby or emergency power generation, natural gas and oil pumping, compressor drives for petrochemical process plants, and total-energy systems.

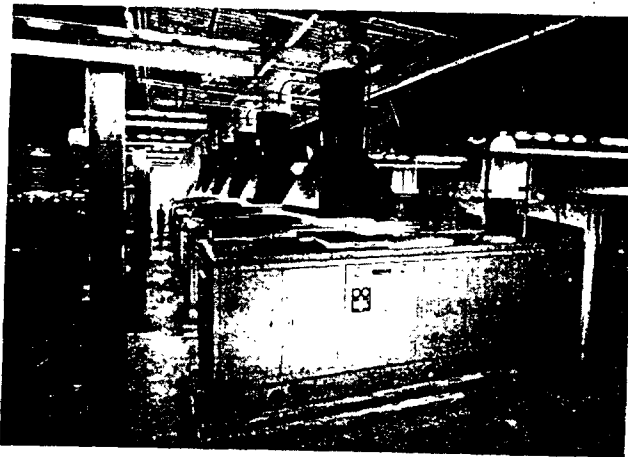
Outside the aircraft industry, today's biggest single market for gas turbines (on a horsepower basis) is in electric generation. Reasons: Gas turbine offers fast response to load changes, it operates on a variety of fuels, can be equipped with controls for remote operation, and has both low initial cost and short delivery time.

Gas turbine drives were also selected for more than half new gas-pipeline compressors; the trend is expected to continue. They now account for roughly 2.2-million hp (installed) in this industry alone.

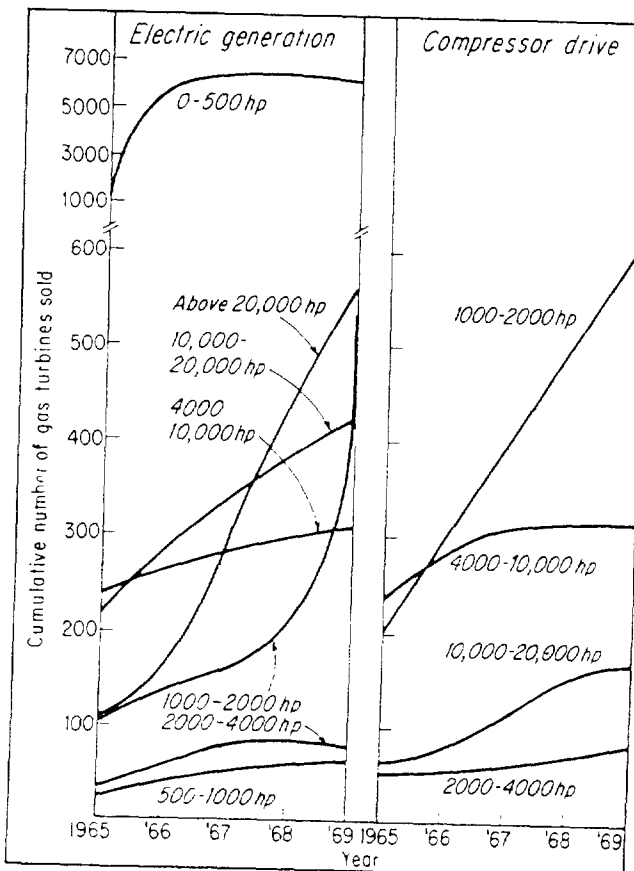
In contrast, oil-pipeline owners have installed only about 8% as much gas-turbine power as the gas-pipeline industry. Main reasons: Few oil lines are large enough to utilize the bigger industrial turbines. Further, experience thus far with crude-oil fuel (supplied directly from the pipeline) in modified aircraft units has not been satisfactory. Remember, turbines are of two basic types: those designed for land use (so-called industrial units) and those modified from an existing aircraft design. Until larger pipelines predominate or aircraft engines can accommodate crude, the market is estimated at 30-60,000 hp annually.

Water flooding, a method of extracting crude oil, offers vast potential for turbines as pump drives. Note that about one-quarter of 1968 U.S. production was accomplished using this increasingly popular technique. Offshore, the expanding search for new oil and gas reserves is ideal for gas turbines in another area. They can be used to generate power while providing high-temperature exhaust gas for purifying salt water and satisfying heating and air conditioning demands. According to experts, 25% of the oil consumed in the mid-70s will come from offshore drilling.

Production of gas turbines for land-based and marine use will increase during the 1970-74 period. Sales of 2-4000-hp units may exceed 700 units, compared to 110 in 1965-69, despite sluggishness in the industrial area (curves). While annual production of 4-10,000-hp machines is not expected to increase appreciably, orders in the 10-20,000-hp range are expected to exceed 1000 units in 1970-74—80% higher than the previous five-year period. Annual production of turbines in excess of 20,000 hp, now at 200 units per year, should remain relatively constant.



Satellite Control Facility relies on twelve 750-kW gas turbines to provide all its energy requirements (Project 18, next page). Two electrical systems are supplied—one handles plant services, the other computers and related equipment.



Cumulative sales of land-based gas turbines for electric generation (including portable units) and compressor drives indicate popularity of 1-2000-hp machines in 1965-69 period.

GAS TURBINES

Single-shaft gas turbine

PROJECT	COMPANY	LOCATION	Manufacturer	Units ordered between 6/69-6/70	Year(s) of initial operation	Main application	Block plant installation?	Method of remote operation	RATING AND CONDITIONS										Gas temp at turbine inlet, F
									Normal power, MW	Normal power, 1000 hp	Standard elevation, ft	Ambient temp, F	Maximum power, MW	Maximum power, 1000 hp	Ambient temp for max power at std elevation, F	Time to reach normal power, minutes			
																Normal startup	Fast startup	Emergency startup	
UNITED STATES AND CANADIAN UTILITIES AND INDUSTRIAL PLANTS																			
1	Baltimore Gas & Electric Co.	Bush River, Md.	GE	24	13	pp	No	Yes	53	72	1000	80	31	40	10	10	10	10	1850
2	Florida Power & Light Co.	Fort Lauderdale, Fla.	GE	514	13	pp	Yes	Yes	8.0	10	1000	30	42	30	6	6	6	6	1760
3	Canadian Utilities, Ltd.	Rainbow Lake, Alb., Can.	GE	1	13	pp	Yes	Yes	5.9	8	1579	20	39	5	5	5	5	5	1480
4	Public Service Electric & Gas Co.	Newark, N.J.	GE	25	13	pp	No	Yes	15.9	21	1000	30	35	0	0	0	0	0	1850
5	Consolidated Edison Co. of N.Y., Inc.	New York, N.Y.	GE	173	13	pp	Yes	Yes	9.7	13	1000	30	31	0	0	0	0	0	1850
6	Lubbock Light & Power Dept.	Lubbock, Texas	GE	118	13	pp	Yes	Yes	8.3	11	1000	40	31	0	0	0	0	0	1760
7	Consolidated Edison Co. of N.Y., Inc.	New York, N.Y.	GE	4	13	pp	Yes	Yes	4	5	1000	40	31	0	0	0	0	0	1760
8	Syracuse Electric Light Dept.	Syracuse, N.Y.	GE	117	13	pp	Yes	Yes	6.3	8	1000	40	31	0	0	0	0	0	1760
9	Alberta Natural Gas Co.	Edmonton, Can.	GE	40	13	ch	No	Yes	13.5	18	1300	30	31	0	0	0	0	0	1480
10	Natural Gas Pipeline Co. of America	Muscatine, Iowa	GE	173	13	ch	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1480
11	Northern Natural Gas Co.	Burlington, Kan.	GE	21	13	ch	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1400
12	TransCanada Pipe Lines Ltd.	Burlington, Sask., Can.	GE	39	13	ch	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1400
13	Natural Gas Pipeline Co. of America	Chicago, Ill.	GE	21	13	ch	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1400
14	Mundelein Oil & Refining Co.	Mundelein, Ill.	GE	131	13	ch	No	Yes	5.3	7	1000	30	31	0	0	0	0	0	1400
15	Atlantic Richfield Co.	Bakersfield, Calif.	GE	1	13	ch	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1400
16	New York Telephone Co.	New York, N.Y.	ALN	19	13	sp	Yes	Yes	1.5	2	1500	40	31	0	0	0	0	0	1825
17	Consumers Power Co.	Arcadia, Calif.	GE	1	13	ch	No	Yes	1.5	2	1500	40	31	0	0	0	0	0	1825
18	United States Air Force	Fort Worth, Texas	GE	1	13	ch	Yes	Yes	1.5	2	1500	40	31	0	0	0	0	0	1825
FOREIGN UTILITIES AND INDUSTRIAL PLANTS																			
19	Swedish State Power Board	Kriststad, Sweden	GE	149	13	pp	Yes	Yes	9.1	12	1000	30	31	0	0	0	0	0	1470
20	Swedish State Power Board	Borjarna, Sweden	GE	134	13	pp	Yes	Yes	8.2	11	1000	30	31	0	0	0	0	0	1470
21	Swedish State Power Board	Kriststad, Sweden	GE	134	13	pp	Yes	Yes	8.2	11	1000	30	31	0	0	0	0	0	1470
22	Tokyo Electric Power Co.	Tokyo, Japan	MHI	1	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
23	Tokyo Electric Power Co.	Kashiwa, Japan	MHI	170	13	pp	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
24	Shiga Electric Power Co. Ltd.	Nagoya, Japan	Hit	130	13	pp	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
25	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
26	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
27	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
28	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
29	P.R. Chemicals Ltd.	Hull, England	BBS	1	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
30	London Transport Board	London, England	GE	134	13	pp	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
31	The Gas Council	London, England	GE	134	13	pp	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
32	Elektrifikaatsion Vorka Oy	Vorka, Finland	GE	134	13	pp	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
33	Vattenfall AB	Stockholm, Sweden	GE	134	13	pp	Yes	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
34	Mitsubishi Coal Mine Co.	Osaka, Japan	MHI	130	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
35	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
36	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
37	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500
38	Shiga Electric Power Co. Ltd.	Buenos Aires, Argentina	BBS	65	13	pp	No	Yes	13.5	18	1000	30	31	0	0	0	0	0	1500

MANUFACTURERS

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31	General Electric Co.	Schenectady, N.Y., U.S.A.
32	General Electric Co.	Schenectady, N.Y., U.S.A.
33	General Electric Co.	Schenectady, N.Y., U.S.A.
34	General Electric Co.	Schenectady, N.Y., U.S.A.
35	General Electric Co.	Schenectady, N.Y., U.S.A.
36	General Electric Co.	Schenectady, N.Y., U.S.A.
37	General Electric Co.	Schenectady, N.Y., U.S.A.
38	General Electric Co.	Schenectady, N.Y., U.S.A.
39	General Electric Co.	Schenectady, N.Y., U.S.A.
40	General Electric Co.	Schenectady, N.Y., U.S.A.
41	General Electric Co.	Schenectady, N.Y., U.S.A.
42	General Electric Co.	Schenectady, N.Y., U.S.A.
43	General Electric Co.	Schenectady, N.Y., U.S.A.
44	General Electric Co.	Schenectady, N.Y., U.S.A.
45	General Electric Co.	Schenectady, N.Y., U.S.A.
46	General Electric Co.	Schenectady, N.Y., U.S.A.
47	General Electric Co.	Schenectady, N.Y., U.S.A.
48	General Electric Co.	Schenectady, N.Y., U.S.A.
49	General Electric Co.	Schenectady, N.Y., U.S.A.
50	General Electric Co.	Schenectady, N.Y., U.S.A.

range in size from 750 kW to 58 MW

Type of cycle	GAS GENERATOR					POWER TURBINE			COM. BUSTORS	FUEL		INSTRUMENTATION AND CONTROL												PROJECT	
	Speed of driven equipment, rpm	Number per unit	Manufacturer	Number of shafts per generator	Number of stages in compressor	Number of turbine stages	Turbine speed, rpm	Number of shafts	Number of rotors	Number of stages per rotor	Type	Number	Type	Switch fuel automatically under load?	Type of soundproofing	Type of control system logic/analog	Method of measuring turbine speed	Location of cycle temperature monitor	Setpoint power control?	Method of controlling turbine surge	Method of controlling turbine acceleration	Method of measuring turbine vibration	Exhaust temp control?		Turbine and generator controls
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	1
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	2
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	3
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	4
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	5
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	6
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	7
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	8
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	9
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	10
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	11
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	12
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	13
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	14
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	15
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	16
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	17
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	18
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	19
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	20
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	21
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	22
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	23
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	24
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	25
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	26
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	27
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	28
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	29
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	30
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	31
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	32
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	33
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	34
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	35
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	36
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	37
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	38
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	39
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	40
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	41
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	42
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	43
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	44
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	45
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	46
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	47
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	48
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	49
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	50
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	51
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	52
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	53
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	54
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	55
XXXX	3600	1	GE	32	33	71	1800	N	N	16	HoC	6	G	No	IS, 75	Sol/Cmb	EM	Ti, Te	Yes	Cv, Vig	SpT ¹²	Ts	Yes ¹¹	Ilg	56
XXXX	3600	1	GE	32																					

2 units), Norfolk, Va., for utility and Pacific Telephone & Telegraph Co.
 Los Angeles, Calif. (1 unit). A total of 15 units were installed in 1969.
 New York, N.Y. (1 unit). One in 1967, one in 1968 and one in 1969.
 Ohio, Ohio.
 Owned prior to

PROJECT	COMPANY	LOCATION	CONSULTING ENGINEER	Year of initial operation	New or existing plant	Principal steam use	BOILERS				FUEL		FURN.		
							No. and type of new units	Manufacturer	Capacity each, 1000 lb./hr. at 180 psi	Operating pressure, psig	Operating temp., F	Type	Ash fusion temp., F	Furnace type	Sealed type
UNITED STATES AND CANADIAN INDUSTRIAL STEAM SYSTEMS															
1	Brunswick Pulp & Paper Co.	Brunswick, Ga.	Charles T. Main Co. Inc.	71	New	P-Po	1 Fi	BW	550	1450	325	BL	N	BD	5
2	Weyerhaeuser Co.	Vadant, Okla.	Rust Engineering Co.	71	New	P-Po	1 Fi	CE	740	1300	325	G	N	BD	5
3	Weyerhaeuser Co.	Vadant, Okla.	Rust Engineering Co.	71	New	P-Po	1 Fi	CE	700	1300	325	BL G	N	BD	5
4	East Northern Paper Co.	Multnomah, Me.	Stone & Webster Engineering Corp.	72	New	P-Po	1 Fi	UR	500	1300	375	G	N	BD	5
5	Weyerhaeuser Co.	Vadant, Okla.	Rust Engineering Co.	71	New	P-Po	1 Fi	CE	450	1300	325	G	N	BD	5
6	Southwest Forest Industries, Inc.	Doniphan, Ariz.	Charles T. Main, Inc.	71	Ex	P-Po	1 Fi	BW	223	1275	350	BL G	N	BD	5
7	Union Carbide Corp.	San Francisco, Calif.	Bechtel Corp.	71	New	P-Po	3 Fi	CE	275	1100	350	J.P.R.	N	BD	5
8	PacifiCorp	Ventura, Calif.	S & Q Construction Co.	70	New	P-Po	1 Pk	CE	150	1500	341	G	N	Pid	5
9	The Procter & Gamble Co.	Cincinnati, Ohio	Bechtel Corp.	71	Ex	P-Po	1 Pk	CE	235	900	325	G	N	Pid	5
10	Western Electric Co. Inc.	Chicago, Ill.	United Engineers & Constructors, Inc.	70	Ex	P-Po	1 Pk	UR	150	380	300	G	N	Pid	5
11	International Paper Co.	Troy, N.Y.	H.A. Simons Ltd.	70	New	P-Po	1 Fi	EC	500	375	325	J.Bk	N	BD	5
12	The Mead Corp.	Chillicothe, Ohio		71	Ex	P-Po	1 Fi	CE	400	375	350	G	N	BD	5
13	Pulaski Paper Co.	Keeau, Hawaii	Amtac Inc.	70	New	P-Po	1 Fi	CE	320	375	350	J.Bk	N	BD	5
14	International Paper Co.	Troy, N.Y.	H.A. Simons Ltd.	70	New	P-Po	1 Fi	BW	128	375	325	BL	N	Pid	5
15	The Mead Corp.	Utsego, Mich.		70	Ex	P-Po	1 Pk	CE	125	375	350	G	N	BD	5
16	Wabash Corp.	Cleveland, Ohio	J.F. Pritchard	70	Ex	P-Po	2 Pk	BW	155	350	300	G	N	Pid	5
17	The Procter & Gamble Co.	Cincinnati, Ohio	Bechtel Corp.	70	Ex	P-Po	1 Pk	CE	130	350	350	G	N	Pid	5
18	Wabash Power Equipment Co.	Chicago, Ill.		70	Ex	P-Po	1 Pk	UR	125	300	350	G	N	Pid	5
19	Wabash Power Equipment Co.	Chicago, Ill.		70	Ex	P-Po	1 Pk	CE	125	300	350	G	N	Pid	5
20	Getty Oil Co.	Los Angeles, Calif.	S & Q Construction Co.	70	New	SH	1 Pk	CE	225	750	341	G	N	Pid	5
21	Hammill Paper Co.	Erie, Pa.	Rust Engineering Co.	71	Ex	P-Po	1 Fi	BW	406	700	275	BL	N	BD	5
22	Ashtabula Corp.	Ashtabula, Ohio	Todd-Harless International, Inc.	69	New	P-Po	2 Pk	CE	25	700	341	BL G	N	Pid	5
23	Wabash Power Equipment Co.	Chicago, Ill.		71	Ex	P-Po	1 Pk	CE	75	650	375	G	N	Pid	5
24	Westvaco Corp.	Lake, Md.		71	Ex	P-Po	1 Fi	CE	150	525	320	G	N	BD	5
25	Westvaco Corp.	Nickelville, Ky.		70	New	P-Po	1 Fi	CE	300	625	320	G	N	BD	5
26	Westvaco Corp.	Lake, Md.		70	Ex	P-Po	1 Pk	CE	240	625	320	G	N	Pid	5
27	Westvaco Corp.	Nickelville, Ky.		70	New	P-Po	1 Pk	CE	240	625	320	G	N	Pid	5
28	Oscar Mayer & Co. Inc.	Davenport, Iowa	Hermick & Lutz Co.	70	Ex	P-Po	1 Fi	CE	30	525	375	G	N	BD	5
29	Thermal Systems, Inc.	Okla. City, Okla.	M.A. Niskian Co.	71	New	P-Po	1 Pk	MIW	30	525	350	G	N	Pid	5
30	The Standard Oil Co. (Ohio)	Toledo, Ohio		69	Ex	P-Po	1 Pk	UR	225	300	350	G	N	Pid	5
31	Cloutier Chemical Co.	New Orleans, La.	Barnard & Burk, Inc.	70	Ex	P-Po	1 Pk	CE	30	500	320	G	N	Pid	5
32	Run Oil Co.	Houston, Texas	Fluor Western, Inc.	71	New	P-Po	3 Pk	CE	105	475	341	G	N	Pid	5
33	Gates Rubber Co.	Danvers, Cal.		70	New	P-Po	2 Pk	CE	50	450	341	G	N	Pid	5
34	Clinton Corn Processing Co.	Clinton, Iowa	Stanley Consultants	71	Ex	P-Po	1 Pk	CE	225	420	365	G	N	Pid	5
35	Crown Zellerbach Corp.	Dumas, Wash.		71	Ex	P-Po	1 Fi	BW	153	415	525	G, BL	N	BD	5
36	FMC Corp.	Philadelphia, Pa.		71	Ex	P-Po	1 Pk	CE	225	415	700	G	N	Pid	5
37	Southwest Missouri State College	Cape Girardeau, Mo.	Rogers-Schmidt Co.	71	Ex	P-Po	1 Fi	KEE	125	415	750	G	N	Pid	5
38	St. Regis Paper Co.	Tolm, Pa.		71	Ex	P-Po	1 Pk	CE	130	410	750	G	N	Pid	5
39	GAF Corp. - Diversified Chemical Div.	Texas City, Texas		70	New	P-Po	1 Pk	MIW	100	300	341	G	N	Pid	5
40	Melanine Chemicals Inc.	Denatonsville, La.		70	New	P-Po	1 Pk	UR	50	380	341	G	N	Pid	5
41	Gates Rubber Co.	Luttrell, Cal.	Rust Engineering Co.	70	New	P-Po	1 Pk	CE	60	350	341	G	N	Pid	5
42	Shenandoah Inc.	Albany, Okla.	Rust Engineering Co.	70	New	P-Po	1 Pk	KEE	50	350	341	G	N	Pid	5
43	Bentley Steel Corp.	Sparrows Point, Md.	United Engineers & Constructors, Inc.	71	New	P-Po	1 Fi	UR	150	320	350	G	N	BD	5
44	GenCorp Exos, Inc.	Burling, Ind.	William H. Kohn & Associates	70	Ex	P-Po	1 Pk	MIW	75	300	341	G	N	Pid	5
45	Wabash Power Equipment Co.	Chicago, Ill.		70	Ex	P-Po	1 Pk	MIW	75	300	341	G	N	Pid	5
46	U.S. Steel Corp.	Birmingham, Texas		70	New	P-Po	1 Pk	BW	50	300	341	G	N	Pid	5
47	Mercedes Inc.	Denora, Pa.		69	Ex	P-Po	1 Pk	MIW	40	290	341	G	N	Pid	5
48	PacifiCorp	Indianapolis, Ind.		70	Ex	P-Po	1 Pk	MIW	70	375	341	G	N	Pid	5
49	Virginia Polytechnic Institute	Blacksburg, Va.	Wiley & Wilson	70	Ex	SH	2 Fi	KEE	30	351	341	G	N	Pid	5
50	Western Electric Co. Inc.	Baltimore, Md.		69	Ex	P-Po	3 Pk	UR	100	250	341	G	N	Pid	5
51	GAF Corp.	St. Paul, Minn.	Tunison & Johnson Engrs. & Archts. Inc.	70	Ex	P-Po	2 Pk	MIW	77	350	341	G	N	Pid	5
52	Danaher Corp.	St. Louis, Mo.		70	Ex	P-Po	1 Pk	UR	30	350	341	G	N	Pid	5
53	The Koppers Co. Inc.	St. Louis, Mo.		69	New	P-Po	2 Pk	UR	50	350	341	G	N	Pid	5
54	A.P. & S. Co. - Division Chemical Div.	St. Louis, Mo.		69	Ex	P-Po	1 Pk	UR	50	350	341	G	N	Pid	5
55	Minerals Research Co.	Burling, Ind.	John G. Lister & Associates	70	Ex	P-Po	1 Pk	BW	40	325	341	G	N	Pid	5
56	Southwest Forest Industries, Inc.	Doniphan, Ariz.	Robert Adams	70	Ex	P-Po	1 Pk	BW	75	325	341	G	N	Pid	5
57	Montclair Co.	St. Louis, Mo.		70	Ex	P-Po	1 Pk	MIW	50	325	341	G	N	Pid	5
58	St. Louis Chemical Co.	St. Louis, Mo.		69	New	P-Po	1 Pk	UR	75	325	341	G	N	Pid	5
59	Banner Fibers Corp.	Amesbury, Mass.		70	Ex	P-Po	1 Pk	BW	40	310	341	G	N	Pid	5
60	Southwest Forest Industries, Inc.	Doniphan, Ariz.	Robert Adams	70	Ex	P-Po	1 Pk	MIW	125	300	341	G	N	Pid	5
61	B.F. Goodrich Chemical Co.	St. Louis, Mo.		70	New	P-Po	2 Pk	BW	115	300	341	G	N	Pid	5
62	St. Louis Chemical Co.	St. Louis, Mo.		70	Ex	P-Po	1 Pk	CE	100	200	375	G	N	Pid	5
63	The Procter & Gamble Co.	Cincinnati, Ohio		70	Ex	P-Po	1 Pk	KEE	70	300	341	G	N	Pid	5
64	Empress Chemical Co.	St. Louis, Mo.		70	New	P-Po	1 Pk	CE	45	200	341	G	N	Pid	5
65	Wabash Power Equipment Co.	Chicago, Ill.		70	New	SH	2 Pk	BW	25	200	341	G	N	Pid	5

MANUFACTURERS
and suppliers of industrial steam systems

- 1. American Industrial Steam Co.
- 2. Brunswick Pulp & Paper Co.
- 3. Brunswick Pulp & Paper Co.
- 4. Brunswick Pulp & Paper Co.
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figure in this year's boiler survey

PROJECT	EQUIPMENT		AIR HEATER		F.D. FANS		I.D. FANS		BOILER FEED SYSTEM		COMBUSTION CONTROL		POLLUTION CONTROL								
	Manufacturer	Type and number per boiler	Manufacturer	Type	Number per boiler	Manufacturer	Drive type and power required ²⁰	Number per boiler	Manufacturer	Drive type and power required ²⁰	Number of pumps	Manufacturer	Drive type and power required ²⁰	Feedwater treatment	Type	Control manufacturer	Max. sulfur in fuel, %	Fuel additive introduction point	Dust collector type	Dust collector manufacturer	Chimney height, ft/7
CE	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	269
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	300
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	300
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	170
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	300
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	...
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	160
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	30
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	200
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	E	F	N	N	El	KC	250
BSC	1 SA	BA	BA	BA	WE	M 600	WE	M 600	KCE	M 600	1	KCE	M 600	MUD In	E	FIS	0.4	N	Me	BU	200
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	Ph	...	5	N	Me	WP	475
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	GE	2	N	Me	WP	170
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	200
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	75
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	...
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	...
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	...
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	...
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	BU	M 600	1	BU	M 600	Ex	E	FIS	2	N	Me	WP	...
ACB	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	210
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	40.50
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	40
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	275
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
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	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
BSC	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	250
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	20
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	140
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	120
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
	1 SA	BA	BA	BA	SW	M 600	SW	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
ACB	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	75
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	140
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	150
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	50
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	40
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	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
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	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	...
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	1 SA	BA	BA	BA	WE	M 600	WE	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	40
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	175
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	40
	1 SA	BA	BA	BA	WE	M 600	WE	M 600	IR	M 600	1	IR	M 600	MUD In	E	...	N	N	N	N	...
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ACB	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	75
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	75
	1 SA	BA	BA	BA	FAA	M 600	FAA	M 600	IR	M 600	1	IR	M 600	MUD In	Ph	F	N	N	N	N	50
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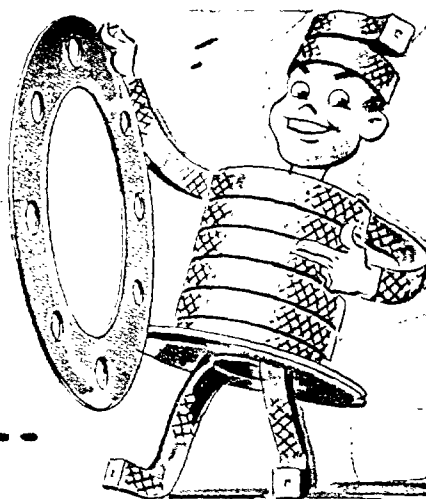
- W2 - Henry's Farm Machine Co.
- W3 - Westinghouse Electric Corp.
- W4 - The White Electric Corp.
- W5 - A. M. Best Compression Equipment Co.
- W6 - Westinghouse Corp.
- W7 - Western Precipitation Div., Joy Mfg. Co.
- W8 - Western Furms. Inc.
- W9 - Whittier Pump Mfg. Co.
- W10 - The Woodward Works & S. Steel Corp.
- W11 - York-Sheldon Inc.
- W12 - John Ziegler Co.

PROJECT	COMPANY	LOCATION	CONSULTING ENGINEER	Year of initial operation	New or existing plant	Principal steam use	BOILERS				FUEL		
							No. and type of new units	Manufacturer	Capacity each 1000 lb./hr. or MBtu/hr.	Operating pressure, psig	Operating temp., F	Type	Ash fusion temp., F
57	Wallace Silver-Smiths	Hatfield, Conn.	Westcott & Mapes	70	Ex	Pr	1 PK	KEE	50	95	300	O	N
58	Southern, Inc.	New Orleans, La.		70	Ex	Pr	1 PK	CE	140	175	Sat	O	N
59	Carolina Paper Board Corp.	Charlotte, N.C.		70	Ex	Pr	1 PK	BW	50	175	Sat	O	N
60	Central Park Ave. Pumping Station	Chicago, Ill.	Laramore, Douglas & Poonam	70	Ex	Pr	1 PK	CE	40	175	577	O	N
61	Springday Co.	Springfield, Mo.		70	Ex	Pr	1 PK	KEE	45	186	Sat	O	N
62	University of Texas	Arlington, Texas	Dolan Love & Jackson, Inc.	69	Ex	SH	1 F	KEE	45	185	Sat	O	N
63	Himelberg Corp.	Kankakee, Ill.		70	Ex	Pr	1 PK	KEE	40	85	Sat	O	N
64	Indiana University	Bloomington, Ind.	Brown Engineering Co.	70	Ex	SH	1 F	UR	150	160	Sat	O	N
65	Seattle Steam Corp.	Seattle, Wash.		70	Ex	SH	1 PK	CE	120	90	Sat	O	N
66	Daubert Chemical Co.	Canfield, Utah		70	Ex	Pr	1 PK	MW	80	160	Sat	O	N
67	Union Carbide of America, Inc.	Bessemer City, N.C.		70	Ex	Pr	1 PK	BW	45	150	Sat	O	N
68	Rock Island Refinery Corp.	Indianapolis, Ind.		70	Ex	Pr	1 F	VO	40	50	170	O	N
69	Great Meadows Institute	Stonington, N.Y.		70	New	SH	1 PK	CE	75	90	Sat	O	N
70	General Motors Corp. Fisher Body Div.	St. Louis, Mo.		70	New	SH	1 PK	BW	55	97	Sat	O	N
71	General Motors Corp. Harrison Radiator Div.	Lockport, N.Y.	CMC, Argonaut Realty Div.	70	New	SH	1 PK	BW	50	155	Sat	O	N
72	Dow Chemical Co.	Freeport, Texas		70	New	Pr	1 PK	KEE	57	155	Sat	O	N
73	University of Texas Medical Center	Dallas, Texas	Baynor & Simen Inc.	70	Ex	SH	1 PK	MW	30	150	Sat	O	N
74	S. Johnson & Son, Inc.	Knoxville, Mo.		70	Ex	Pr	1 PK	BW	30	150	Sat	O	N
75	East P. Paper Co.	Philadelphia, Pa.		70	Ex	Pr	1 PK	CE	50	150	Sat	O	N
76	Bassett-Walker Knitting Co.	Martinsville, Va.	J.E. Irvine Co.	70	New	Pr	1 PK	BW	75	90	Sat	O	N
77	The Quaker Oats Co.	Rockford, Ill.		70	Ex	Pr	1 PK	BW	50	90	Sat	O	N
78	Weyerhaeuser Co.	Fitchburg, Mass.	Jackson & Moreland	70	New	Pr	1 PK	BW	50	90	Sat	O	N
79	Detroit House of Correction	Detroit, Mich.	Joyner & McLean, Inc.	70	Ex	Pr	1 PK	CE	65	150	Sat	O	N
80	Shenandoah Land, Inc.	Summersville, Ga.		69	New	Pr	2 F	CE	13	150	158	O	N
81	Sacred Heart Medical Center	Cokane, Wash.	Valentine, Fisher & Tomlinson	69	New	Pr	1 PK	BW	40	150	Sat	O	N
82	Summit State School	Tupper Lake, N.Y.	Paul L. Beninger & Associates	70	Ex	SH	1 PK	KEE	20	150	365	O	N
83	Wilson Pharm. & Chem. Corp. Wilson Labs Div.	Chicago, Ill.		69	Ex	Pr	1 PK	BW	10	150	331	O	N
84	Edgewater Hospital	Chicago, Ill.	Ganze, Karapin & Associates	70	New	Pr	1 PK	BW	24	150	Sat	O	N
85	Koppers Co. Inc.	Pittsburgh, Pa.		70	Ex	Pr	1 PK	MW	24	150	331	O	N
86	Providence Hospital	Mobile, Ala.	Evans & Young	70	Ex	Pr	2 PK	MW	20	150	365	O	N
87	Arco Chemical Corp.	Peterson, Pa.		69	Ex	Pr	1 PK	BW	50	40	Sat	O	N
88	W.R. Grace & Co. Dewey & Almy Chem. Div.	Danvers, Ky.		70	Ex	Pr	1 PK	MW	50	40	Sat	O	N
89	Townsend, Inc.	Millis, Mass.		70	Ex	Pr	1 PK	BW	50	40	Sat	O	N
90	Chrysler-Carlson Corp.	Rochester, N.Y.		69	Ex	Pr	1 PK	KEE	10	150	Sat	O	N
91	Cole Co.	Honolulu, Hawaii		70	Ex	Pr	1 PK	BW	150	75	Sat	O	N
92	Chemtron Corp. Tube Mills Div.	Louisville, Ky.		70	Ex	Pr	1 PK	CE	50	175	Sat	O	N
93	Medical Center Development Corp.	Berlin, Mich.	Albert Kahn Associates	70	New	Pr	1 PK	BW	30	175	Sat	O	N
94	General Motors Corp. Diesel Eng. Div.	Grand Rapids, Mich.	CMC, Argonaut Realty Div.	69	Ex	Pr	1 PK	BW	30	175	Sat	O	N
95	Chrysler Chemical Co.	San Francisco, Calif.		70	Ex	Pr	1 PK	CE	20	170	Sat	O	N
96	The Babcock & Wilcox Co. Tubular Prod. Div.	Beaver Falls, Pa.		70	Ex	Pr	1 PK	BW	125	175	Sat	O	N
97	Monsanto Co.	Niagara, W. Va.	Black & Veatch	70	Ex	Pr	1 PK	CE	15	175	Sat	O	N
98	General Dynamics Corp.	Gorton, Conn.		69	New	Pr	1 PK	BW	100	175	Sat	O	N
99	Central State Hospital	Richmond, Ky.	E.R. Ronald & Associates	70	Ex	Pr	1 PK	MW	50	175	Sat	O	N
100	Koppers Co. Inc.	Pittsburgh, Pa.		70	New	Pr	1 PK	MW	50	175	Sat	O	N
101	Lake Superior State College	Sault Ste. Marie, Mich.	Commonwealth Associates Inc.	70	New	Pr	1 PK	CE	50	175	352	O	N
102	Swanton Planning Co.	Swanton, Minn.		70	Ex	Pr	1 PK	MW	50	175	Sat	O	N
103	International Paper Co.	Traverse City, Mich.	H.A. Simons Ltd.	69	New	Pr	1 PK	CE	40	175	Sat	O	N
104	Johns-Manville Co. Inc.	Fort Collins, Colo.	Helms & Lutz Co.	70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
105	California State College	San Francisco, Calif.		70	Ex	Pr	1 PK	MW	40	175	Sat	O	N
106	Eastman International Corp.	Easton, Tenn.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
107	Eastman Hospital	Easton, Tenn.	Harold H. Friedman Associates	70	New	Pr	1 PK	MW	40	175	Sat	O	N
108	University of Colorado	Boulder, Colo.		69	Ex	Pr	1 PK	BW	40	175	Sat	O	N
109	University of Southern California	Los Angeles, Calif.		69	New	Pr	1 PK	BW	40	175	Sat	O	N
110	Alameda County State Hospital	Alameda, Calif.	P.L. Bryson	69	New	Pr	1 PK	CE	40	175	Sat	O	N
111	P.K. & Carter Mfg. Co.	Tampa, Fla.	J.E. Irvine Co.	69	New	Pr	1 PK	CE	40	175	Sat	O	N
112	Daubert Chemical Co.	Canfield, Utah		70	Ex	Pr	1 PK	BW	40	175	Sat	O	N
113	Koppers Co. Inc.	Pittsburgh, Pa.		70	Ex	Pr	1 PK	BW	40	175	Sat	O	N
114	System Engineering Corp.	Chicago, Ill.	Husky Pumps	70	New	Pr	1 PK	BW	40	175	Sat	O	N
115	Benjamin Corp. Wash. Div.	Mobile, Ala.		70	Ex	Pr	1 PK	MW	40	175	Sat	O	N
116	Chrysler Corp. Wash. Div.	St. Louis, Mo.		69	Ex	Pr	1 PK	CE	40	175	Sat	O	N
117	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
118	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
119	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
120	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
121	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
122	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
123	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
124	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
125	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
126	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
127	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
128	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
129	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
130	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
131	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
132	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
133	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
134	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
135	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
136	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
137	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
138	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
139	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
140	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
141	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
142	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
143	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
144	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
145	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
146	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
147	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
148	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
149	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
150	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
151	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
152	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
153	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
154	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
155	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
156	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
157	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
158	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
159	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
160	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
161	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
162	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
163	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
164	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
165	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
166	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
167	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
168	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
169	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
170	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
171	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
172	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
173	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
174	General Motors Corp.	St. Louis, Mo.		70	Ex	Pr	1 PK	CE	40	175	Sat	O	N
175	General Motors Corp.	St. Louis, Mo.	</										

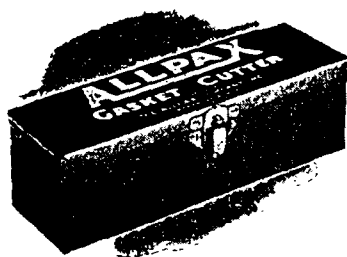
Environment dominate users' thinking

Burner	VENT		AIR HEATER		F D FANS		I-D FANS		BOILER FEED SYSTEM		COMBUSTION CONTROL		POLLUTION CONTROL				PROJECT					
	Type and number per boiler	Manufacturer	Type	Manufacturer	Number per boiler	Manufacturer	Drive type and power required ²⁰	Number per boiler	Manufacturer	Drive type and power required ²⁰	Number of pumps	Manufacturer	Drive type and power required ²⁰	Feedwater treatment	Type	Control manufacturer	Max. sulfur in fuel, %	Fuel additive introduction point	Dust collector type	Dust collector manufacturer	Chimney height, ft ¹⁷	
12 SA	FAA	N	N	N	COE	M 40	N	N	N	WC	T 100	F 2 in	E	RE	N	N	N	N	N	N	45	67
12 SA	COE	N	N	N	FAA	M 40	N	N	N	WC	M T 100	Sc F 2 in	Co	CE	N	N	N	N	N	N	40	68
12 SA	BA	N	N	N	N	M 40	N	N	N	WC	M 40	Z in	Co	BM	N	N	N	N	N	N	50	69
12 SA	COE	N	N	N	N	M 40	N	N	N	IP	M T 50	Z in	Co	Ph	N	N	N	N	N	N	215	70
12 SA	COE	N	N	N	N	M 40	N	N	N	IP	M 30	Z Da in	Co	COE	N	N	N	N	N	N	35	71
12 SA	COE	N	N	N	COE	M 40	N	N	N	PP	M 40	Z in	Co	COE	N	N	N	N	N	N	...	72
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	73
12 SA	COE	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	74
12 SA	COE	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	Ph	N	N	N	N	N	N	150	75
12 SA	COE	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	BM	N	N	N	N	N	N	54	76
12 SA	BA	N	N	N	COE	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	77
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	78
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	79
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	80
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	81
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	82
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	83
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	84
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	85
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	86
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	87
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	88
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	89
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	90
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	91
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	92
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	93
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	94
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	95
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	96
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	97
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	98
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	99
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	100
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	101
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	102
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	103
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	104
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	105
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	106
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	107
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	108
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	109
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	110
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	111
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	112
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	113
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	114
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	115
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	116
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	117
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	118
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	119
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	120
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	121
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	122
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	123
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	124
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	125
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	126
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	127
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	128
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	129
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	130
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	131
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	132
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	133
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	134
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	135
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	136
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	137
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	138
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	139
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	140
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	141
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	142
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	143
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	144
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	145
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	146
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	147
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	148
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	149
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	150
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	151
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	152
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE	N	N	N	N	N	N	...	153
12 SA	BA	N	N	N	N	M 40	N	N	N	N	M T	Z in	Co	COE								

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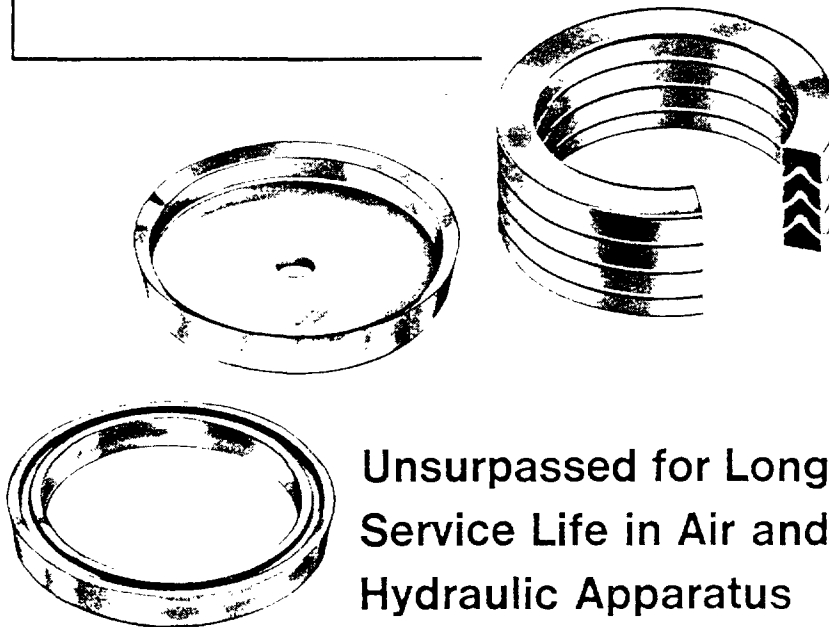
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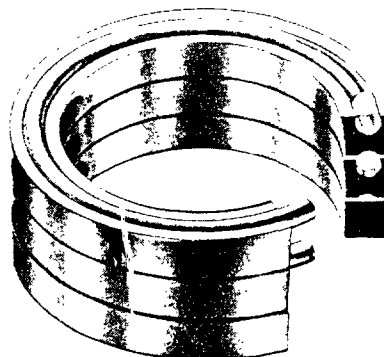
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