U .S. DEPARTMENT OF COMMERCE
DANIEL C. ROPER, Secretary
NATIONAL BUREAU OF STANDARDS
LYMAN J. BRIGGS, Director

FUEL OILS

(THIRD EDITION)

COMMERCIAL STANDARD CS12-35

Effective Date for New Production February 15, 1935

A RECORDED STANDARD OF THE INDUSTRY

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U. S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS

PROMULGATION

of

COMMERCIAL STANDARD CS12–35

for

FUEL OILS

(Third Edition)

On January 9, 1929, a joint conference of representative refiners, distributors, and consumers of fuel oil, manufacturers of oil burners and general interests adopted a recommended standard for domestic and industrial fuel oils, which was accepted in writing by the industry and published as Commercial Standard CS12–29. In 1933, upon recommendation of the standing committee, which is identical with section 1 of Technical Committee C of American Society for Testing Materials Committee D–2, the standard was revised and issued as Fuel Oils, Commercial Standard CS12–33.

On August 24, 1934, the standing committee recommended that a revised draft of CS12–33 be circulated for acceptance. The industry has since accepted and approved for promulgation by the U. S. Department of Commerce, through the National Bureau of Standards, the revised standard as shown herein.

The standard became effective for new production on February 15, 1935.

Promulgation recommended.

I. J. Fairchild,
Chief, Division of Trade Standards.

Promulgated.

Lyman J. Briggs,
Director, National Bureau of Standards.

Promulgation approved.

Daniel C. Roper,
Secretary of Commerce.

FUEL OILS

(Third Edition)

COMMERCIAL STANDARD CS12–35

SCOPE

1. These specifications cover six grades of fuel oil for various types of fuel-oil burning equipment.

GENERAL REQUIREMENTS

2. The fuel oils herein specified shall be hydrocarbon oils free from acid, grit, and fibrous or other foreign matter likely to clog or injure the burner or valves. If required, the oil shall be strained by being drawn through filters or wire gauze of 16 meshes to the inch. (United States standard sieve 16, ASTM designation 1,190 micron.) The clearance area through the strainers shall be at least twice the area of the suction pipe, and the strainers shall be in duplicate.

DETAIL REQUIREMENTS [1]

3. The various grades of fuel oil shall conform to the detailed requirements shown in table 1.

[1] The technical requirements of this commercial standard are identical in substance with ASTM Tentative Specifications for Fuel Oils D396–34T.

TABLE 1.—*Detailed requirements for fuel oils* [1]

Grade		Flash point (°F)		Pour point (°F)	Water and sediment (%)	Carbon residue (%)	Ash (%)	Distillation temperatures (°F)					Viscosity (seconds)			
								10 percent point	90 percent point		End point		Saybolt universal (at 100° F)		Saybolt furol (at 122°F)	
Number	Description	Min	Max	Max	Max	Max	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
1	A distillate oil for use in burners requiring a volatile fuel.	100 or legal	150	[2] 15	0.05	0.02		420			600					
2	A distillate oil for use in burners requiring a moderately volatile fuel.	110 or legal	190	[2] 15	0.05	0.05		440	620			600				
3	A distillate oil for use in burners requiring a low-viscosity fuel.	110 or legal	200	[2] 15	0.1	0.15				[3] 620			70			
4	An oil for use in burners requiring low-viscosity fuel.	150		([4])	1.0		0.1						500	[5] 70		
5	An oil for use in burners equipped with preheaters permitting a medium-viscosity fuel.	150			1.0		0.15								100	25
6	An oil for use in burners equipped with preheaters permitting a high-viscosity fuel.	150			[6] 2.0										300	[7] 100

[1] Recognizing the necessity for low sulfur fuel oils used in connection with heat-treatment, non-ferrous-metal, glass, and ceramic furnaces and other special uses, a sulfur requirement may be specified in accordance with the following table:

Grade of fuel oil *Number*	Sulfur (maximum) *Percent*
1	0.5
2	.5
3	.75
4	1.25
5	No limit
6	No limit

Other sulfur limits may be specified only by mutual agreement between the buyer and seller.

[2] Lower or higher pour points may be specified whenever required by conditions of storage or use. However, these specifications shall not require a pour point lower than 0° F under any conditions.

[3] This requirement shall be waived when the carbon residue is more than 0.07 percent and less than 0.15 percent.

[4] Pour point may be specified whenever required by conditions of storage or use. However, these specifications shall not require a pour point lower than 15° F under any conditions.

[5] This requirement shall be waived when the carbon residue is more than 1.0 percent.

[6] A deduction in quantity shall be made for all water and sediment in excess of 1.0 percent.

[7] This requirement shall be waived when the carbon residue is 4 percent or more.

METHODS OF TEST

4. The requirements enumerated in these specifications shall be determined in accordance with the following methods of testing of the American Society for Testing Materials, except as may be required under paragraphs 5 and 6.

FLASH POINT

5. *Minimum.*—The flash point, instrument, and method for determining minimum flash point shall be those legally required for the locality in which the oil is sold. In absence of legal requirements, the minimum flash point shall be determined in accordance with the standard method of test for flash point by means of the Pensky-Martens closed tester, ASTM designation D93–22.

6. *Maximum.*—Standard method of test for flash point by means of the Pensky-Martens closed tester, ASTM designation D93–22.

POUR POINT

7. Standard method of test for cloud and pour points, ASTM designation D97–34.

WATER AND SEDIMENT

8. Standard method of test for water and sediment in petroleum products by means of centrifuge, ASTM designation D96–30.

CARBON RESIDUE

9. Standard method of test for carbon residue of petroleum products (Conradson carbon residue), ASTM designation D189–30.

ASH

10. Procedure for determination of ash as described in the standard methods of analysis of grease, ASTM designation D128–27. Sample shall be thoroughly mixed to insure that portion for ash determination is representative of the sample.

DISTILLATION

11. Distillation of grade 1 oil shall be made in accordance with the standard method of test for distillation of gasoline, naphtha, kerosene, and similar petroleum products, ASTM designation D86–30; and of grades 2 and 3 in accordance with the standard methods of testing gas oils, ASMT designation D158–28.

VISCOSITY

12. Standard methods of test for viscosity of petroleum products and lubricants, ASTM designation D88–33.

REFERENCES

13. Complete information regarding the procedure for making the tests specified is to be found in the publications of the American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pa.

SIGNIFICANCE OF TESTS PRESCRIBED [2]

FLASH POINT

14. The flash point of a product may be defined as the temperature to which it must be heated in order to give off sufficient vapor to form an inflammable mixture with air. This temperature varies with the apparatus and procedure employed and consequently both must be specified when the flash point of an oil is stated.

15. The minimum flash point of oils used for fuel is usually controlled by law. When there are no legal requirements, the minimum values in the table are to be employed. Maximum values are specified in oils nos. 1, 2, and 3 to insure the required ease of ignition.

POUR POINT

16. The pour point of an oil is the lowest temperature at which it will flow when cooled and tested under prescribed conditions. Pour point specifications are included in order that oil may be secured which will not cause difficulty in handling or in use at the lowest temperatures to which it may normally be subjected.

WATER AND SEDIMENT

17. Water and sediment are impurities which are almost entirely excluded in fuel oils nos. 1, 2, and 3, and which are permitted in somewhat larger quantities in fuel oils nos. 4, 5, and 6. It is difficult to eliminate them entirely from this latter group of oils, and the advantage is not sufficient to justify the cost. Water and sediment are determined together by the centrifuge.

CARBON RESIDUE

18. The carbon residue test when considered in connection with other tests and the use for which the oil is intended furnishes pertinent information and throws some light on the relative carbon-forming qualities of an oil. For medium viscosity and blended oils it is also used to detect the presence of heavy residual products.

ASH

19. The ash test is used to determine the amount of noncombustible impurities in the oil. These impurities come principally from the natural salts present in the crude oil, or from the chemicals that may be used in refinery operations, although they may also come from scale and dirt picked up from containers and pipes. The presence of ash in fuel oils causes rapid deterioration of refractory materials in the combustion chamber, particularly at high temperatures. Some of the ash-producing impurities are abrasive and destructive to pumps, valves, control equipment, and other burner parts. Ash specifications are included in order to minimize these operating difficulties as far as practicable.

DISTILLATION

20. Laboratory distillation of a sample under prescribed conditions gives an index of the volatility of the oil. The 10- and 90-percent points represent, respectively, the temperatures at which 10 and 90

[2] For a fuller description of the significance of tests in petroleum products see "The Significance of Tests of Petroleum Products", latest revised edition, published by the American Society for Testing Materials.

percent of the sample are distilled. The end point is the maximum temperature recorded by the distillation thermometer at the end of the distillation.

21. The 10-percent point serves as an index of the ease of ignition of the oil and the 90-percent point and the end point are specified to make sure that the oil will volatilize and burn completely and produce a minimum amount of carbon.

VISCOSITY

22. The viscosity of an oil is the measure of its resistance to flow. Maximum limits are placed on this property because of its effect upon the rate at which oil will flow through pipe lines and upon the degree of atomization that may be secured in any given equipment.

23. Viscosity is measured as the time in seconds required for a definite volume of oil to pass through a small tube of specified dimensions at a definite temperature. Viscosity decreases rapidly as temperature increases, and preheating makes possible the use of oils of relatively high viscosity at normal temperatures. The Saybolt universal viscosimeter is used for fuel oils of fairly low viscosity and the Saybolt furol viscosimeter for more viscous oils.

EFFECTIVE DATE

The standard became effective for new production February 15, 1935.

STANDING COMMITTEE

The original standing committee for fuel oils has been broadened to coincide exactly with section 1 of Technical Committee C of the American Society for Testing Materials Committee D–2.

Suggestions for revision or other comment for consideration of the committee may be addressed to the officers of this committee in care of the American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pa., or to the Division of Trade Standards, National Bureau of Standards, Washington, D. C.

HISTORY OF THE PROJECT

General Conference.—The manufactures of oil burners and many petroleum refiners had long felt the need of uniform specifications for fuel oils. The American Oil Burner Association assumed the initiative in this matter and developed specifications for six grades of fuel oils with the cooperation of the American Society for Testing Materials and the American Petroleum Institute.

In order to bring these specifications into broader use, the cooperation of the National Bureau of Standards was requested. Anticipating the benefits to be derived from a commonly understood basis of quality, all interests of the industry freely participated in a well attended general conference held in New York City January 9, 1929, and upon recommendation of this conference the standard was accepted as an every-day guide for the production, sale, and use of fuel oils. The standard was published as Domestic and Industrial Fuel Oils, Commercial Standard CS12–29, and was reaffirmed on December 10, 1930, and again on December 29, 1931.

First Revision.—On June 21, 1932, a meeting of the standing committee, which had been broadened to coincide exactly with section 1 of technical committee C of ASTM Committee D–2 representing the producers, distributors, users of fuel oils, and general interests, was held to discuss the need for revising the commercial standard. The committee approved a revision which was formally submitted to letter ballot. The revision embodied a number of minor changes to bring it in line with current practice in the industry, and included a table showing the permissible sulfur content for each grade.

The revised standard was endorsed by practically all of the larger refiners, by many oil distributors and consumers as well as the manufacturers of oil burners. It was published as Fuel Oils (second edition), Commercial Standard CS12–33 and became effective May 1, 1933.

Second Revision.—As a result of improvements in oil burners and a need for limitations which would eliminate as far as practicable, overlapping of oil grades, the standing committee on June 25, 1934, approved for submission to letter ballot a revised draft which set maximum as well as minimum limits for certain characteristics, inserted requirements for carbon residue and ash, and increased the viscosity for grades nos. 3 and 4. Following acceptance by a satisfactory majority, the success of the revision was announced on December 14, 1934, and the standard became effective 60 days later.

APPENDIX

Although composite experience in the use of Commercial Standard CS12–33, indicates that the present revision will close the major loopholes for misunderstanding and unfair competition, it is apparent that additional data and possibly some new criteria are needed to insure a more complete adaptation of burners and fuel oils to each other.

ACCEPTANCE OF COMMERCIAL STANDARD

This sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this commercial standard.

Date_____

Division of Trade Standards,
National Bureau of Standards,
Washington, D. C.

GENTLEMEN:

Having considered the statements on the reverse side of this sheet, we accept the Commercial Standard CS12–35 as our standard of practice in the

{production [1] / distribution [1] / use [1]} of fuel oils.

We will assist in securing its general recognition and use, and will cooperate with the standing committee to effect revisions of the standard when necessary.

(Cut on th[illegible])

Signature_____

(Kindly typewrite or print the following lines)

Title_____

Company_____

Street address_____

City and State_____

[1] Please designate which group you represent by drawing lines through the other two. In the case of related interests, trade papers, colleges, etc., desiring to record their general approval, the words "In principle" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial standards are commodity specifications voluntarily established by mutual consent of the industry. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The U. S. Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the industry as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. *The acceptor's responsibility.*—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a Nation-wide basis is fourfold: First, to act as an unbiased coordinator to bring all branches of the industry together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by companies representing a satisfactory majority of production, the success of the project is announced. If, however, in the opinion of the standing committee of the industry or the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

(Individuals and organizations listed below have indicated in writing acceptance of this specification as their standard of practice, but such endorsement does not signify that they may not find it necessary to deviate from the standard, nor that they guarantee all of their products to conform with the requirements of this standard.)

ASSOCIATIONS

American Hotel Association, New York, N. Y.
American Mutual Alliance, Chicago, Ill. (in principle).
Board of Fire Underwriters of the Pacific, San Francisco, Calif. (in principle).
Diesel Engine Manufacturers Association, New York, N. Y. (in principle).
Heating & Piping Contractors D. C. Association, Inc., Washington, D. C. (in principle).
National Association of Master Plumbers of the United States, New York, N. Y.
National Association of Purchasing Agents, Inc., New York, N. Y.

FIRMS

Acme Oil Burner Co., Inc., Cedar Rapids, Iowa.
Acme Petroleum Co., Chicago, Ill.
Aeroil Burner Co., Inc., West New York, N. J.
Aetna Oil Service, Inc., Lousiville, Ky.
Aladdin Oil Burner Corporation, Newark, N. J.
Alam Heating Co., Newark, N. J. (in principle).
Allied Engineering Co., Cleveland, Ohio.
Almy Water Tube Boiler Co., Providence, R. I.
American Airlines, Inc., Chicago, Ill.
American Mexican Petroleum Corporation, Chicago, Ill.
American Petroleum Co., The, Cleveland, Ohio (in principle).
American Plumbing Co., Winona, Minn.
American Steel Export Co., Inc., New York, N. Y. (in principle).
Amsco Refining Co., Laredo, Tex.
Anderson-Prichard Oil Corporation, Oklahoma City, Okla.
Ansonia Electrical Co., The, Ansonia, Conn.
Appliance Engineering Corporation, Boston, Mass.
Argo Oil Corporation, Detroit, Mich.
Arnault Engineering Co., Hackensack, N. J. (in principle).
Arrow Petroleum Co., Forest Park, Ill., Chicago, Ill.
Ashland Refining Co., Ashland, Ky.
Associated Electric Laboratories, Inc., Chicago, Ill. (in principle).
Atlantic Burner Service, Ventnor, N. J.
Atlantic Refining Co., Philadelphia, Pa.
Atlas Imperial Diesel Engine Co., Oakland, Calif. (in principle).
Atlas Powder Co., Wilmington, Del. (in principle).
Aurora Gasolene Co., Detroit, Mich.
Autocrat Oil Burner Corporation, Cedar Rapids, Iowa.
Automatic Burner Corporation, Chicago, Ill.
Automatic Oil Heat, Inc., New London, Conn.
Automatic Utilities and Fuel Oils, Inc., Bogota, N. J.
Baker Oil Burners, Inc., Denver, Colo.
Balder Electric Co., St. Louis, Mo. (in principle).
Ballard Oil Co. of Hartford, Inc., Hartford, Conn.
Baltimore and Ohio Railroad Co., Baltimore, Md. (in principle).
Barnsdall Oil Co., Tulsa, Okla.
Bartlett & Snow Co., The C. O., Cleveland, Ohio.
Bauhan, Rolfe W., Princeton, N. J. (in principle).
Behr-Manning Corporation, Troy, N. Y.
Bennis & Sons, Inc., Edward F., Germantown, Philadelphia, Pa.
Berks Engineering Co., Inc., Reading, Pa.
Beshore & Co., Chas., Marion, Ind.
Birdsboro Steel Foundry and Machine Co., Birdsboro, Pa.
Bock Oil Burner Corporation, Madison, Wis.
Bonded Oil System, Inc., Boston, Mass.
Boswell Oil Co., Cincinnati, Ohio.
Bradford Oil Refining Co., Bradford, Pa.

Braun Bros. Oil Co., Winnetka, Ill.
Brazer, Clarence W., Chester, Pa.
Brewer-Titchener Corporation, The, Cortland, N. Y.
Bridgeport Boiler Works, New York, N. Y.
Brock Refrigeration Co., Trenton, N. J.
Brust, Peter, Milwaukee, Wis.
Buda Co., Harvey, Ill.
Burke Oil Co., Aberdeen, S. Dak.
Byles & Weidler, Inc., Oil City, Pa.
Cadillac Motor Car Co., Detroit, Mich.
Callaway Fuel Co., Milwaukee, Wis.
Canfield Oil Co., The, Cleveland, Ohio.
Carborundum Co., The, Perth Amboy, N. J.
Caterpillar Tractor Co., San Leandro, Calif. (in principle).
Celluloid Corporation, Newark, N. J.
Center St. Fuel Co., Milwaukee, Wis.
Century Engineering Corporation, Cedar Rapids, Iowa.
Certified Oil Co., Inc., New York, N. Y.
Chanslor Canfield Midway Oil Co., Los Angeles, Calif. (in principle).
Chapman Coal Co., W. J., Baltimore, Md.
Chesebrough Mfg. Co., C'd., New York, N. Y.
Chicago, Rock Island and Pacific Railway, Chicago, Ill.
Child, Harry C., Sayre, Pa.
Christian & Co., B. W., Delavan, Wis.
Cities Service Oil Co., Tulsa, Okla.
Claflin-Sumner Coal Co., Worcester, Mass.
Coleman, J. E., Red Bank, N. J.
Colonial Beacon Oil Co., Inc., Boston, Mass.
Col-Tex Refining Co., Oklahoma City, Okla.
Commerce Petroleum Co., Chicago, Ill.
Conklin and Sons Co., Madison, Wis.
Consumers Oil Co., Baltimore, Md.
Consumers Petroleum Co., Chicago, Ill.
Continental Baking Co., Inc., New York, N. Y.
Cook's Oil Co., Oakland, San Jose, and South San Francisco, Calif.
Cross Co., Henry H., Chicago, Ill.
Crown Central Petroleum Corporation, Baltimore, Md.
Crystal Oil Works Co., Oil City, Pa.
D'Arcey, Inc., John, Chelsea, Mass.
Dayton Steel Foundry Co., The, Dayton, Ohio (in principle).
Deep Rock Oil Corporation, Chicago, Ill.
Deere Tractor Co., John, Waterloo, Iowa.
DeJarnette, Chas. W., Des Moines, Iowa (in principle).
De Laval Separator Co., Poughkeepsie, N. Y.
Derby Oil & Refining, Wichita, Kans.
Detroit City Ice & Fuel Co., Detroit, Mich.
Detroit Edison Co., The, Detroit, Mich.
Dexter & Blethen, Dover-Foxcroft, Maine.
Dexter Folder Co., Pearl River, N. Y.
Diesel Power, New York, N. Y. (in principle).
Dodge and Morrison, New York, N. Y.
Dome Oil Co., Inc., Washington, D. C.
Domestic Petroleum Corporation, Perth Amboy, N. J.
Edison, Inc., Thomas A., West Orange, N. J.
Electric Boat Co., Groton, Conn.
Electric Bond & Share Co., New York, N. Y. (in principle).
Ellett-Stempfle Co., Elmira, N. Y.
Elliott-Lewis Co., Philadelphia, Pa.
Empire Oil & Refining Co., Tulsa, Okla.
Engineer Co., The, New York, N. Y.
Everite Utilities Corporation, Brooklyn, N. Y.
Excelsior Oil Corporation, Mount Vernon, N. Y.
Fair-Chester Oil Co., Inc., East Port Chester, Conn.
Falley Petroleum Co., Chicago, Ill.
Farm Bureau Oil Co., Indianapolis, Ind.
Flannagan, Eric G., Henderson, N. C. (in principle).
Florence Stove Co., Gardner, Mass.
Floyd-Wells Co., The, Royersford, Pa.
Foster Petroleum Corporation, Westerly, R. I. (in principle).
Franklin Creek Refining Corporation, Franklin, Pa.
Franklin Oil Heating, Inc., Columbus, Ohio.
Frederick, Maryland, City of, Frederick, Md.
Frontier Fuel Oil Corporation, Buffalo, N. Y.
Fuel Engineering Co. of New York, New York, N. Y. (in principle).
Fuel Oil & Burner Service Co., Philadelphia, Pa.
Fuel Oil Journal, New York, N. Y. (in principle).
General Electric Co., Air Conditioning Department, Schenectady, N. Y.
General Petroleum Corporation of Calif., Los Angeles, Calif.
Gerhardt, W. F., Richmond, Va.
Gilbert, E. D., Coatesville, Pa.
Globe Oil & Refining Co. of Illinois, Chicago, Ill.
Good Housekeeping Institute, New York, N. Y. (in principle).
Goodrich & Co., Inc., Walter H., New Haven, Conn.
Goodrich Oil Burner Service, Queens Village, Long Island, N. Y.

Grace Oil Co., Wildwood, N. J.
Grant Manufacturing Corporation, Jersey City, N. J.
Gray Industrial Laboratories, The, Newark, N. J.
Griffith-Consumers Co., Washington, D. C.
Gulf Refining Co., Pittsburgh, Pa.
Hajoca Corporation, Philadelphia, Pa.
Hancock Oil Co. of California, The, Long Beach, Calif.
Hansen Snider Lbr. Co., Wisconsin Dells, Wis.
Harbor Fuel Co., Inc., Glen Cove, Long Island, N. Y.
Harley & Ellington, Inc., Detroit, Mich. (in principle).
Harnischfeger Corporation, Milwaukee, Wis.
Harper & West, Boston, Mass. (in principle).
Harris, Jay, Forest Hills, N. Y.
Harvard University, Cambridge, Mass.
Hayward Manufacturing Co., Inc., Brooklyn, N. Y.
Health Products Corporation, Newark, N. J.
Heating & Ventilating, New York, N. Y. (in principle).
Heating Journals, Inc., New York, N. Y. (in principle).
Heil Co., The (oil burner manufacturers), Milwaukee, Wis.
Henry Furnace & Foundry Co., The, Philadelphia, Pa. (in principle).
Henry Oil Co., Morristown, N. J.
Hidlay Oil Co., Inc., Bloomsburg, Pa.
Hill Diesel Engine Co., Lansing, Mich.
Hoke, Karl Buckingham, Toledo, Ohio (in principle).
Home Oil Burner Corporation, Hempstead, N. Y.
Homestead Valve Manufacturing Co., Coraopolis, Pa.
Honolulu Oil Corporation, Ltd., San Francisco, Calif.
Hotstream Heater Co., The, Cleveland, Ohio (in principle).
Houseman, William W., Port Richmond, Staten Island, N. Y.
Hunt Co., Robert W., Chicago, Ill. (in principle).
Huron Oil Co., Detroit, Mich.
Hydrocarbons Corporation, Chicago, Ill.
Illinois Farm Supply Co., Chicago, Ill.
Ingersoll-Rand, Phillipsburg, N. J.
Iowa State College, department of agricultural engineering, Ames, Iowa (in principle).
Jefferson, C. J., Eltingville, Staten Island, N. Y. (in principle).
Jenkins Bros., Bridgeport, Conn.
Johns-Manville Corporation, Manville, N. J.
Johnson Oil Refining Co., Chicago, Ill.
Johnston Manufacturing Co., Minneapolis, Minn.
Kanotex Refining Co., The, Arkansas City, Kans.
Keich & O'Brien, Warren, Ohio (in principle).
Kentucky Consumers Oil Co., Louisville, Ky.
Kiehl, Eugene P., Philadelphia, Pa.
King-Seeley Corporation, Ann Arbor, Mich.
Kleen Heet, Inc., Chicago, Ill.
Kleinhans, Inc., Henry, Elizabeth, N. J.
Kratz, R. C., Philadelphia, Pa. (in principle).
Landis Electric Co., Lancaster, Pa.
Lawrence Co., A. P., Schenectady, N. Y.
Lightning Service Co., Inc., Newark, N. J.
Lincoln Oil Refining Co., Robinson, Ill.
Lion Oil Refining Co., El Dorado, Ark.
Liquidometer Corporation, The, Long Island City, N. Y.
Little, Inc., Arthur D., Cambridge, Mass. (in principle).
Littleford Bros., Cincinnati, Ohio.
Lubrite Refining Corporation, St. Louis, Mo.
Lupton, Inc., David, Philadelphia, Pa.
Lynn Machine & Tool Co., Lynn, Mass.
Lynn Products Co., Inc., Lynn, Mass.
Mack Oil Co., Berwyn, Pa.
Magnolia Petroleum Co., Dallas, Tex.
Malone-Gellatly Co., Red Cloud, Nebr.
Marathon Oil Co., Tulsa, Okla.
Maritime Oil Co., Houston, Tex.
Marker, Burton L., Chester, Pa. (in principle).
Maryland Oil Burner Service Co., Baltimore, Md.
Mathieson Alkali Works, Inc., The, Niagara Falls, N. Y.
Mayflower Fuel Oil Co., West New York, N. J.
McIlvaine North Shore Sales and Service, Evanston, Ill.
McIntosh, J. C. & D. F., Canton, Ohio.
Midwest Oil Co., Minneapolis, Minn.
Miller, P. E., Plattsburg, N. Y.
Miller Sons' Co., A. D., N. S., Pittsburgh, Pa.
Montgomery Ward & Co., Chicago, Ill.
Montreal Department of Public Works, Montreal, Canada (in principle).
Moore, David H., Atlantic City, N. J.
Moore & McCormack Co., Inc., agents, New York, N. Y.
Motor Wheel Corporation, Lansing, Mich.
Nassau Utilities Fuel Corporation, Roslyn, N. Y.
National Airoil Burner Co., Philadelphia, Pa.
National Dyeing and Printing Co., East Paterson, N. J.
National Fuel Oil Co., Chicago, Ill.

National Radiator Corporation, Johnstown, Pa.
National Refining Co., The, Cleveland, Ohio.
Naylor, T. C., Binghamton, N. Y.
Nelson, Albert L., St. Louis, Mo.
New York Central Lines, New York, N. Y. (in principle).
New York State Reconstruction Home, West Haverstraw, N. Y.
Niederreiter, John J., Richmond Hill, N. Y.
Nordberg Manufacturing Co., Milwaukee, Wis.
Northern Equipment Co., Erie, Pa.
Norton Co., Worcester, Mass.
Ohio Oil Co., The, Findlay, Ohio.
Ohio State University, Columbus, Ohio (in principle).
Oil Creek Refining Co., Titusville, Pa.
Oilomatic Heating Co., Inc., Reading, Pa. (in principle).
Olney Oil & Refining Co., Wichita Falls, Tex.
Orr, Benjamin N., New York, N. Y.
Owens, J. M., Norristown, Pa.
Panhandle Refining Co., Wichita Falls, Tex.
Paragon Oil Co., Inc., New York, N. Y.
Paramount Industries, Inc., Detroit, Mich.
Pate Oil Co., Milwaukee, Wis.
Patterson & Co., Inc., Jos. M., Phliadelphia, Pa.
Peaster Oil Co., Winnetka, Ill.
Pennsylvania, Commonwealth of, Department of Property and Supplies, Harrisburg, Pa. (in principle).
Pennsylvania Petroleum Co., York, Pa.
Pennsylvania Refining Co., Butler, Pa.
Pennzoil Co., The, Oil City, Pa.
Perfection Stove Co., Cleveland, Ohio.
Permutit Co., The, Birmingham, N. J.
Peterson Co., George C., Chicago, Ill.
Petroleum Brokerage Co., Joplin, Mo.
Petroleum Oils Corporation, Kansas City, Mo.
Petroleum Products, Inc., Kansas City, Mo.
Petro Nassau Corporation, Rockville Centre, Long Island, N. Y.
Pfizer & Co., Inc., Chas., New York, N. Y.
Philadelphia Electric Co., Philadelphia, Pa.
Phoenix Chemical Laboratory, Chicago, Ill.
Pierce Burner Corporation, Wilmington, Del.
Pneumatic Scale Corporation Ltd., Norfolk Downs, Mass.
Pocomoke Foundry & Machine Works, Pocomoke City, Md. (in principle).
Poole Engineering Co., Lawrence, Mass.
Porter Corporation, J. E., Ottawa, Ill.
Power Plant Engineering, Chicago, Ill. (in principle).
Procter & Gamble Co., The, Cincinnati, Ohio.
Public Service Oil Co., Inc., New York, N. Y.
Pure Oil Co., The, Chicago, Ill.
Purol, Inc., Trenton, N. J.
Pyramid Petroleum Products Co., Kearny, N. J.
Quaker State Oil Refining Corporation, Emlenton, Pa.
Quimby Pump Co., Inc., Newark, N. J. (in principle).
Quincy Oil Co., The, Quincy, Mass.
Range and Furnace Oil Burning Utility, Tomkinsville, Staten Island, N. Y.
Reading & Reading, Inc., Trenton, N. J.
Red Indian Oil Co., Detroit, Mich.
Refiners Petroleum Co., Chicago, Ill.
Reid, Jr., William H., Billings, Mont.
Reif-Rexoil, Inc., Buffalo, N. Y.
Republic Oil Co., Petersburg, Va.
Richards, Louis M., Somerville, N. J.
Richardson Lubricating Co., Quincy, Ill.
Richfield Oil Co. of California, Los Angeles, Calif.
Richfield Oil Corporation of New York, New York, N. Y.
City of Rochester, New York, Rochester, N. Y.
Rochester Smelting & Refining Co., Inc., Rochester, N. Y.
Rockford Drop Forge Co., Rockford, Ill.
Rock of Ages Corporation, Barre, Vt.
Rockwell Co., W. S., New York, N. Y.
Royce, William, Lakeside, Mich.
Russell & Lance, Tacoma, Wash. (in principle).
Scattene, Joseph R., Bethlehem, Pa.
Schildwachter & Sons, Inc., Fred M., Bronx, New York, N. Y.
Schock Independent Oil Co., Mount Joy, Pa.
Schrafft & Sons Corporation, W. F., Charlestown, Mass.
Schuck Electric Co., Philadelphia, Pa.
Schuler, George A., Allentown, Pa.
Schultz, W. R., North Scituate, Mass.
Schutte and Koerting Co., Philadelphia, Pa.
Sego Milk Products Co., Salt Lake City, Utah.
Seneca Petroleum Co., Chicago, Ill.
Seymour Manufacturing Co., The, Seymour, Conn.
Shedlov Oil Burner Co., Minneapolis, Minn.
Sheffler-Gross Co., Inc., Philadelphia, Pa.
Shellady, Inc., Wm. D., Wilmington, Del.
Shell Oil Co., San Francisco, Calif.

Shell Petroleum Corporation, St. Louis, Mo.
Shenango-Penn Mold Co., Dover, Ohio.
Simms Oil Co., Dallas, Tex.
Simplex Oil Heating Corporation, New York, N. Y.
Sinaiko Bros. Oil Co., Madison, Wis.
Skelly Oil Co., Tulsa, Okla.
Skokie Oil & Coal Co., Niles Center, Ill.
Slattery & Co., New York, N. Y.
Sloan and Zook Refining Co., The, Warren, Pa.
Smith Co., The H. B., Westfield, Mass. (in principle).
Smith Oil & Refining Co., Rockford, Ill.
Smith Paper Mills Ltd., Howard, Cornwall, Ontario.
Snyder & Co., Baltimore, Md. (in principle).
Socony-Vacuum Oil Co., Inc., New York, N. Y.
South Dakota, State of, Vermillion, S. Dak. (in principle).
Souther Engineering Co., The Henry, Hartford, Conn. (in principle).
Spear Stove & Heating Co., James, Philadephia, Pa.
Spencer Petroleum Co., Chicago, Ill.
Stack-Heat Converter Co., Philadelphia, Pa. (in principle).
Standard Oil Co. of California, San Francisco, Calif.
Standard Oil Co. (Indiana), Chicago, Ill.
Standard Oil Co. of Louisiana, New Orleans, La.
Standard Oil Co. of New Jersey, New York, N. Y.
Standard Oil Co. (Ohio), The, Cleveland, Ohio.
Standard Oil Development Co., New York, N. Y.
Starkweather Engineering Co., Inc., Boston, Mass.
Starlight Refining Co., Karns City, Pa.
Stillman & Van Siclen, Inc., New York, N. Y. (in principle).
Stoll Oil Refining Co., Louisville, Ky.
Strain & Sutton, Poughkeepsie, N. Y.
Struck, J. A., Branchville, N. J.
Stuart Co., W. W., Des Moines, Iowa.
Suburban Fuel Oil Service, Inc., Mount Vernon, N. Y.
Swarthmore Heating Service, Swarthmore, Pa.
Sylvestre Oil Co., Inc., Mt. Vernon, N. Y.
Syncro-Flame Burner Corporation, Hartford, Conn.
Tate-Jones & Co., Inc., Leetsdale, Pa. (in principle).
Technical Publishing Co., Chicago, Ill. (in principle).
Texas Co., The, New York, N. Y.
Texas Pacific Coal and Oil Co., Fort Worth, Tex.
Town & Country Oil Corporation, Mt. Vernon, N. Y.
Trenton Plumbing, Trenton, N. J. (in principle).
Tri-State Refining Co., Ashland, Ky.
Trump Corporation, Syracuse, N. Y.
Tuthill Pump Co., Chicago, Ill.
Uhl, Jr., Otto, East Elmhurst, Long Island, N. Y.
Ultra-Penn Refining Co., Butler, Pa.
Union Oil Co. of California, Los Angeles, Calif.
United Light & Power Engineering & Construction Co., The, Davenport, Iowa.
United Oil Manufacturing Co., Erie, Pa. Cleveland, Ohio.
United Refining Co., Warren, Pa.
U. S. Industrial Chemical Co., Baltimore, Md.
U. S. Smelting Furnace Co., Belleville, Ill.
Universal Engineer Publishing Co., New York, N. Y. (in principle).
Universal Oil Products Co., Riverside, Ill. (in principle).
Vickers Petroleum Co. of Delaware, The, Wichita, Kans.
Victor Coal and Fuel Co., Philadelphia, Pa.
Virginia Polytechnic Institute, Blacksburg, Va.
Volcanic Specialties Co., The, Alliance, Ohio.
Vreeland & Tiger, Little Falls, N. J.
Wagner-Engineering Corporation, Pittsfield, Mass.
Waltham, Massachusetts, City of, Waltham, Mass.
Ward Oil Co., Inc., Ossining, N. Y. Tarrytown, N. Y.
Warner-Quinlan Co., New York, N. Y.
Waverly Oil Works Co., Pittsburgh, Pa.
Webaco Oil Co., Webster, N. Y.
Webster & Co., Warren, Camden, N. J.
Webster Electric Co., Racine, Wis.
Weitxel, Cameron B., Manheim, Pa.
Wells Petroleum Co., Chicago, Ill.
Western Oil and Refining Co., Los Angeles, Calif.
Westinghouse Air Brake Co., Wilmerding, Pa.
White Eagle Oil Corporation, Kansas City, Mo.
White Star Refining Co., Detroit, Mich.
Whitlock Coil Pipe Co., The, Hartford, Conn.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
Willatsen, Andrew, Seattle, Wash.
Wilshire Oil Co., Inc., Los Angeles, Calif.
Wilson & Co., Inc., Chicago, Ill.
Winkler-Koch Engineering Co., The, Wichita, Kans.

Winton Engine Corporation, Cleveland, Ohio.
Witte Engine Works, Kansas City, Mo.
Wolverine-Empire Refining Co., Oil City, Pa.
Wood Industries, Inc., Gar, Detroit, Mich.
Worthington Pump & Machinery Corporation, New York, N. Y.
Yellen, John J., Perth Amboy, N. J.
York Oil Burner Co., York, Pa.

GOVERNMENT

Government of the District of Columbia, Washington, D. C.
U. S. Treasury Department, Washington, D. C.
Veterans' Administration, Washington, D. C.
War Department, Engineer Department, United States Army, Washington, D. C.

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