TABLE 4. DETAILED REQUIREMENTS FOR FUEL OILS[a]

GRADE[b]	FLASH POINT F DEG		POUR POINT F DEG	WATER AND SEDIMENT PER CENT	CARBON RESIDUE PER CENT	ASH PER CENT	DISTILLATION TEMPERATURES F DEG			VISCOSITY SECONDS			
							10 Per Cent Point	90 Per Cent Point	End Point	Saybolt Universal at 100 F		Saybolt Furol at 122 F	
	Min.	Max.	Max.	Max.	Max.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Min.
No. 1 Fuel oil—a distillate oil for use in burners requiring a volatile fuel.	100 or Legal	165	0[c]	Trace	0.05 on 10% Residuum[d]		410		560[e]				
No. 2 Fuel oil—a distillate oil for use in burners requiring a moderately volatile fuel.	110 or Legal	190	10[c]	0.05	0.25 on 10% Residuum[d]		440	600					
No. 3 Fuel oil—a distillate oil for use in burners requiring a low viscosity fuel.	110 or Legal	230	20[c]	0.10	0.15 Straight			675	600[e]	45			
No. 5 Fuel oil—an oil for use in burners requiring a medium viscosity fuel.	130 or Legal			1.00		0.10					50	40	
No. 6 Fuel oil—an oil for use in burners equipped with preheaters permitting a high viscosity fuel.	150			2.00[h]								300	45

[a]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	SULFUR, MAX. PER CENT
No. 1	0.5
No. 2	0.5
No. 3	0.75
No. 5	No Limit
No. 6	No Limit

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

[b]It is the intent of these classifications that failure to meet any requirement of a given grade does not automatically place an oil in the next lower grade unless in fact it meets all requirements of the lower grade.

[c]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.

[d]For use in other than sleeve type blue flame burners carbon residue on 10 per cent residuum may be increased to a maximum of 0.12 per cent. This limit may be specified by mutual agreement between the buyer and seller.

[e]The maximum end point may be increased to 690 F when used in burners other than sleeve type blue flame burners

[f]To meet certain burner requirements the carbon residue limit may be reduced to 0.15 per cent on 10 per cent residuum.

[g]The minimum distillation temperature of 600 F for 90 per cent may be waived if *A.P.I.* gravity is 26 or lower.

[h]Water by distillation, plus sediment by extraction. Sum, maximum 2.0 per cent. The maximum sediment by extraction shall not exceed 0.50 per cent. A deduction in quantity shall be made for all water and sediment in excess of 1.0 per cent.

TABLE 5. APPROXIMATE GRAVITY AND CALORIFIC VALUE OF STANDARD GRADES OF FUEL OIL

COMMERCIAL STANDARD NO.	APPROXIMATE GRAVITY RANGE *A.P.I.*	CALORIFIC VALUE BTU PER GALLON
1	38-40	136,000
2	34-36	138,500
3	28-32	141,000
5	18-22	148,500
6	14-16	152,000

CLASSIFICATION OF FUEL OILS

Fuel oils are produced by distillation from crude petroleum after gasoline, naphtha, and other lighter products have been removed. Fuel oil is composed chemically of about 85 per cent carbon and 12½ per cent hydrogen with small amounts of oxygen, nitrogen, and sulfur. Oils are classified according to their specific gravity, but specific gravity alone is not a sufficient index of the properties that are important for heating purposes. Other characteristics that must be considered in the choice of a fuel oil are the flash point, pour point, water and sediment content, carbon residue, ash, sulfur content, distillation temperatures, and viscosity.

The flash point and distillation characteristics are important relative to easy ignition and complete gasification of the oil in a burner. A low pour point and low water content are of interest in connection with the storage of the fuel in outdoor tanks, while a low viscosity permits easy passage through a small orifice. The sediment, carbon residue, and ash content should be low to prevent clogging of strainers and accumulation of unburned material in the burner. The sulfur content may be of importance because of the corrosive effect of sulfur compounds in the burner and heating appliance or in special commercial processes.

The Commercial Standard Specifications for Fuel Oils (CS 12-40) of the *U. S. Department of Commerce* are given in Table 4. These specifications conform to *American Society for Testing Materials* Tentative Specifications for Fuel Oils D 396-38T.

The relationship between the *A.P.I.* gravity of fuel oils and their calorific value is given in Table 5. Fuel oil grades No. 1, No. 2 and No. 3 only are used in domestic heating equipment. Grades No. 5 and No. 6 are used in commercial and industrial burners and usually require preheating.

CLASSIFICATION OF GAS

Gas is broadly classified as being either *natural* or *manufactured*. Natural gas is a mechanical mixture of several combustible and inert gases rather than a chemical compound. Manufactured gas as distributed is usually a combination of certain proportions of gases produced by two or more processes. Representative properties of gaseous fuels commonly used in domestic heating are presented in Table 6.

Natural gas is the richest of the gases and contains from 80 to 95 per cent methane, with small percentages of the other combustible hydrocarbons. In addition, it contains from 0.5 to 5.0 per cent of CO_2, and from 1 to 12 or 14 per cent of nitrogen. The heat value varies from 1000 to 1200 Btu per cubic foot, the majority of natural gases averaging about 1000 Btu per cubic foot. Table 6 shows typical values for the