TABLE 4. DETAILED REQUIREMENTS FOR FUEL OILS[a]

| GRADE OF FUEL OIL[b] | FLASH POINT F | POUR POINT F | WATER AND SEDIMENT % | CARBON RESIDUE ON 10% RESIDUUM % | ASH % | DISTILLATION TEMPERATURES F | | | VISCOSITY SECONDS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 10% Point | 90% Point | End Point | Saybolt Universal at 100 F | | Saybolt Furol at 122 F | Kin. C. S. at 100 F | | Kin. C. S. at 122 F |
| | Min. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Min. | Max. | Max. | Min. | Max. Min. |
| 1. A distillate oil intended for vaporizing pot-type burners and other burners requiring this grade[c] A.P.I. gravity 35 (min.) | 100 or Legal | 0 | Trace | 0.15 | | 420 | | 625 | | | | 2.2 | 1.4 | |
| 2. A distillate oil for general purpose domestic heating for use in burners not requiring no. 1 A.P.I. gravity 26 (min.) | 110 or Legal | 20[e] | 0.10 | 0.35 | | [e] | 675 | | 40 | | | (4.3) | | |
| 4. An oil for burner installations not equipped with preheating facilities | 110 or Legal | 20 | 0.50 | | 0.10 | | 675 | | 125 | 45 | | (26.4) | (5.8) | |
| 5. A residual type oil for burner installations equipped with preheating facilities | 130 or Legal | | 1.00 | | 0.10 | | | | | 50 | 40 | | 32.1 | (81) |
| 6. An oil for use in burners equipped with preheaters permitting a high-viscosity fuel | 150 or Legal | | 2.00[f] | | | | | | | | 300 | 45 | | (338) (92) |

[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 |
| Nos. 4, 5 and 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] No. 1 oil shall be tested for corrosion in accordance with par. 15 for 3 hours at 122 F. The exposed copper strip shall show no gray or black deposit.

[e] The 10 per cent point may be specified at 440 F maximum for use in other than atomizing burners.

[f] The amount of water by distillation, plus the sediment by extraction, shall not exceed 2.00 per cent. The amount of 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 | 35–45 | 138,800–132,900 |
| 2 | 26–40 | 144,300–135,800 |
| 4 | 12–25 | 153,000–145,000 |
| 5 | 10–23 | 154,600–146,200 |
| 6 | 8–17.5 | 156,000–149,700 |

geologic formations. Manufactured gas, as distributed, is usually a combination of gases produced by two or more processes of disintegration of carbonaceous material such as coal, coke or oil. Liquefied petroleum gases are certain hydrocarbons which are gaseous under normal atmospheric conditions, but can be liquefied under moderate pressure at normal temperatures. However, the demand for gaseous fuels in the past few years has so extended the original sources of manufacture and distribution that hardly any city of any size can be said to be supplied with one specific type of gas. During peak load demands for heating in natural gas systems high Btu oil-gas, and high Btu liquefied petroleum-air mixtures, are added; while in manufactured gas systems, the supply is augmented by use of reformed natural gas, reformed refinery gas, lower Btu mixtures of liquefied petroleum and air, and use of straight natural gas for increasing heating value of other manufactured gases.

Representative properties of gaseous fuels commonly used in domestic heating are presented in Table 6.

Natural gas contains from 75 to 95 per cent methane, with smaller percentages of the higher hydrocarbons. In addition, non-inflammable components such as carbon dioxide, nitrogen and helium are often present. The percentages of the different components vary with the area from which the gas is withdrawn, and even the composition from a given well will vary over the life of the well. The heating value varies from 900 to 1400 Btu per cu ft as shown in Table 6, although in the majority of cases is between 1000 and 1050 Btu per cu ft.

Table 6 also gives the calorific values of the more common types of manufactured gases. Most states and municipalities have legislation which controls the distribution of gas and establishes a minimum limit to its heat content. The gross or higher calorific value usually ranges between 520 and 545 Btu per cu ft, with an average of 535. There has been a tendency lately in some manufactured gas territories to increase the calorific value of the gas in order to serve more customers with the existing distribution system.

A given heat value may be maintained and yet permit considerable latitude in the composition of the gas so that, as distributed, the composition is not necessarily the same in different districts nor at successive times in the same district. However, in any community the variations in gas composition are held within suitable limits so that the performance of gas appliances conforming to American Standard Requirements will not be adversely affected.

Liquefied petroleum gases, principally propane and butane or mixtures of both, are the richest of the gases, having calorific values of 2500 and 3200 Btu per cu ft, respectively. They are normally supplied as liquids under