

**Automotive Fluid Testers**Engine Coolant/Antifreeze, Battery Acid, and
Brake Fluid Testers**Temperature Indicators**Temperature indicators and Sterilization
Indicators

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APPENDIX I

VOLUME CONVERSION

ASTM/API/IP TABLE 5A/B

ASTM/API/IP Table 5A/B gives the values of API gravities at 60° F corresponding to API gravities observed with a glass hydrometer at temperatures other than 60° F. In converting an API gravity at the observed temperature (API hydrometer indication) to the corresponding API gravity at 60° F, two corrections are necessary. The first correction is the change in volume of the glass hydrometer by temperature. The second correction is the change in volume of the oil. Both corrections have been applied to this table.

NOTE: This table must be used with API gravities (hydrometer indications) measured with a soft glass hydrometer calibrated at 60° F.

FUEL CLASSIFICATION BY API GRAVITY PROCEDURES

The first step in volume conversion is fuel classification.

- Taking the Readings. Described below are the procedures that must be followed during fuel classification.
- Step 1. Draw a 300-milliliter sample of fuel from the drum, nozzle, or other fuel source. Put it into a clean dry sample bottle, quart bottle with lid, or a sample can. Cover the sample container. Take the sample to a tent, building, or other sheltered place to conduct the test. Conduct the test promptly while the sample is fresh.
- Step 2. Agitate the contents of the sample container by shaking it thoroughly.
- Step 3. Slowly and carefully pour the sample down the inside of a clean, dry hydrometer cylinder, filling the cylinder approximately 3/4 full.
- Step 4. Allow any air bubbles that are deep in the liquid to rise to the

surface. Hold the cylinder just below the rim with one hand, and tap the top of the cylinder sharply with the cupped palm of the other hand to remove surface air bubbles.

- Step 5. Set the cylinder on a level surface where it is protected from air currents.
- Step 6. Use the hydrometer with the range closest to the API gravity range of the fuel you think you are testing. See Figure I-1. For example, if you think the fuel is diesel and the API gravity range of diesel is between 30.0 and 42.0, use the third or fourth hydrometer from the equipment list.
- Step 7. Check the mercury column if the hydrometer being used has a built-in thermometer. If the mercury has separated, the hydrometer will not take acceptable temperature readings, and you should use another hydrometer. If a hydrometer with an accurate thermometer is not available, you may use a calibrated tank thermometer to measure the temperature.
- Step 8. Lower the hydrometer gently into the sample.

NOTE: If the hydrometer sinks or floats with the scale out of the fuel, you have selected the wrong one for the type of fuel you are testing. Try another hydrometer close to the same range. Keep trying until a hydrometer floats in the sample.

- Step 9. Stir the sample gently by raising and lowering the hydrometer, and watch the movement of the mercury in the thermometer. (A fast registering thermometer should give an accurate reading in 30 to 45 seconds.) When the mercury stops moving, take a temperature reading and record it.
- Step 10. Allow the hydrometer to come to rest, but not touching the side of the cylinder. If it moves to the side, move it back to the center of the liquid and spin it gently.
- Step 11. When the hydrometer is floating freely at rest, read it to the nearest scale division. Have your eye slightly below the level of the liquid, and raise it slowly until the surface of the liquid appears to be a straight line across the hydrometer scale. Record the gravity reading to the nearest scale division as shown in Figure I-2.
- Step 12. Stir the sample gently again by raising and lowering the hydrometer, and take a second temperature reading. If the temperature of

the fuel has not varied more than 1° F from the previous reading, record the temperature to the nearest 1° F. This is your test temperature reading. If the temperature of the sample has changed more than 1° F, repeat steps 9 through 12 until the temperature is stable (within 1° F).

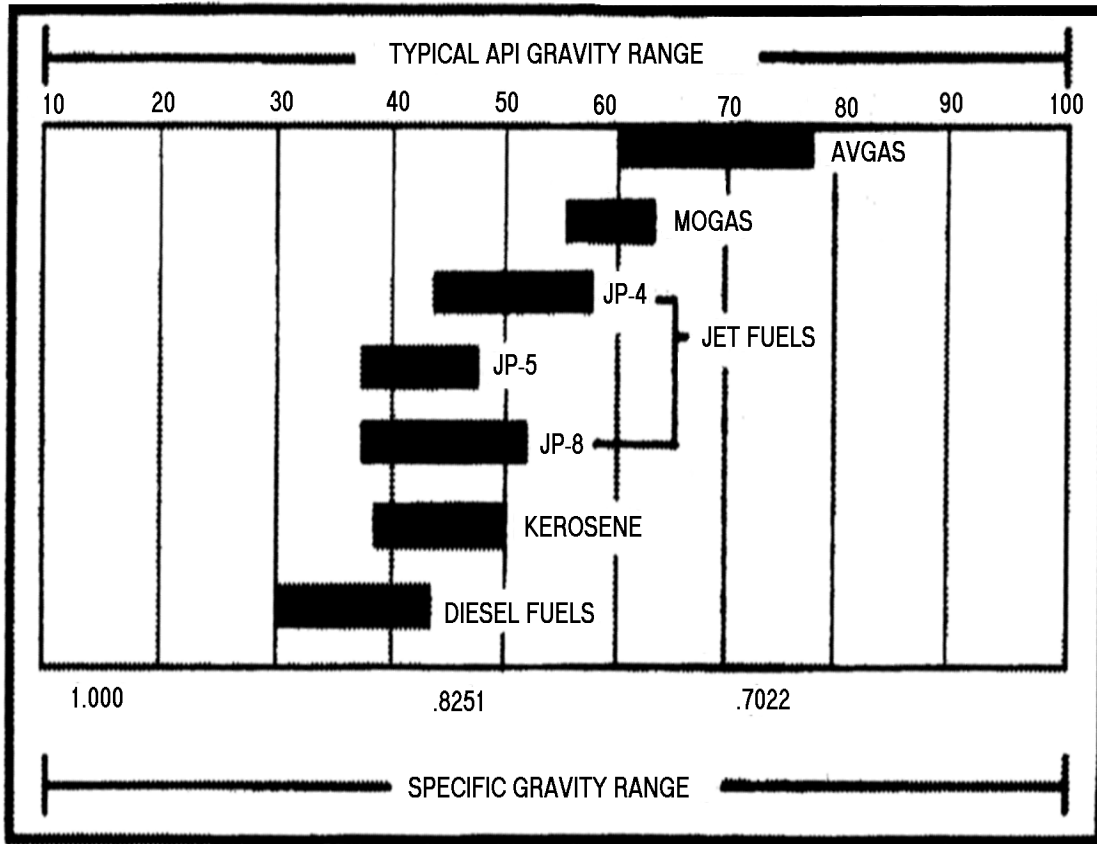


Figure I-1. Typical API gravity ranges (corrected to 60 degrees)

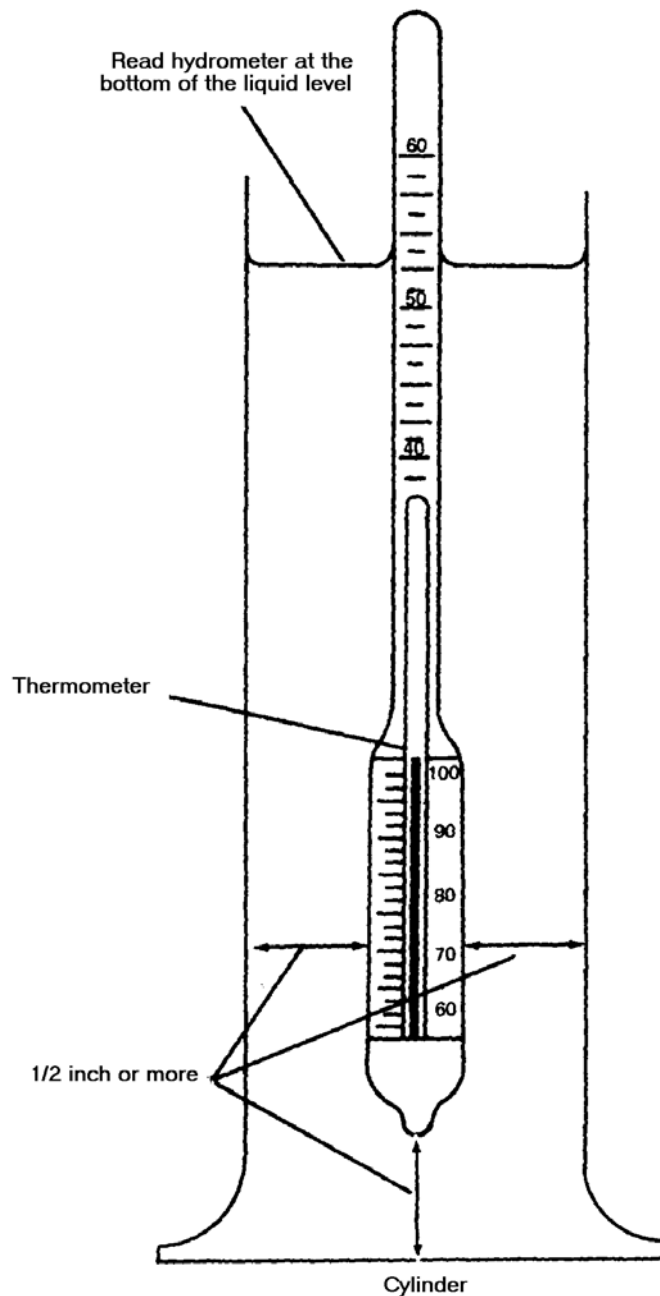


Figure I-2. Hydrometer ready to be read

Correcting Observed Reading to 60° F

Using Table 5A/B, correct the API gravity of the observed temperature to API gravity at 60° F. Table 5A is used for JP-4 and Table 5B is used for petroleum products other than JP-4. Example: Assume the observed hydrometer reading is 40.4 and the observed temperature is 83° F. The product is not JP-4. The steps are given below to correct the observed reading to 60° F.

- Step 1. Find the Table 5B page that lists API gravity of 40 through 45 at observed temperature across the top and the observed temperature range of 60° through 90° F down the left side.
- Step 2. Read down the left side until you find the observed temperature (83.0° F). The observed API reading of 40.4 is rounded to 40.5 (The API gravity is in increments of 0.5, so the observed API gravity must be rounded to the nearest 0.5). Read across the table to where the observed API gravity of 40.5 intersects the observed temperature of 83.0° F. The API gravity at 60° F is 38.7.

NOTE: For more precise API gravity correction to 60° F, interpolation is used. See ASTM 1250. However, when API gravity is corrected to 60° F for the purpose of volume correction using Table 6A/B, interpolation is not required.

- Step 3. API gravity that is recorded on the gage worksheet for volume correction use only must be rounded off to the nearest 0.5. Round off to the nearest 0.5 as follows:
 - • If the fraction is .1 or .2, round down to the nearest whole degree. (For example, 42.2 becomes 42.0.)
 - • If the fraction is .3, .4, .5, .6, or .7, round to the nearest .5 degree. (For example 38.3 becomes 38.5, or 38.7 becomes 38.5.)
 - • If the fraction is .8 or .9, round up to the nearest whole number. (For example, 42.8 becomes 43.0.)

Classifying the Fuel

The fuel is now classified. The steps are described below:

- Step 1. Compare the corrected API gravity with the API gravity ranges shown in Figure I-1. If the corrected API gravity of the product is lower or higher than expected, it indicates possible commingling with either heavier or lighter products.
- Step 2. If the corrected API gravity is NOT within range for the fuel you are testing, isolate and mark the fuel container; sample the fuel; and send the sample to your supporting laboratory for identification, complete analysis, and disposition instructions. Do not use the fuel until you

receive disposition instructions from the laboratory.

ASTM/API/IP TABLE 6A/B

ASTM/API/IP Table 6A/B gives you the facts you need to convert product volumes observed at temperatures other than 60° F for values of API gravity in the range of 0° to 100° API. The volume correction factor in these tables makes no allowance for the thermal expansion of tanks and other containers. You must use these tables with API gravity values at 60° F and values measured at Fahrenheit temperatures. Table 6A is used for JP-4 and table 6B is used for all petroleum products other than JP-4 See [DA PAM 710-2-1](#). For example, what is the volume of 63,162 gallons of diesel at 83° F? The product's API gravity at 60° F is 38.5. Use the Table 6B column "API gravity at 60° F," headed 38.5° API, and note that against an "Observed Temperature" of 83° F the factor is .9890. Therefore, 1 US gallon of product having a gravity of 38.5° API at 60° F and measured at 83° F occupies at 60° F a volume of .9890. Thus, 63,162 US gallons measured at 83° F occupy a volume of 63,162 X .9890 (or 62,467) US gallons at 60° F.