Fuel Economy Measurement - Road Test Procedure - SAE J1082

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SAE RECOMMENDED PRACTICE
APPROVED APRIL 1974

FUEL ECONOMY MEASUREMENT—ROAD TEST PROCEDURE—SAE J1082

SAE Recommended Practice

Report of Fuel Economy Measurement Procedures Task Force approved April 1974.

1. Purpose—This recommended practice provides uniform testing procedures for measuring on-the-road fuel economy of light-duty vehicles (motor vehicles designed primarily for transportation of persons and having a capacity of 12 persons or less, or for transportation of property and rated at 6000 lb (2700 kg) or less).

2. Scope—This procedure incorporates driving cycles that produce fuel consumption data relating to urban, suburban, and interstate driving patterns. The procedure is intended to be used to determine the relative fuel economy among vehicles and driving patterns under warmed-up conditions on a test track or on suitable roads.

3. Definitions

3.1 Driving Cycles

3.1.1 URBAN CYCLE—Driving pattern defined by paragraph 8.3.2. Similar to driving conditions in the central business district of a large city.

3.1.2 SUBURBAN CYCLE—Driving pattern defined by paragraph 8.3.3. Similar to driving conditions in suburban areas of a large city.

3.1.3 INTERSTATE CYCLE—Driving pattern defined by paragraph 8.3.4. Similar to driving conditions on an expressway.

3.2 Test Vehicle—Passenger car or light truck prepared for test according to paragraph 7.

3.3 Test Vehicle Weight—Unloaded vehicle weight plus 300 lb (136 kg).

3.3.1 UNLOADED VEHICLE WEIGHT—The weight of the vehicle as built to production parts list with maximum capacity of all fluids necessary for operation of the vehicle.

3.3.2 DRIVER AND PASSENGER OR BALLAST WEIGHT—The 300 lb (136 kg) includes occupants, instrumentation, and ballast, if necessary.

NOTE: This weight will be distributed to simulate properly passenger locations and vehicle attitude (one passenger in driver's position, and one passenger or equivalent weight in front seat passenger position).

3.4 Observed Economy—Observed economy is the fuel economy measured during a driving cycle. It is determined by dividing the actual miles driven on the cycle by the number of gallons consumed. Economy will be expressed as miles/gallon.

3.5 Corrected Economy—Corrected economy is the observed economy multiplied by the correction factors listed in paragraph 10.

3.6 Correction Factors—Factors used to adjust data to the standard ambient condition of 60°F (15.6°C) and 29.00 in Hg (98 kPa) and reference fuel properties.

4. Instrumentation—All instrumentation will be calibrated.

4.1 Fuel—the fuel measurement device must be compatible with the vehicle fuel system and shall alter the fuel temperature and pressure as little as possible. The fuel measurement device must be capable of measurement in 0.001 gal, 4 ml, 0.01 lb, or 4 g increments and should be accurate within ½% of the indicated fuel consumption.

4.2 Speed—The speed indicating device shall indicate vehicle speed in miles/hour (kilometres/hour) and be accurate within 0.5 mph (0.8 km/h).

4.3 Acceleration—The acceleration indicating device must be capable of indicating both positive and negative acceleration. It shall indicate acceleration/deceleration in feet/second² (metres/second²) and be accurate within 0.5 ft/s² (0.2 m/s²).

4.4 Time—The time measuring instrument must be capable of measuring time interval to 0.1 s and be accurate within 0.1 s in 1 min.

4.5 Temperature—The temperature indicating devices must be capable of measuring to the nearest 1°F or ½°C. Accuracy must be within ±1°F or ±½°C. The sensing element shall be shielded from radiant heat sources.

4.6 Atmospheric Pressure—An aneroid or mercury barometer should be used. This device should be accurate within 0.1 in Hg (340 Pa).

4.7 Wind—Wind speed should be measured with a device which provides an indication of wind speed that is accurate within 2 mph (3.2 km/h). Wind direction should also be indicated.

4.8 Distance—A distance-indicating device is required if the tests are not conducted on a premarked course. This device must be capable of indicating distance to within 15 ft (5 m) and be accurate within 25 ft (8 m) in 1 mile (1.6 km).

4.9 Vehicle Weight—Vehicle weight should be measured with a device that is accurate within ±0.5% with minimum resolution of 20 lb (9 kg).

5. Test Material

5.1 Test Vehicle—The test vehicle shall be completely defined on the Test Vehicle Specifications and Preparation List (Fig. 1). (The test vehicle will normally be representative of a production built vehicle—any exceptions must be properly noted.)

5.2 Test Fuel—Normally, service station fuel will be satisfactory for test purposes. Distillation, specific gravity, and Reid vapor pressure should be recorded.

5.3 Lubricants—Lubricants used shall conform to the manufacturer's recommendation for the predominant weather condition in which the vehicle is being tested.

6. Test Conditions

6.1 Ambient Temperature—Tests should be conducted at ambient temperatures between 30 and 90°F (−1 and 32°C).

6.2 Wind Velocity—Tests must not be conducted when average wind speed exceeds 15 mph (24 km/h) or when gusts exceed 20 mph (32 km/h).

6.3 Road Conditions—Roads must be dry, clean, and smooth, and not exceed ½% grade.

6.4 It is recommended that roadside markers be used to indicate the points at which speed changes are to be made, as indicated in paragraph 8.3.

7. Test Vehicle Preparation

7.1 Break-In—The vehicle should have accumulated a minimum of 2000 miles (3200 km) of operation prior to test. At least 1000 miles (1600 km) must have been driven at cycling speeds between 40 mph (64 km/h) and maximum legal highway speeds. If a closed track is available for break-in, the maximum speed should not exceed 100 mph (160 km/h). Chassis dynamometer break-in is acceptable, providing the tires have operated at least 100 miles (160 km) prior to test.

FUEL ECONOMY TEST - LIGHT-DUTY VEHICLES
TEST VEHICLE SPECIFICATIONS AND PREPARATION

SPECIFICATION LIST

DATE _____
CAR NO. _____
YEAR & MAKE _____
MODEL & BODY _____
VEHICLE IDENT. NO. _____
PRODUCTION _____ OTHER _____
ENGINE TYPE _____ DISP. _____
NET H.P. _____ COMP. RATIO _____
ENGINE NO. _____
CARB. TYPE & NO. _____
DISTRIBUTOR NO. _____
EXHAUST SYSTEM TYPE _____
TRANSMISSION _____
REAR AXLE TYPE & RATIO _____
BRAKES, FRONT _____ , REAR _____
STEERING _____
*TIRE MAKE _____ SIZE _____
LOAD RANGE _____ TYPE _____
COLD INFLATION - TIRE PRESSURE
LF _____ RF _____
LR _____ RR _____
TEST WEIGHT _____
*TIRES MUST HAVE A MINIMUM OF 100 MILES (1610 km) BREAK-IN

CHECK OPTIONAL EQUIPMENT
___ POWER DISC BRAKES
___ POWER DRUM BRAKES
___ POWER STEERING
___ AIR CONDITIONING
___ RADIO
___ POWER SEATS
___ POWER WINDOWS
___ POWER DOOR LOCKS
___
___
___

TEST FUEL SPECIFICATIONS
FUEL TYPE AND GRADE _____
GRAVITY (API OR SPECIFIC) _____
REID VAPOR PRESSURE _____ PSI (Pa)
DISTILLATION 10% _____ °F (°C)
50% _____ °F (°C)
90% _____ °F (°C)

CHECKLIST

___ ENGINE OIL LEVEL
___ COOLANT LEVEL
___ TRANSMISSION FLUID LEVEL
___ BELTS AND HOSES - TIGHT
___ EMISSION CONTROLS - FUNCTIONAL
___ CHOKE OPERATION
___ THROTTLE OPERATION
___ PUMP AND NOZZLES - NO LEAKS
___ IGNITION WIRES - TIGHT
___ BRAKE DRAG - NOT EXCESSIVE
___ TRANSMISSION OPERATION
___ TIRE PRESSURE AND CONDITION
___ ENGINE TUNE
___ IGNITION TIMING _____
___ IDLE RPM _____ IDLE CO _____
___ IGNITION POINT DWELL _____
___ WHEEL ALIGNMENT
___ AIR CLEANER - CLEAN
___ A/C COMPRESSOR LEAD - REMOVED
___ NO FUEL LEAKS
___ MANIFOLD HEAT VALVE
___ FAN CLUTCH

COMMENTS: _____

CAR CHECKED BY: _____

DATE: _____

FIG. 1—FUEL ECONOMY TEST—LIGHT-DUTY VEHICLES: TEST VEHICLE SPECIFICATIONS AND PREPARATION

DATA FORM
FUEL ECONOMY TEST - LIGHT-DUTY VEHICLES

CAR NO. _____ VIN _____
YEAR & MAKE _____
MODEL & BODY _____
ENGINE TYPE _____ DISP. _____
REAR AXLE RATIO _____
TRANSMISSION _____
TIRE MAKE _____ SIZE _____
TIRE PRESSURE: F _____ R _____
FUEL TYPE _____ SP GR _____

TEST VEHICLE WEIGHT _____
TEST ROAD _____
TYPE OF SURFACE _____
INSTRUMENTATION _____
1. _____ NO. _____
2. _____ NO. _____
3. _____ NO. _____
4. _____ NO. _____
5. _____ NO. _____

URBAN CYCLE (2.0 MILES (3.22 km)) DATE _____ TIME _____
ODOMETER: START _____ FINISH _____

	FUEL TEMPERATURE						AMBIENT CONDITIONS					
	0.5 MILES	1.0 MILES	1.5 MILES	2.0 MILES	ACCUM.	ACCUM.	TEMPERATURE		BAROMETRIC		WIND	
DIRECTION	(0.8 km)	(1.6 km)	(2.4 km)	(3.2 km)	TIME	FUEL	START	FINISH	START	FINISH	START	FINISH

SUBURBAN CYCLE (5.2 MILES (8.37 km)) DATE _____ TIME _____
ODOMETER: START _____ FINISH _____

	FUEL TEMPERATURE					AMBIENT CONDITIONS					
	2.0 MILES	3.3 MILES	5.2 MILES	ACCUM.	ACCUM.	TEMPERATURE		BAROMETRIC		WIND	
DIRECTION	(3.2 km)	(5.3 km)	(8.4 km)	TIME	FUEL	START	FINISH	START	FINISH	START	FINISH

_____ MPH (_____km/h) INTERSTATE CYCLE (4.7 MILES (7.56 km)) DATE _____ TIME _____
ODOMETER: START _____ FINISH _____

	FUEL TEMPERATURE				AMBIENT CONDITIONS					
	0.0 MILES	4.7 MILES	ACCUM.	ACCUM.	TEMPERATURE		BAROMETRIC		WIND	
DIRECTION	(0.0 km)	(7.6 km)	TIME	FUEL	START	FINISH	START	FINISH	START	FINISH

TESTED BY _____

FIG. 2—FUEL ECONOMY TEST—LIGHT-DUTY VEHICLES: DATA FORM

7.2 Inspection—The vehicle must be inspected and adjusted where necessary to meet manufacturer's specifications. Checks are specified on the Test Vehicle Specifications and Preparation List (Fig. 1).

7.3 Instrumentation—The fuel measuring device and other instrumentation, as necessary, must be installed in such a manner as not to hinder the vehicle operation or operating characteristics.

7.4 Test Weight—The vehicle weight must be adjusted to provide the test weight indicated in paragraph 3.3 (this test weight includes instrumentation and operator).

8. Test Procedure

8.1 Warmup—The vehicle must be driven a minimum of 20 miles (32 km) at approximately 55 mph (88 km/h) or maximum legal highway speed to stabilize engine and drivetrain operating temperatures before running the first driving cycle.

8.2 Vehicle Controls

8.2.1 Air conditioning compressor, headlamps, and other accessories that consume power should be turned off unless required for safe vehicle operation.

8.2.2 Vehicle windows must remain closed while fuel consumption is being measured during the suburban and interstate cycles.

8.3 Driving Schedules

8.3.1 General Driving Instructions

8.3.1.1 Vehicles incapable of attaining acceleration rates specified by the driving schedules will be driven at maximum acceleration until the specified schedule speed or the next maneuver point is reached.

8.3.1.2 Vehicles with automatic transmissions should be driven with the transmission in drive range. If transmission hunting should be encountered at a specified acceleration, the acceleration should be increased to maintain the transmission in the lower gear and this departure from the schedule noted on the data form.

8.3.1.3 Vehicles equipped with manual transmissions will be operated in the following manner: Idles will be made in gear, clutch disengaged. Decelerations will be made in gear, and the clutch will be disengaged at 15 mph (24.1 km/h) on a stop. Downshifts will be permitted to obtain specified acceleration rate after a deceleration or to obtain smooth engine operation at a slow speed. The following manual transmission shift speeds may be modified as necessary to avoid engine lugging or overspeed. Departure from specified shift speeds should be noted on the data form.

8.3.1.4 Vehicles with manual three-speed transmissions shall be shifted (1-2) at 15 mph (24.1 km/h) and (2-3) at 25 mph (40.2 km/h), or when the specified schedule speed is reached.

8.3.1.5 Vehicles with manual four-speed transmissions, except truck-type transmissions, shall be shifted (1-2) at 15 mph (24.1 km/h), (2-3) at 25 mph (40.2 km/h), and (3-4) at 35 mph (56.3 km/h), or when the specified schedule speed is reached.

8.3.1.6 Vehicles with manual four-speed truck-type transmissions will be treated as three-speed transmission vehicles, using the top three gears.

8.3.2 Urban Cycle

8.3.2.1 The urban cycle will normally be run on a 2 mile (3.2 km) straightaway; for straightaways less than 2 miles (3.2 km) long, turnarounds may be made at normal stop intervals. Successive cycles on a straightaway will be run in opposite directions to minimize wind effects.

8.3.2.2 Effort should be made to maintain accelerations and decelerations within ± 1 ft/s^2 (0.3 m/s^2) of that specified. Speed should be maintained within ± 1 mph (1.6 km/h).

8.3.2.3 Driving cycle maneuvers, except for the stop at the end of

the cycle, are initiated at the points indicated. For example, brake application for the first 4 ft/s² (1.2 m/s²) stop will begin at the 0.2 mile (0.32 km) distance. The car position at the final stop will be at the 2.0 mile (3.22 km) distance.

8.3.2.4 Fuel temperatures will be recorded on the Data Form (Fig. 2) during the idle periods.

8.3.2.5 Record weather data for each test cycle.

8.3.2.6 Ambient conditions should be such that repeatability may be attained in as few cycles as possible.

8.3.2.7 Fuel consumption for each test shall be the average for consecutive cycles run in opposite directions. Stabilization shall be reached when the fuel consumption for successive tests repeats within 2%. Elapsed time must repeat within 1%.

8.3.2.8 *Urban Cycle Fuel Economy Driving Schedule*—Average speed: 15.6 mph (25.1 km/h); running time: 461 s/cycle. After proper warmup (paragraph 8.1), the urban driving cycle should be run as follows:

Distance		Operation
miles	km	
0.0	0.0	Start fuel meter and timing device, idle 15 s, accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²). Proceed at 15 mph (24.1 km/h) to the 0.2 mile (0.32 km) marker.
0.2	0.32	Stop at 4 ft/s² (1.2 m/s²), accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²). Proceed at 15 mph (24.1 km/h) to the 0.3 mile (0.48 km) marker.
0.3	0.48	Decelerate to 5 mph (8.0 km/h) at 4 ft/s² (1.2 m/s²), accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²). Proceed at 15 mph (24.1 km/h) to the 0.5 mile (0.80 km) marker.
0.5	0.80	Stop at 4 ft/s² (1.2 m/s²), idle 15 s, accelerate to 20 mph (32.2 km/h) at 7 ft/s² (2.1 m/s²). Proceed at 20 mph (32.2 km/h) to the 0.7 mile (1.13 km) marker.
0.7	1.13	Stop at 4 ft/s² (1.2 m/s²), accelerate to 20 mph (32.2 km/h) at 7 ft/s² (2.1 m/s²). Proceed at 20 mph (32.2 km/h) to the 0.8 mile (1.29 km) marker.
0.8	1.29	Decelerate to 10 mph (16.1 km/h) at 4 ft/s² (1.2 m/s²), accelerate to 20 mph (32.2 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 20 mph (32.2 km/h) to the 1.0 mile (1.61 km) marker.
1.0	1.61	Stop at 4 ft/s² (1.2 m/s²), idle 15 s, accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²), then to 25 mph (40.2 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 25 mph (40.2 km/h) to the 1.2 mile (1.93 km) marker.
1.2	1.93	Stop at 4 ft/s² (1.2 m/s²), accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²), then to 25 mph (40.2 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 25 mph (40.2 km/h) to the 1.3 mile (2.09 km) marker.
1.3	2.09	Decelerate to 15 mph (24.1 km/h) at 4 ft/s² (1.2 m/s²), accelerate to 25 mph (40.2 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 25 mph (40.2 km/h) to the 1.5 mile (2.41 km) marker.
1.5	2.41	Stop at 4 ft/s² (1.2 m/s²), idle 15 s, accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²), then to 30 mph (48.3 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 30 mph (48.3 km/h) to the 1.7 mile (2.74 km) marker.
1.7	2.74	Stop at 4 ft/s² (1.2 m/s²), accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²) and then to 30 mph (48.3 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 30 mph (48.3 km/h) to the 1.8 mile (2.90 m) marker.
1.8	2.90	Decelerate to 20 mph (32.2 km/h) at 4 ft/s² (1.2 m/s²), accelerate to 30 mph (48.3 km/h) at 5 ft/s² (1.5 m/s²). Proceed at 30 mph (48.3 km/h).
2.0	3.22	Begin braking at 4 ft/s² (1.2 m/s²) to arrive at stop at 2.0 mile (3.22 km) marker. Stop fuel meter and timing device at stop, record fuel consumed, elapsed time, and fuel temperature.
0.0	0.0	Run recheck cycle.

8.3.3 SUBURBAN CYCLE

8.3.3.1 The suburban cycle may be run on either a closed track or a straightaway. A test on a closed track shall consist of one cycle. A test on a straightaway shall consist of two cycles run in opposite directions to minimize wind effects.

8.3.3.2 Effort should be made to maintain accelerations and decelerations within ±1 ft/s² (0.3 m/s²) of that specified. Speed should be maintained with ±1 mph (1.6 km/h).

8.3.3.3 Driving cycle maneuvers are initiated at the points indicated.

8.3.3.4 Fuel temperatures should be recorded during the idle periods.

8.3.3.5 Record weather data for each test cycle.

8.3.3.6 Ambient conditions should be such that repeatability may be attained in as few cycles as possible.

8.3.3.7 The fuel consumptions and elapsed times for the average of two consecutive tests shall be used. The tests should be repeated until two successive tests repeat within 2 and 1% for fuel consumption and elapsed time, respectively.

8.3.3.8 *Suburban Cycle*—Average speed: 41.1 mph (74.9 km/h); running time: 455 s/cycle. After proper warmup (paragraph 8.1), the suburban driving cycle should be driven as follows:

SUMMARY SHEET
FUEL ECONOMY TEST DATA - LIGHT-DUTY VEHICLES

DATE _____

VEHICLE MAKE _____ ENGINE _____ CAR NO. _____

VIN _____ TRANSMISSION _____ AXLE RATIO _____

TIRE MAKE _____ SIZE _____ PRESSURE _____

VEHICLE TEST WEIGHT _____

TEST ROAD _____ SURFACE _____

FUEL ECONOMY

	CORRECTED MPG (km/l)	OBSERVED MPG (km/l)	FUEL TEMP.	AIR TEMP.	BARO PRESS.	WIND SPEED-DIRECTION
URBAN CYCLE						
SUBURBAN CYCLE						
55 MPH (88.5 km/h) INTERSTATE CYCLE						
70 MPH (112.6 km/h) INTERSTATE CYCLE						

COMMENTS: _____

TESTED BY: _____

FIG. 3—FUEL ECONOMY TEST—LIGHT-DUTY VEHICLES: SUMMARY SHEET

Distance		Operation
miles	km	
0.0	0.0	Approach starting line at 40 mph (64.4 km/h). At line, start fuel measuring and timing devices, accelerate to 60 mph (96.5 km/h) at 3 ft/s² (0.9 m/s²). Proceed at 60 mph (96.5 km/h) to the 0.7 mile (1.13 km) marker.
0.7	1.13	Decelerate to 30 mph (48.3 km/h) at 4 ft/s² (1.2 m/s²). Accelerate to 50 mph (80.5 km/h) at 3 ft/s² (0.9 m/s²). Proceed at 50 mph (80.5 km/h) to the 2.0 mile (3.22 km) marker.
2.00	3.22	Stop at 4 ft/s² (1.2 m/s²), idle 7 s, accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²). Continue accelerating to 25 mph (40.2 km/h) at 5 ft/s² (1.5 m/s²). Continue accelerating to 40 mph (64.4 km/h) at 3 ft/s² (0.9 m/s²). Proceed at 40 mph (64.4 km/h) to the 2.6 mile (4.18 km) marker.
2.60	4.18	Accelerate to 50 mph (80.5 km/h) at 3 ft/s² (0.9 m/s²). Proceed at 50 mph (80.5 km/h) to the 3.3 mile (5.31 km) marker.
3.30	5.31	Stop at 4 ft/s² (1.2 m/s²), idle 7 s, accelerate to 15 mph (24.1 km/h) at 7 ft/s² (2.1 m/s²). Continue accelerating to 25 mph (40.2 km/h) at 5 ft/s² (1.5 m/s²). Continue accelerating to 40 mph (64.4 km/h) at 3 ft/s² (0.9 m/s²). Proceed at 40 mph (64.4 km/h) to the 5.2 mile (8.37 km) marker.
5.2	8.37	Stop fuel measuring and timing devices while driving at 40 mph (64.4 km/h) at 5.2 miles (8.37 km). Record fuel consumed, elapsed time, and fuel temperature.
0.0	0.0	Run recheck cycle.

8.3.4 INTERSTATE CYCLES—(55 or 70 mph (88.5 or 112.6 km/h)).

8.3.4.1 The interstate cycles may be run on either a closed track or a straightaway. A test on a closed track shall consist of one cycle. A test on a straightaway shall consist of two cycles run in opposite directions to minimize wind effects.

8.3.4.2 Effort should be made to perform accelerations and decelerations as specified. Speed should be maintained within ±1 mph (1.6 km/h).

8.3.4.3 Driving cycle maneuvers are initiated at the points indicated.

8.3.4.4 Fuel temperatures should be recorded at the start and finish of the test cycle.

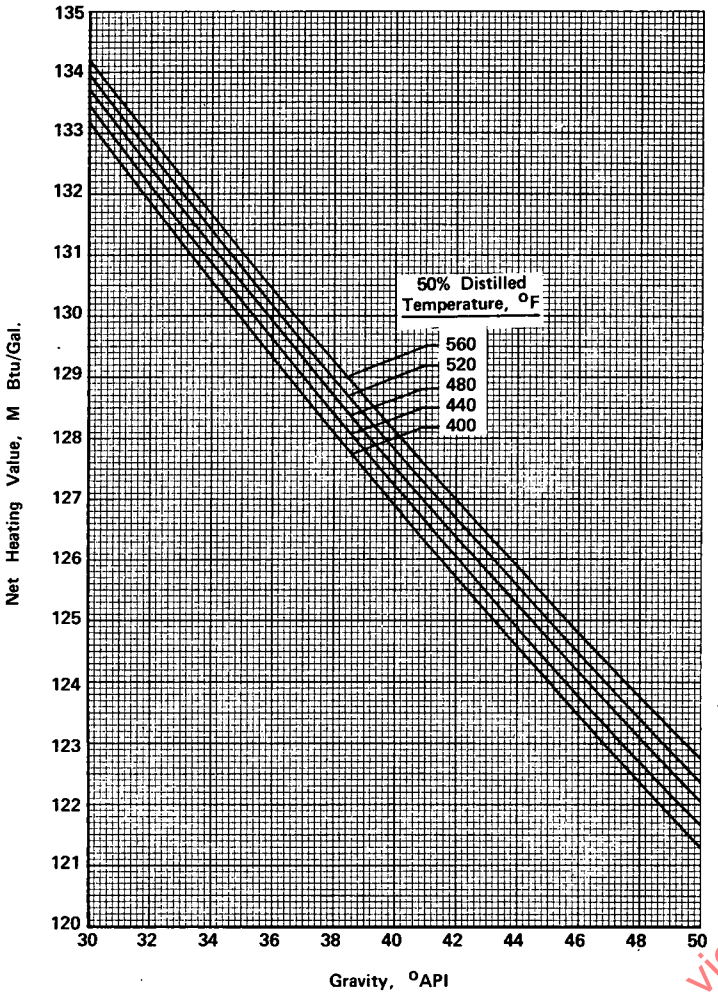

FIG. 4—VOLUMETRIC NET HEAT CONTENT OF DIESEL FUELS (U.S. UNITS)

8.3.4.5 Record weather data for each test cycle.

8.3.4.6 Ambient conditions should be such that repeatability may be attained in as few cycles as possible.

8.3.4.7 The fuel consumptions and elapsed times for the average of two consecutive tests shall be used. The tests should be repeated until two successive tests repeat within 2 and 1% for fuel consumption and elapsed time, respectively.

8.3.4.8 *Interstate Cycle* (55 mph (88.5 km/h))—Average speed: 55 mph (88.5 km/h); running time: 308 s/cycle. After proper warmup (paragraph 8.1), the interstate driving cycle should be driven as follows:

Distance		Operation
miles	km	
0.0	0.0	Approach the starting line at 55 mph (88.5 km/h). At line, start fuel measuring and timing devices. Proceed at 55 mph (88.5 km/h) to the 0.2 mile (0.32 km) marker.
0.20	0.32	Accelerate to 60 mph (96.6 km/h) at 1 ft/s² (0.3 m/s²). Immediately decelerate to 50 mph (80.5 km/h) at 1 ft/s² (0.3 m/s²). Immediately accelerate to 55 mph (88.5 km/h) at 1 ft/s² (0.3 m/s²). Proceed at 55 mph (88.5 km/h) to the 1.2 mile (1.93 km) marker.
1.2	1.93	Repeat accelerations and decelerations as at 0.20 miles (0.32 km). Proceed to the 2.2 mile (3.54 km) marker.
2.2	3.54	Repeat accelerations and decelerations as at 0.20 miles (0.32 km). Proceed to the 3.2 mile (5.15 km) marker.
3.2	5.15	Repeat accelerations and decelerations as at 0.20 miles (0.32 km). Proceed to the 4.7 mile (7.56 km) marker.
4.7	7.56	Stop fuel measuring and timing devices while driving at 55 mph (88.5 km/h) at 4.7 miles (7.56 km). Record fuel consumed, elapsed time, and operating temperature.
0.0	0.0	Run recheck cycle.

8.3.4.9 *Interstate Cycle* (70 mph (112.6 km/h))—Average speed: 70 mph (112.6 km/h); running time: 242 s/cycle. After proper warmup, the interstate driving cycle should be driven as follows:

Distance		Operation
miles	km	
0.0	0.0	Approach the starting line at 70 mph (112.6 km/h). At line, start fuel measuring and timing devices. Proceed at 70 mph (112.6 km/h) to the 0.2 mile (0.32 km) marker.
0.20	0.32	Accelerate to 75 mph (120.7 km/h) at 1 ft/s² (0.3 m/s²). Immediately decelerate to 65 mph (104.6 km/h) at 1 ft/s² (0.3 m/s²). Immediately accelerate to 70 mph (112.6 km/h) at 1 ft/s² (0.3 m/s²). Proceed at 70 mph (112.6 km/h) to the 1.2 mile (1.93 km) marker.
1.2	1.93	Repeat accelerations and decelerations as at 0.20 miles (0.32 km). Proceed to the 2.2 mile (3.54 km) marker.
2.2	3.54	Repeat accelerations and decelerations as at 0.20 miles (0.32 km). Proceed to the 3.2 mile (5.15 km) marker.
3.2	5.15	Repeat accelerations and decelerations as at 0.20 miles (0.32 km). Proceed to the 4.7 mile (7.56 km) marker.
4.7	7.56	Stop fuel measuring and timing devices while driving at 70 mph (112.6 km/h) at 4.7 miles (7.56 km). Record fuel consumed, elapsed time, and operating temperature.
0.0	0.0	Run recheck cycle.

9. Data Recording—Data shall be entered as required on test data forms:

9.1 Test Vehicle Specifications and Preparation (Fig. 1).

9.2 Data Form (Fig. 2).

9.3 Summary Sheet (Fig. 3).

10. Data Correction

10.1 Reference Conditions

Ambient temperature: 60°F (15.6°C)

Fuel temperature: 60°F (15.6°C)

Barometric pressure: 29.00 in Hg (98 kPa)

Fuel gravity (gasoline): 0.737 sp gr, 60.5°API gravity

Fuel gravity

ASTM 1D: 0.820 sp gr, 41.0°API gravity

ASTM 2D: 0.845 sp gr, 36.0°API gravity

Fuel net heating value

ASTM 1D: 126,700 Btu/gal

ASTM 2D: 129,900 Btu/gal

10.2 Fuel Economy Correction (Gasoline)

10.2.1 Correction Formula (U.S. units of measure)

$$\text{Corrected mpg} = \text{observed mpg} \times T_aCF \times P_bCF \times T_fCF \times \text{sp gr}_fCF$$

or

$$= \text{observed mpg} \times T_aCF \times P_bCF \times T_fCF \times \text{API gr}_fCF$$

where:

CF = correction factor

T_a = average ambient temperature during test cycle, °F

T_f = average fuel temperature at measuring instrument during test cycle, °F

P_b = average barometric pressure during test cycle, in Hg

sp gr_f = specific gravity of test fuel at 60°F

API gr_f = API gravity of test fuel at 60°F

10.2.2 Correction Factors (Gasoline) (U.S. units of measure)

$T_aCF = 1 + 0.0014\ (60 - T_a)$

P_bCF = 1.0 for urban cycle

= $1.0 + 0.0072\ (P_b - 29.00)$ for suburban cycle

= $1.0 + 0.0084\ (P_b - 29.00)$ for interstate cycle (55 mph)

= $1.0 + 0.0144\ (P_b - 29.00)$ for interstate cycle (70 mph)

$$T_fCF = \frac{1}{\text{multiplier for volume reduction to 60°F}}$$

Note: Multiplier may be obtained using T_f and specific gravity at 60°F from Table 1. Table 2 may be used similarly with T_f and API gravity at 60°F.[1]

$$\text{SP gr}_fCF = 1 + 0.8\ (0.737 - \text{sp gr}_f)$$

$$\text{API gr}_fCF = 1 + 0.0032\ (\text{API gr}_f - 60.5)$$

10.3 Fuel Economy Correction (ASTM 1D and 2D Fuels)—Note: The method for correcting observed fuel economy for ASTM 1D and 2D fuels has not been investigated to the same degree that it has for gasoline-powered vehicles. However, the ambient temperature and barometric pressure corrections are primarily for changes in air density and its effect on aerodynamic drag. Hence, the correction factors for gasoline-powered vehicles are recommended for use until additional data become available.

[1]Table 1 is an abridged version of Table 25 and Table 2 an abridged version of Table 7 of the "Petroleum Measurement Tables," published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

TABLE 1—REDUCTION OF VOLUME TO 60°F AGAINST SPECIFIC GRAVITY 60/60°F (ABRIDGED TABLE)

This table gives the factors for converting oil volumes observed at temperatures other than 60°F to the corresponding volumes at 60°F for ranges of values of specific gravity 60/60°F.

Table 1 has been set up in eight ranges of specific gravity as follows:

Group No.	Range of Group Specific Gravity 60/60°F	Coefficient of Expansion per °F at 60°F	Corresponding Specific Gravity 60/60°F	Group No.	Range of Group Specific Gravity 60/60°F	Coefficient of Expansion per °F at 60°F	Corresponding Specific Gravity 60/60°F
7	0.6112-0.6275	0.00090	0.6193	3[a]	0.7239-0.7753	0.00060	0.7467
6	0.6276-0.6417	0.00085	0.6360	2	0.7754-0.8498	0.00050	0.8063
5	0.6418-0.6722	0.00080	0.6506	1	0.8499-0.9659	0.00040	0.9218
4	0.6723-0.7238	0.00070	0.6953	0	0.9660-1.0760	0.00035	1.0291

[a]All blends of gasoline and benzene are considered to fall in Group 3; when the presence of benzene is uncertain, the oil shall be classified in Group 3 if the specific gravity is more than 0.7750 and the 50% distillation recovery point is less than 293°F.

It is very important to note that the group classification of the oil is determined by its specific gravity 60/60°F. Large errors (up to 0.5%) may arise if the specific gravity at the observed temperature is used to determine the group, because this error may place the oil in the wrong group.

Observed Temperature, °F	Group Number							
	7 (0.6112-0.6275 sp gr)	6 (0.6276-0.6417 sp gr)	5 (0.6418-0.6722 sp gr)	4 (0.6723-0.7238 sp gr)	3 (0.7239-0.7753 sp gr)	2 (0.7754-0.8498 sp gr)	1 (0.8499-0.9659 sp gr)	0 (0.9660-1.0760 sp gr)
	Factor for Reducing Volume to 60°F							
0	1.0532	1.0501	1.0478	1.0419	1.0362	1.0298	1.0241	1.0211
1	1.0523	1.0493	1.0470	1.0412	1.0356	1.0293	1.0237	1.0208
2	1.0514	1.0484	1.0462	1.0405	1.0350	1.0288	1.0233	1.0204
3	1.0506	1.0476	1.0454	1.0399	1.0344	1.0283	1.0229	1.0201
4	1.0497	1.0468	1.0446	1.0392	1.0338	1.0278	1.0225	1.0197
5	1.0488	1.0460	1.0438	1.0385	1.0332	1.0273	1.0221	1.0194
6	1.0479	1.0451	1.0430	1.0378	1.0326	1.0268	1.0217	1.0190
7	1.0470	1.0443	1.0423	1.0371	1.0320	1.0263	1.0213	1.0186
8	1.0462	1.0435	1.0415	1.0364	1.0314	1.0258	1.0209	1.0183
9	1.0453	1.0427	1.0407	1.0357	1.0308	1.0253	1.0205	1.0179
10	1.0444	1.0418	1.0399	1.0350	1.0302	1.0248	1.0201	1.0176
11	1.0435	1.0410	1.0391	1.0343	1.0296	1.0243	1.0197	1.0172
12	1.0427	1.0402	1.0383	1.0336	1.0290	1.0238	1.0193	1.0169
13	1.0418	1.0393	1.0375	1.0329	1.0284	1.0233	1.0189	1.0165
14	1.0409	1.0385	1.0367	1.0322	1.0278	1.0228	1.0185	1.0162
15	1.0400	1.0377	1.0359	1.0315	1.0272	1.0223	1.0181	1.0158
16	1.0391	1.0369	1.0351	1.0308	1.0266	1.0218	1.0177	1.0155
17	1.0383	1.0360	1.0343	1.0301	1.0260	1.0214	1.0173	1.0151
18	1.0374	1.0352	1.0336	1.0294	1.0253	1.0209	1.0168	1.0148
19	1.0365	1.0344	1.0328	1.0287	1.0247	1.0204	1.0164	1.0144
20	1.0356	1.0335	1.0320	1.0280	1.0241	1.0199	1.0160	1.0141
21	1.0347	1.0327	1.0312	1.0273	1.0235	1.0194	1.0156	1.0137
22	1.0338	1.0319	1.0304	1.0266	1.0229	1.0189	1.0152	1.0133
23	1.0330	1.0310	1.0296	1.0259	1.0223	1.0184	1.0148	1.0130
24	1.0321	1.0302	1.0288	1.0253	1.0217	1.0179	1.0144	1.0126
25	1.0312	1.0294	1.0280	1.0246	1.0211	1.0174	1.0140	1.0123
26	1.0303	1.0285	1.0272	1.0239	1.0205	1.0169	1.0136	1.0119
27	1.0294	1.0277	1.0264	1.0232	1.0199	1.0164	1.0132	1.0116
28	1.0285	1.0269	1.0256	1.0225	1.0193	1.0159	1.0128	1.0112
29	1.0276	1.0260	1.0248	1.0218	1.0187	1.0154	1.0124	1.0109
30	1.0268	1.0252	1.0240	1.0211	1.0181	1.0149	1.0120	1.0105
31	1.0259	1.0244	1.0232	1.0204	1.0175	1.0144	1.0116	1.0102
32	1.0250	1.0235	1.0224	1.0197	1.0169	1.0139	1.0112	1.0098
33	1.0241	1.0227	1.0216	1.0190	1.0163	1.0134	1.0108	1.0095
34	1.0232	1.0219	1.0208	1.0183	1.0157	1.0129	1.0104	1.0091
35	1.0223	1.0210	1.0200	1.0176	1.0151	1.0124	1.0100	1.0088
36	1.0214	1.0202	1.0192	1.0169	1.0145	1.0119	1.0096	1.0084
37	1.0205	1.0193	1.0184	1.0162	1.0139	1.0114	1.0092	1.0081
38	1.0197	1.0185	1.0176	1.0155	1.0133	1.0109	1.0088	1.0077
39	1.0188	1.0177	1.0168	1.0148	1.0127	1.0104	1.0084	1.0074
40	1.0179	1.0168	1.0160	1.0141	1.0121	1.0099	1.0080	1.0070
41	1.0170	1.0160	1.0152	1.0134	1.0115	1.0094	1.0076	1.0067
42	1.0161	1.0152	1.0144	1.0127	1.0109	1.0089	1.0072	1.0063
43	1.0152	1.0143	1.0136	1.0120	1.0103	1.0084	1.0068	1.0060
44	1.0143	1.0135	1.0128	1.0113	1.0097	1.0079	1.0064	1.0056
45	1.0134	1.0126	1.0120	1.0106	1.0091	1.0075	1.0060	1.0053
46	1.0125	1.0118	1.0112	1.0099	1.0085	1.0070	1.0056	1.0049
47	1.0116	1.0110	1.0104	1.0091	1.0079	1.0065	1.0052	1.0046
48	1.0107	1.0101	1.0096	1.0084	1.0073	1.0060	1.0048	1.0042
49	1.0099	1.0093	1.0088	1.0077	1.0067	1.0055	1.0044	1.0038
50	1.0090	1.0084	1.0080	1.0070	1.0061	1.0050	1.0040	1.0035
51	1.0081	1.0076	1.0072	1.0063	1.0054	1.0045	1.0036	1.0031
52	1.0072	1.0067	1.0064	1.0056	1.0048	1.0040	1.0032	1.0028
53	1.0063	1.0059	1.0056	1.0049	1.0042	1.0035	1.0028	1.0024
54	1.0054	1.0051	1.0048	1.0042	1.0036	1.0030	1.0024	1.0021
55	1.0045	1.0042	1.0040	1.0035	1.0030	1.0025	1.0020	1.0017
56	1.0036	1.0034	1.0032	1.0028	1.0024	1.0020	1.0016	1.0014
57	1.0027	1.0025	1.0024	1.0021	1.0018	1.0015	1.0012	1.0010
58	1.0018	1.0017	1.0016	1.0014	1.0012	1.0010	1.0008	1.0007
59	1.0009	1.0008	1.0008	1.0007	1.0006	1.0005	1.0004	1.0003
60	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	0.9991	0.9992	0.9992	0.9993	0.9994	0.9995	0.9996	0.9997
62	0.9982	0.9983	0.9984	0.9986	0.9988	0.9990	0.9992	0.9993
63	0.9973	0.9975	0.9976	0.9979	0.9982	0.9985	0.9988	0.9990
64	0.9964	0.9966	0.9968	0.9972	0.9976	0.9980	0.9984	0.9986
65	0.9955	0.9958	0.9960	0.9965	0.9970	0.9975	0.9980	0.9983
66	0.9946	0.9949	0.9952	0.9958	0.9964	0.9970	0.9976	0.9979
67	0.9937	0.9941	0.9944	0.9951	0.9958	0.9965	0.9972	0.9976
68	0.9928	0.9932	0.9935	0.9944	0.9951	0.9960	0.9968	0.9972
69	0.9919	0.9924	0.9927	0.9936	0.9945	0.9955	0.9964	0.9969

(Table continued on next page)

TABLE 1—REDUCTION OF VOLUME TO 60°F AGAINST SPECIFIC GRAVITY 60/60°F (continued)

Observed Temperature, °F	Group Number							
	7 (0.6112-0.6275 sp gr)	6 (0.6276-0.6417 sp gr)	5 (0.6418-0.6722 sp gr)	4 (0.6723-0.7238 sp gr)	3 (0.7239-0.7753 sp gr)	2 (0.7754-0.8498 sp gr)	1 (0.8499-0.9659 sp gr)	0 (0.9660-1.0760 sp gr)
	Factor for Reducing Volume to 60°F							
70	0.9910	0.9915	0.9919	0.9929	0.9939	0.9950	0.9960	0.9965
71	0.9901	0.9907	0.9911	0.9922	0.9933	0.9945	0.9956	0.9962
72	0.9892	0.9898	0.9903	0.9915	0.9927	0.9940	0.9952	0.9958
73	0.9883	0.9890	0.9895	0.9908	0.9921	0.9935	0.9948	0.9955
74	0.9874	0.9881	0.9887	0.9901	0.9915	0.9930	0.9944	0.9951
75	0.9865	0.9873	0.9879	0.9894	0.9909	0.9925	0.9940	0.9948
76	0.9856	0.9864	0.9871	0.9887	0.9903	0.9920	0.9936	0.9944
77	0.9847	0.9856	0.9863	0.9880	0.9897	0.9916	0.9932	0.9941
78	0.9838	0.9847	0.9855	0.9873	0.9891	0.9911	0.9929	0.9937
79	0.9829	0.9839	0.9846	0.9866	0.9885	0.9906	0.9925	0.9934
80	0.9820	0.9830	0.9838	0.9859	0.9879	0.9901	0.9921	0.9930
81	0.9811	0.9822	0.9830	0.9851	0.9873	0.9896	0.9917	0.9927
82	0.9802	0.9813	0.9822	0.9844	0.9866	0.9891	0.9913	0.9923
83	0.9792	0.9805	0.9814	0.9837	0.9860	0.9886	0.9909	0.9920
84	0.9783	0.9796	0.9806	0.9830	0.9854	0.9881	0.9905	0.9916
85	0.9774	0.9788	0.9798	0.9823	0.9848	0.9876	0.9901	0.9913
86	0.9765	0.9779	0.9790	0.9816	0.9842	0.9871	0.9897	0.9909
87	0.9756	0.9771	0.9781	0.9809	0.9836	0.9866	0.9893	0.9906
88	0.9747	0.9762	0.9773	0.9802	0.9830	0.9861	0.9889	0.9902
89	0.9738	0.9753	0.9765	0.9795	0.9824	0.9856	0.9885	0.9899
90	0.9729	0.9745	0.9757	0.9787	0.9818	0.9851	0.9881	0.9896
91	0.9720	0.9736	0.9749	0.9780	0.9812	0.9846	0.9877	0.9892
92	0.9711	0.9728	0.9741	0.9773	0.9806	0.9841	0.9873	0.9889
93	0.9702	0.9719	0.9733	0.9766	0.9799	0.9836	0.9869	0.9885
94	0.9693	0.9711	0.9724	0.9759	0.9793	0.9831	0.9865	0.9882
95	0.9683	0.9702	0.9716	0.9752	0.9787	0.9826	0.9861	0.9878
96	0.9674	0.9694	0.9708	0.9745	0.9781	0.9821	0.9857	0.9875
97	0.9665	0.9685	0.9700	0.9738	0.9775	0.9816	0.9854	0.9871
98	0.9656	0.9676	0.9692	0.9731	0.9769	0.9811	0.9850	0.9868
99	0.9647	0.9668	0.9684	0.9723	0.9763	0.9806	0.9846	0.9864
100	0.9638	0.9659	0.9675	0.9716	0.9757	0.9801	0.9842	0.9861
101	0.9629	0.9651	0.9667	0.9709	0.9751	0.9796	0.9838	0.9857
102	0.9620	0.9642	0.9659	0.9702	0.9745	0.9791	0.9834	0.9854
103	0.9610	0.9633	0.9651	0.9695	0.9738	0.9786	0.9830	0.9851
104	0.9601	0.9625	0.9643	0.9688	0.9732	0.9781	0.9826	0.9847
105	0.9592	0.9616	0.9634	0.9681	0.9726	0.9776	0.9822	0.9844
106	0.9583	0.9608	0.9626	0.9673	0.9720	0.9771	0.9818	0.9840
107	0.9574	0.9599	0.9618	0.9666	0.9714	0.9766	0.9814	0.9837
108	0.9565	0.9590	0.9610	0.9659	0.9708	0.9761	0.9810	0.9833
109	0.9555	0.9582	0.9602	0.9652	0.9702	0.9756	0.9806	0.9830
110	0.9546	0.9573	0.9593	0.9645	0.9696	0.9751	0.9803	0.9826
111	0.9537	0.9565	0.9585	0.9638	0.9690	0.9746	0.9799	0.9823
112	0.9528	0.9556	0.9577	0.9630	0.9683	0.9741	0.9795	0.9819
113	0.9519	0.9547	0.9569	0.9623	0.9677	0.9736	0.9791	0.9816
114	0.9510	0.9539	0.9561	0.9616	0.9671	0.9731	0.9787	0.9813
115	0.9500	0.9530	0.9552	0.9609	0.9665	0.9726	0.9783	0.9809
116	0.9491	0.9521	0.9544	0.9602	0.9659	0.9721	0.9779	0.9806
117	0.9482	0.9513	0.9536	0.9595	0.9653	0.9717	0.9775	0.9802
118	0.9473	0.9504	0.9528	0.9587	0.9647	0.9712	0.9771	0.9799
119	0.9464	0.9495	0.9519	0.9580	0.9641	0.9707	0.9767	0.9795
120	0.9454	0.9487	0.9511	0.9573	0.9634	0.9702	0.9763	0.9792
121	0.9445	0.9478	0.9503	0.9566	0.9628	0.9697	0.9760	0.9788
122	0.9436	0.9469	0.9495	0.9559	0.9622	0.9692	0.9756	0.9785
123	0.9427	0.9461	0.9487	0.9552	0.9616	0.9687	0.9752	0.9782
124	0.9418	0.9452	0.9478	0.9544	0.9610	0.9682	0.9748	0.9778
125	0.9408	0.9443	0.9470	0.9537	0.9604	0.9677	0.9744	0.9775
126	0.9399	0.9435	0.9462	0.9530	0.9598	0.9672	0.9740	0.9771
127	0.9390	0.9426	0.9454	0.9523	0.9592	0.9667	0.9736	0.9768
128	0.9381	0.9417	0.9445	0.9516	0.9585	0.9662	0.9732	0.9764
129	0.9371	0.9409	0.9437	0.9508	0.9579	0.9657	0.9728	0.9761
130	0.9362	0.9400	0.9429	0.9501	0.9573	0.9652	0.9725	0.9758
131	0.9353	0.9391	0.9420	0.9494	0.9567	0.9647	0.9721	0.9754
132	0.9344	0.9383	0.9412	0.9487	0.9561	0.9642	0.9717	0.9751
133	0.9334	0.9374	0.9404	0.9480	0.9555	0.9637	0.9713	0.9747
134	0.9325	0.9365	0.9396	0.9472	0.9549	0.9632	0.9709	0.9744
135	0.9316	0.9357	0.9387	0.9465	0.9542	0.9627	0.9705	0.9740
136	0.9307	0.9348	0.9379	0.9458	0.9536	0.9622	0.9701	0.9737
137	0.9297	0.9339	0.9371	0.9451	0.9530	0.9617	0.9697	0.9734
138	0.9288	0.9330	0.9362	0.9444	0.9524	0.9612	0.9693	0.9730
139	0.9279	0.9322	0.9354	0.9436	0.9518	0.9607	0.9690	0.9727
140	0.9270	0.9313	0.9346	0.9429	0.9512	0.9602	0.9686	0.9723
141	0.9260	0.9304	0.9338	0.9422	0.9506	0.9597	0.9682	0.9720
142	0.9251	0.9296	0.9329	0.9415	0.9499	0.9592	0.9678	0.9716
143	0.9242	0.9287	0.9321	0.9407	0.9493	0.9587	0.9674	0.9713
144	0.9232	0.9278	0.9313	0.9400	0.9487	0.9582	0.9670	0.9710
145	0.9223	0.9269	0.9304	0.9393	0.9481	0.9577	0.9666	0.9706
146	0.9214	0.9261	0.9296	0.9386	0.9475	0.9572	0.9662	0.9703
147	0.9204	0.9252	0.9288	0.9379	0.9469	0.9567	0.9659	0.9699
148	0.9195	0.9243	0.9279	0.9371	0.9462	0.9562	0.9655	0.9696
149	0.9186	0.9234	0.9271	0.9364	0.9456	0.9557	0.9651	0.9693
150	0.9177	0.9226	0.9263	0.9357	0.9450	0.9552	0.9647	0.9689

TABLE 2—REDUCTION OF VOLUME TO 60°F AGAINST API GRAVITY AT 60°F (ABRIDGED TABLE)

This table gives the factors for converting oil volumes observed at temperatures other than 60°F to the corresponding volumes at 60°F for ranges of values of API gravity at 60°F.

Table 2 has been set up in eight ranges of API gravity as follows:

Group No.	Range of Group, API Gravity at 60°F	Coefficient of Expansion per °F at 60°F	Corresponding API Gravity at 60°F	Group No.	Range of Group, API Gravity at 60°F	Coefficient of Expansion per °F at 60°F	Corresponding API Gravity at 60°F
0	0-14.9	0.00035	6.0	4	64.0-78.9	0.00070	72.0
1	15.0-34.9	0.00040	22.0	5	79.0-88.9	0.00080	86.0
2	35.0-50.9	0.00050	44.0	6	89.0-93.9	0.00085	91.0
3[a]	51.0-63.9	0.00060	58.0	7	94.0-100.0	0.00090	97.0

[a]All blends of gasoline and benzene are considered to fall in Group 3; when the presence of benzene is uncertain, the oil shall be classified in Group 3 if the gravity is numerically less than 51.0°API and the 50% distillation recovery point is less than 293°F.

It is very important to note that the group classification of the oil is determined by its API gravity at 60°F. Large errors (up to 0.5%) may arise if the gravity at the observed temperature is used to determine the group, because this error may place the oil in the wrong group.

Observed Temperature, °F	Group Number and API Gravity Range at 60°F							
	Group 0	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
	0-14.9° API	15.0-34.9° API	35.0-50.9° API	51.0-63.9° API	64.0-78.9° API	79.0-88.9° API	89.0-93.9° API	94.0-100.° API
	Factor for Reducing Volume to 60°F							
0	1.0211	1.0241	1.0298	1.0362	1.0419	1.0478	1.0501	1.0532
1	1.0208	1.0237	1.0293	1.0356	1.0412	1.0470	1.0493	1.0523
2	1.0204	1.0233	1.0288	1.0350	1.0405	1.0462	1.0484	1.0514
3	1.0201	1.0229	1.0283	1.0344	1.0399	1.0454	1.0476	1.0506
4	1.0197	1.0225	1.0278	1.0338	1.0392	1.0446	1.0468	1.0497
5	1.0194	1.0221	1.0273	1.0332	1.0385	1.0438	1.0460	1.0488
6	1.0190	1.0217	1.0268	1.0326	1.0378	1.0430	1.0451	1.0479
7	1.0186	1.0213	1.0263	1.0320	1.0371	1.0423	1.0443	1.0470
8	1.0183	1.0209	1.0258	1.0314	1.0364	1.0415	1.0435	1.0462
9	1.0179	1.0205	1.0253	1.0308	1.0357	1.0407	1.0427	1.0453
10	1.0176	1.0201	1.0248	1.0302	1.0350	1.0399	1.0418	1.0444
11	1.0172	1.0197	1.0243	1.0296	1.0343	1.0391	1.0410	1.0435
12	1.0169	1.0193	1.0238	1.0290	1.0336	1.0383	1.0402	1.0427
13	1.0165	1.0189	1.0233	1.0284	1.0329	1.0375	1.0393	1.0418
14	1.0162	1.0185	1.0228	1.0278	1.0322	1.0367	1.0385	1.0409
15	1.0158	1.0181	1.0223	1.0272	1.0315	1.0359	1.0377	1.0400
16	1.0155	1.0177	1.0218	1.0266	1.0308	1.0351	1.0369	1.0391
17	1.0151	1.0173	1.0214	1.0260	1.0301	1.0343	1.0360	1.0383
18	1.0148	1.0168	1.0209	1.0253	1.0294	1.0336	1.0352	1.0374
19	1.0144	1.0164	1.0204	1.0247	1.0287	1.0328	1.0344	1.0365
20	1.0141	1.0160	1.0199	1.0241	1.0280	1.0320	1.0335	1.0356
21	1.0137	1.0156	1.0194	1.0235	1.0273	1.0312	1.0327	1.0347
22	1.0133	1.0152	1.0189	1.0229	1.0266	1.0304	1.0319	1.0338
23	1.0130	1.0148	1.0184	1.0223	1.0259	1.0296	1.0310	1.0330
24	1.0126	1.0144	1.0179	1.0217	1.0253	1.0288	1.0302	1.0321
25	1.0123	1.0140	1.0174	1.0211	1.0246	1.0280	1.0294	1.0312
26	1.0119	1.0136	1.0169	1.0205	1.0239	1.0272	1.0285	1.0303
27	1.0116	1.0132	1.0164	1.0199	1.0232	1.0264	1.0277	1.0294
28	1.0112	1.0128	1.0159	1.0193	1.0225	1.0256	1.0269	1.0285
29	1.0109	1.0124	1.0154	1.0187	1.0218	1.0248	1.0260	1.0276
30	1.0105	1.0120	1.0149	1.0181	1.0211	1.0240	1.0252	1.0268
31	1.0102	1.0116	1.0144	1.0175	1.0204	1.0232	1.0244	1.0259
32	1.0098	1.0112	1.0139	1.0169	1.0197	1.0224	1.0235	1.0250
33	1.0095	1.0108	1.0134	1.0163	1.0190	1.0216	1.0227	1.0241
34	1.0091	1.0104	1.0129	1.0157	1.0183	1.0208	1.0219	1.0232
35	1.0088	1.0100	1.0124	1.0151	1.0176	1.0200	1.0210	1.0223
36	1.0084	1.0096	1.0119	1.0145	1.0169	1.0192	1.0202	1.0214
37	1.0081	1.0092	1.0114	1.0139	1.0162	1.0184	1.0193	1.0205
38	1.0077	1.0088	1.0109	1.0133	1.0155	1.0176	1.0185	1.0197
39	1.0074	1.0084	1.0104	1.0127	1.0148	1.0168	1.0177	1.0188
40	1.0070	1.0080	1.0099	1.0121	1.0141	1.0160	1.0168	1.0179
41	1.0067	1.0076	1.0094	1.0115	1.0134	1.0152	1.0160	1.0170
42	1.0063	1.0072	1.0089	1.0109	1.0127	1.0144	1.0152	1.0161
43	1.0060	1.0068	1.0084	1.0103	1.0120	1.0136	1.0143	1.0152
44	1.0056	1.0064	1.0079	1.0097	1.0113	1.0128	1.0135	1.0143
45	1.0053	1.0060	1.0075	1.0091	1.0106	1.0120	1.0126	1.0134
46	1.0049	1.0056	1.0070	1.0085	1.0099	1.0112	1.0118	1.0125
47	1.0046	1.0052	1.0065	1.0079	1.0091	1.0104	1.0110	1.0116
48	1.0042	1.0048	1.0060	1.0073	1.0084	1.0096	1.0101	1.0107
49	1.0038	1.0044	1.0055	1.0067	1.0077	1.0088	1.0093	1.0099
50	1.0035	1.0040	1.0050	1.0061	1.0070	1.0080	1.0084	1.0090
51	1.0031	1.0036	1.0045	1.0054	1.0063	1.0072	1.0076	1.0081
52	1.0028	1.0032	1.0040	1.0048	1.0056	1.0064	1.0067	1.0072
53	1.0024	1.0028	1.0035	1.0042	1.0049	1.0056	1.0059	1.0063
54	1.0021	1.0024	1.0030	1.0036	1.0042	1.0048	1.0051	1.0054
55	1.0017	1.0020	1.0025	1.0030	1.0035	1.0040	1.0042	1.0045
56	1.0014	1.0016	1.0020	1.0024	1.0028	1.0032	1.0034	1.0036
57	1.0010	1.0012	1.0015	1.0018	1.0021	1.0024	1.0025	1.0027
58	1.0007	1.0008	1.0010	1.0012	1.0014	1.0016	1.0017	1.0018
59	1.0003	1.0004	1.0005	1.0006	1.0007	1.0008	1.0008	1.0009
60	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	0.9997	0.9996	0.9995	0.9994	0.9993	0.9992	0.9992	0.9991
62	0.9993	0.9992	0.9990	0.9988	0.9986	0.9984	0.9983	0.9982
63	0.9990	0.9988	0.9985	0.9982	0.9979	0.9976	0.9975	0.9973
64	0.9986	0.9984	0.9980	0.9976	0.9972	0.9968	0.9966	0.9964
65	0.9983	0.9980	0.9975	0.9970	0.9965	0.9960	0.9958	0.9955
66	0.9979	0.9976	0.9970	0.9964	0.9958	0.9952	0.9949	0.9946
67	0.9976	0.9972	0.9965	0.9958	0.9951	0.9944	0.9941	0.9937
68	0.9972	0.9968	0.9960	0.9951	0.9944	0.9935	0.9932	0.9928
69	0.9969	0.9964	0.9955	0.9945	0.9936	0.9927	0.9924	0.9919

(Table continued on next page)