NATIONAL BUREAU OF STANDARDS REPORT

10 010

EXAMINATION OF MILEAGE MEASURING DEVICES

(Preliminary Report of a Manual for Weights and Measures Officials)

U.S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

NATIONAL BUREAU OF STANDARDS

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[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Part of the Center for Radiation Research.
[3] Located at Boulder, Colorado 80302.

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by

S. Hasko and C. H. Schreyer

U.S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

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PROCEDURE
for the
CALIBRATION OF FIFTH WHEEL TESTING EQUIPMENT

1. Introduction

The fifth wheel is a commercially available mileage-measuring device recommended for use by weights and measures officials as a portable standard test instrument for testing the accuracy of odometers on rented highway vehicles. The fifth wheel may also be used for testing taximeters. Information on the design of a fifth wheel device, including illustrations and general specifications, may be found in National Bureau of Standards Technical Note 195, titled "Report on Technical Investigation of Odometers." Copies of this report may be obtained from the NBS Office of Weights and Measures. For the convenience of the reader, a schematic drawing of the fifth wheel assembly is shown in Figure 1. Specifications for additional test equipment as used in these procedures are given in the appendix.

2. Calibration of Fifth Wheel

A fifth wheel must be calibrated on a carefully selected and accurately measured road course. A concrete or "black-top" asphalt roadway having no loose stones or gravel is preferred over macadam because of marking or tacking required during measurement. The site should consist of 1 1/4 to 1 1/2 miles of flat, straight road with little

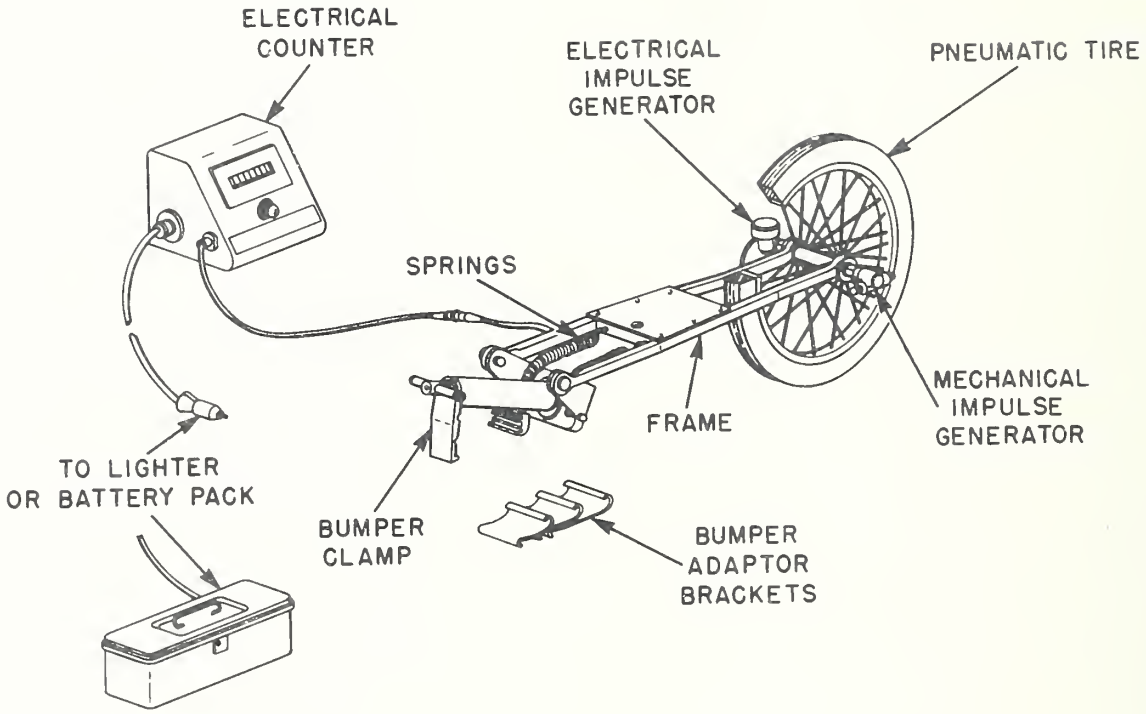


Figure 1. A schematic drawing of a typical fifth wheel assembly.

traffic. A four-lane or divided road is preferred. If a flat and straight road cannot be found, one with a gentle hill may be tolerated, but hazards to personnel and traffic should be minimized. The crown of the road should not exceed 2 percent (i.e., 0.02-foot rise per foot of width).

2.1. Layout of Measured Course

The laying out of a one-mile course can be completed in one day using three or four men. One man is needed to hold the tape at the initial mark, a second to hold the tape under tension while measuring and to keep a record of the measurements, and a third man to mark or tack the 100-foot intervals as measured (See Fig. 2.). The fourth man would act as a flagman and could move the vehicle, which should be equipped with "4-way" blinking caution lights, or other safety lights. The following equipment will be needed to lay out the course:

(a) A 100-foot steel surveyor's tape standard (certified by appropriate authority).

(b) A calibrated six-inch steel rule (optional).

(c) A calibrated straight-face spring scale of at least 10 pounds capacity.

(d) Masonry nails and fiber-tip marking pen, or surveyor's tacks.

(e) Hammer.

(f) Paint (aerosol spray type).

(g) Thermometer (complete immersion type), 1-degree graduations.

Figure 2. Laying out a measured course.

Safety should be the primary consideration in the selection of the starting position. Clear visibility of at least one-quarter mile will give oncoming vehicles adequate stopping distance if needed.

Step (1): Mark starting point permanently with a case-hardened masonry nail embedded in the road surface two feet from the edge of the roadway. Spray paint a circle around the marker and a perpendicular line from the marker to the road edge.

Step (2): Record air temperature.

Step (3): Initiate measurement of one-mile test course. Place 100-foot mark of steel tape in line with the exact center of starting marker and lay out tape on road surface two feet in from and parallel to the edge of the road and hold under ten pounds tension as determined with a straight-face spring scale. Mark or tack roadway surface at the zero mark on the tape. Scribe the marker or tack with the exact measurement line. Spot the mark or tack with a circle of paint, to facilitate relocating it.

Step (4): Continue this measuring procedure in a straight line parallel with, and two feet in from edge of roadway until exactly one mile is measured with the tape. Note that one mile is 52 lengths of the 100-foot tape plus 80 feet.

CAUTION: Do not drag the tape on the road surface between measurements. The tape must be lifted clear of the ground each time it is moved to a new position.

Step (5): Record air temperature.

Step (6): Move exactly two feet down the road beyond the one-mile mark, and establish a new temporary starting point.

Step (7): Repeat the measuring procedure in the reverse direction along the same route. The finish point should be within two feet short (plus or minus five inches[1]) of the permanently marked starting point. If this agreement is lacking, the measurement procedure should be thoroughly reviewed for sources of error and the entire measurement procedure repeated. It is important that the change in average temperature between each one-mile measurement does not exceed 2° F. or the temperature correction factor for steel tapes must be considered. Temperature correction is discussed in the next step, but it should be noted now that there may be a change in the length of a measured

[1] This is a tentative tolerance figure based on experience of personnel with some preliminary training. Exceedance of this tolerance usually indicates either (1) presence of gross errors in one or both measurements, or (2) improper tape handling.

mile of 12/32 inches for each degree change in average temperature. The true one-mile point will be determined after making corrections for temperature and error in the tape.

Step (8): Correct for temperature. Since steel tapes are calibrated at 68° F., a correction must be made for the length of the tape at the temperature of use. The change in length amounts to .00774 inch per degree F. on a 100-foot steel tape. This can be converted with sufficient accuracy to 13/32 inch per degree temperature difference for each measured mile. The total change in tape length is 13/32 inch multiplied by the difference between the average temperature and 68° F. multiplied by the measured miles.

The formula derived is:

13/32 x TD x M = TC -- Where TD = temperature difference (°F.)

M = length of course (miles)

TC = temperature correction (in.)

For example, say the starting temperature were 80°, the temperature at the conclusion of the measuring were 82°, and the measured course were 1 mile.

Applying these figures to the formula, the computation would be:

13/32 x (81 - 68) x 1 =

13/32 x 13 x 1 = 5 5/16 inches

As the average temperature is warmer than 68° F. the tape would be longer in use; thus the 5 5/16 inches must be subtracted. Conversely, if the average temperature were colder than 68° F. the tape would contract and the answer obtained would be added. [Specifically, if the average temperature is more than 68° F. subtract the computed temperature correction, and if the average temperature is less than 68° F. add the computed temperature correction.]

Step (9): Correct for error in the tape as certified. To illustrate, the tape was found to be 100.003 feet long at 68° F. under a tension of 10 pounds. Thus, the tape has an error of +.003 feet. In laying out a one-mile (5,280-ft) course, the 100-foot tape was used 52.8 times. With an error of +.003, the tape error would be computed as +.003 ft x 52.8 = .1584 ft. In converting to inches, .1584 ft x 12 = 1.9 inches, or 1 7/8 inches. As the tape is actually longer than 100 feet, the 1 7/8 inches must be subtracted.

Step (10): Summarize corrections. The original or corrected original measured course would then have a final correction as follows:

Temperature correction	-5 5/16
Tape error	-1 14/16
Total correction to be applied	-7 3/16

Step (11): Embed another masonry nail marker permanently into the roadway 7 3/16 inches closer to the starting point from the end mark of the first mile measurement. This true or correct one-mile marker is spotted with paint similar to the way the starting point was marked by spray painting a circle around the marker and then a perpendicular line from the circle to the road edge. The permanently embedded markers indicate the starting and finishing points of an accurately measured one-mile course. Erect start and finish identification signs at the proper markers.

2.2. Fifth Wheel Calibration Procedure

The fifth wheel in its test position may be difficult to see by a following motorist. If not supplied by the manufacturer, a warning flag should be made and attached to the frame of the device next to or over the wheel in such a manner that it is at eye-level to the driver of a following vehicle (See Fig. 3.). In addition, the four-way hazard warning signals of the test vehicle should be operating whenever a test is being conducted.

If the electrical counting head of the fifth wheel is to be powered from the cigaret lighter socket, a connecting wire at least 15 feet in length should be provided. This length is recommended to permit placing the counter close to the fifth wheel when adjusting for zero start position.

Step (1): Attach the fifth wheel to the rear bumper of a motor vehicle

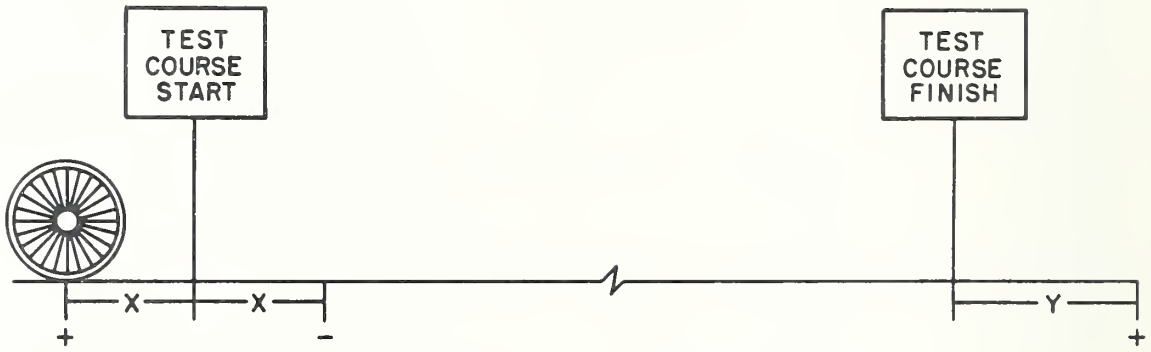
Figure 3. Fifth wheel in calibration position on measured course.

with the bumper clamp (and any auxiliary clamps--if needed). Do not install the fifth wheel in a position where the exhaust gases of the vehicle blow directly on any part of the fifth wheel or its components (clamps, frame, rim, tire of the electrical contactor). Make all necessary connections between the fifth wheel and the counting mechanism which should be placed on the front seat of the vehicle.

Step (2): With the fifth wheel in operating position, and at a tire pressure of 26 to 28 psi, drive for at least five miles to develop a stabilized tire pressure. At the measured course drive slowly past the starting marker until the fifth wheel is aligned as closely as possible with the marker (Fig. 3.). The point of contact of the fifth wheel with the road should be less than 10 inches from the starting line. (See Fig. 4.) Stop and set parking brake.

Step (3): Adjust fifth wheel tire pressure to exactly 25 psi.

Step (4): Measure the distance the fifth wheel is from the starting point and record. (See Item 1, Fig. 5., Report Form.) The use of a plumb bob (Fig. 6.) from the center point of the fifth wheel axle to the road surface will aid in measuring this distance. Give proper sign to value (plus or minus) as indicated in Figure 4. This measurement is zero if the fifth wheel is exactly aligned with the starting point.



X—LESS THAN 10 INCHES
Y—LESS THAN 75 INCHES

Figure 4. Determination of signs (plus + or minus -) and the limitations of alignment for start and finish of fifth wheel calibrations.

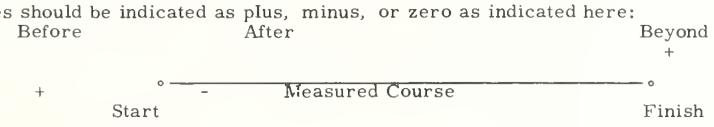
(Department Heading)
Calibration Test Report of Fifth Wheel

Date _____

Make of Fifth Wheel _____ Serial No. _____ Tire Pressure (Fifth Wheel) _____ psi.
Length of Course _____ Where Tested _____ Avg. Temp. _____ Weather _____

Test Data	Run Numbers					
	1	2	3	4	5	Avg.
1. Distance (inches) of fifth wheel from START marker ---------- (Before marker is PLUS value; after marker is MINUS value*)						
2. Distance (inches) of fifth wheel beyond FINISH marker ---------- (This is always a PLUS value*)						
3. Total distance from markers (Item 1 plus Item 2) ----------						
4. Reading on Counter (in thousandths of a mile) ----------						
5. Corrected reading [Item 4 minus 0.001 mile if total distance (Item 3) equals or exceeds 31 11/16 inches] ----------						

*Distances should be indicated as plus, minus, or zero as indicated here:



6. Over a measured course of _____ miles.
The calibration test indicates that the Fifth Wheel measures _____ miles (Item 5, Average).

7. Calibration correction (Item 6, minus Item 5, Average) and retain (+) or (-) sign. _____

If Item 6 is larger than Item 5, Average, the calibration correction is plus (+). If Item 5, Average, is larger than Item 6, the correction is minus (-).

_____ Inspector

_____ Title

Figure 5. A suggested fifth wheel calibration report form.

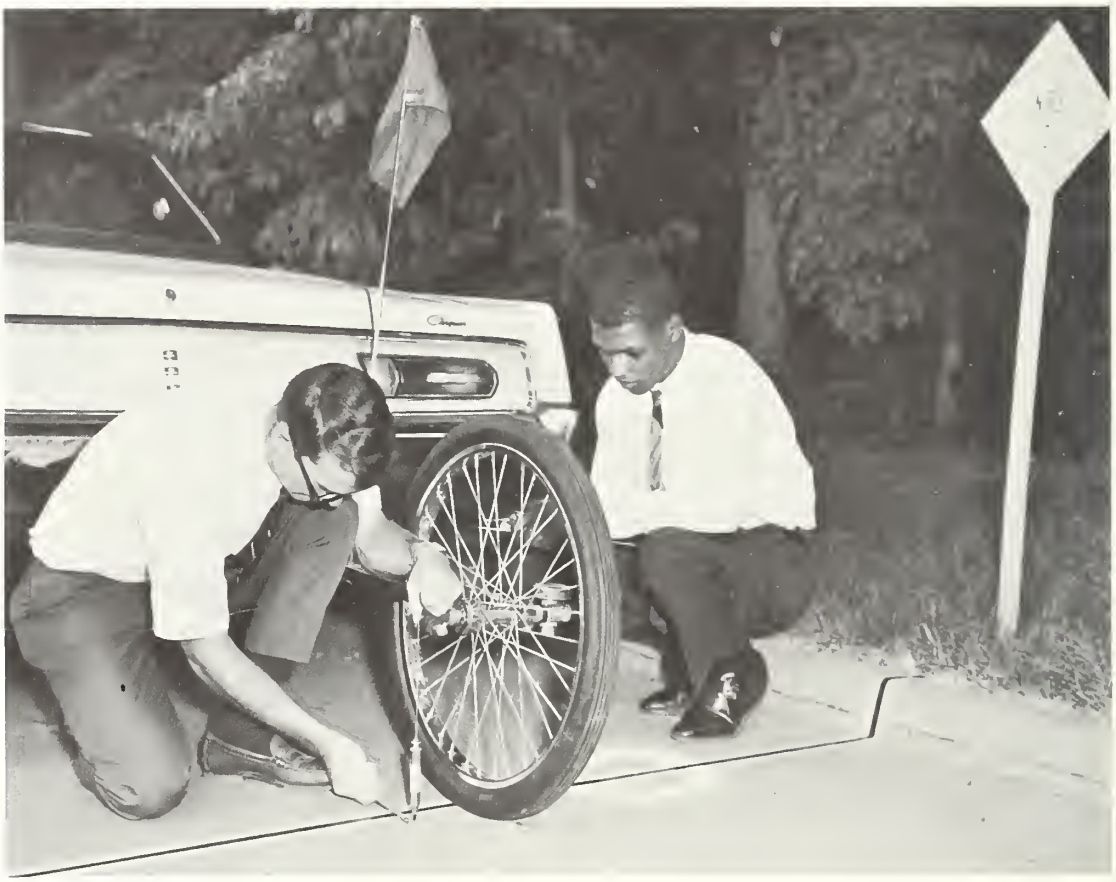


Figure 6. Measuring distance from fifth wheel to starting point of measured course.

Step (5): With the counter located in a viewable and audible position, lift the frame of the fifth wheel and freely rotate the tire in a forward direction for several clicks in the counter. This will remove any backlash in the gears. With the wheel turning very slowly stop the rotation the instant a full number clicks into place on the counter (Fig. 7.) and lower the frame until the tire is in firm contact with the road surface. The wheel contactor is now synchronized with the starting point for the test. Place the counter in the vehicle in view of the driver and clear to zero.

Step (6): Accelerate without spinning wheels to 35 mph, and maintain this speed as constant as possible throughout the calibration run. Maintain a uniform distance between the vehicle and the road edge during the calibration run.

Step (7): As the final marker is approached, decelerate to a slow speed. Stop the vehicle the instant the counter registers the first whole number after the fifth wheel has passed beyond the final marker. Record on the Report Form, under Item 4, the counter indication.

Step (8): Measure the distance the fifth wheel has passed beyond the final marker (same method as Step 4) and record on Report Form,

Figure 7. Synchronizing electrical contactor of fifth wheel with starting point of test.

under Item 2. This distance should be less than 75 inches and is always a plus value.

Step (9): Complete Report Form for Run 1.

Step (10): Continue making test runs until three complete runs are made with not more than 16 inches difference between the total distances of individual runs. See completed Report Form. Fig. 8. Some difficulty may be experienced in meeting this requirement if the atmospheric temperature change exceeds 4°F. per hour.

Step (11): If the sum of total distances from the starting and finishing marks (Item 3, Report Form) equals or exceeds 31 11/16 inches, subtract 0.001 mile from the counter reading (Item 4, Report Form) to obtain the corrected counter reading (Item 5, Report Form). If Item 3 is less than 31 11/16 inches, the corrected counter reading is the same as Item 4 (the original counter reading).

Step (12): Obtain average corrected counter reading (Item 5, Average). This indicates the mileage measured by the fifth wheel over the measured course.

Step (13): Complete the Report Form. As indicated on the Report Form the calibration correction is obtained by subtracting the

average corrected distance recorded by the fifth wheel (Item 5, Average) from the length of the measured course and retaining the proper + or - sign. If Item 6 is larger than Item 5 the calibration correction is plus (+). Conversely, if Item 5 is larger than Item 6 the correction is minus (-).

The fifth wheel appears to be slightly temperature sensitive. Changes of as much as 0.001 mile per mile per 20° F. change in calibration temperature have been noted. Thus, calibrations should be made at approximately 30° F. intervals in the temperature range of intended use. The temperature range of intended use should not be more than 20° F. from a calibration temperature. Keep copies of all calibrations with the fifth wheel when testing odometers and taximeters.

(Department Heading)
Calibration Test Report of Fifth Wheel

Date 3 7-15-65

Make of Fifth Wheel Truck Test Serial No. 294 Tire Pressure (Fifth Wheel) 25 psi.
Length of Course 1-mile Where Tested Smith Kilburg, Mo. Avg. Temp. 85°F Weather Sunny

Test Data	Run Numbers					
	1	2	3	4	5	Avg.
1. Distance (inches) of fifth wheel from START marker (Before marker is PLUS value; after marker is MINUS value*)	+ 8	- 2	+ 5			
2. Distance (inches) of fifth wheel beyond FINISH marker (This is always a PLUS value*)	+ 39	+ 48	+ 47			
3. Total distance from markers (Item 1 plus Item 2)	+ 47	+ 46	+ 52			
4. Reading on counter (in thousandths of a mile)	1.000	1.000	1.000			
5. Corrected reading [Item 4 minus 0.001 mile if total distance (Item 3) equals or exceeds 31 11/16 inches]	0.999	0.999	0.999			0.999

*Distances should be indicated as plus, minus, or zero as indicated here:

Before (+) Start — After (-) — Measured Course — Beyond (+) Finish

6. Over a measured course of 1.000 miles.
The calibration test indicates that the Fifth Wheel measures 0.999 miles (Item 5, Average).

7. Calibration correction (Item 6, minus Item 5, Average and retain (+) or (-) sign. +0.001

If Item 6 is larger than Item 5, Average, the calibration correction is plus (+). If Item 5, Average, is larger than Item 6, the correction is minus (-).

W. M. Forthright
Inspector

Weights & Measures Inspector
Title

Figure 8. A completed fifth wheel calibration report form.

PROCEDURE

for the

EXAMINATION AND TEST OF RENTAL CAR ODOMETERS USING FIFTH WHEEL TESTING EQUIPMENT

1. Introduction

An automobile odometer is a mileage measuring device indicating in units of miles and tenths of miles. The primary indicating element of an odometer may be (a) the mileage traveled portion of the "speedometer" assembly of a motor vehicle (Fig. 9.), (b) a special cable driven mileage-indicating device (Fig. 10.), or (c) a hub odometer attached to the hub of a wheel on a motor vehicle (Fig. 11.). When the vehicle is in motion the most sensitive indicating element of an odometer; namely, the tenth mile indicator (analog) should advance continuously.

The test of an odometer may be conducted as a road test, a fifth wheel test, or both. A road test consists of driving the vehicle over an accurately measured road course. A fifth wheel test consists of driving the vehicle over a road course and determining the distance actually traveled through the use of a mileage measuring device, (fifth wheel) attached to the vehicle and that independently measures and indicates the distance. This procedure is concerned with the latter test method.

2. Selection of Test Site

The odometer code in NBS Handbook 44 specifies a test of two miles at an approximate speed of 45 miles per hour. Thus, the test route

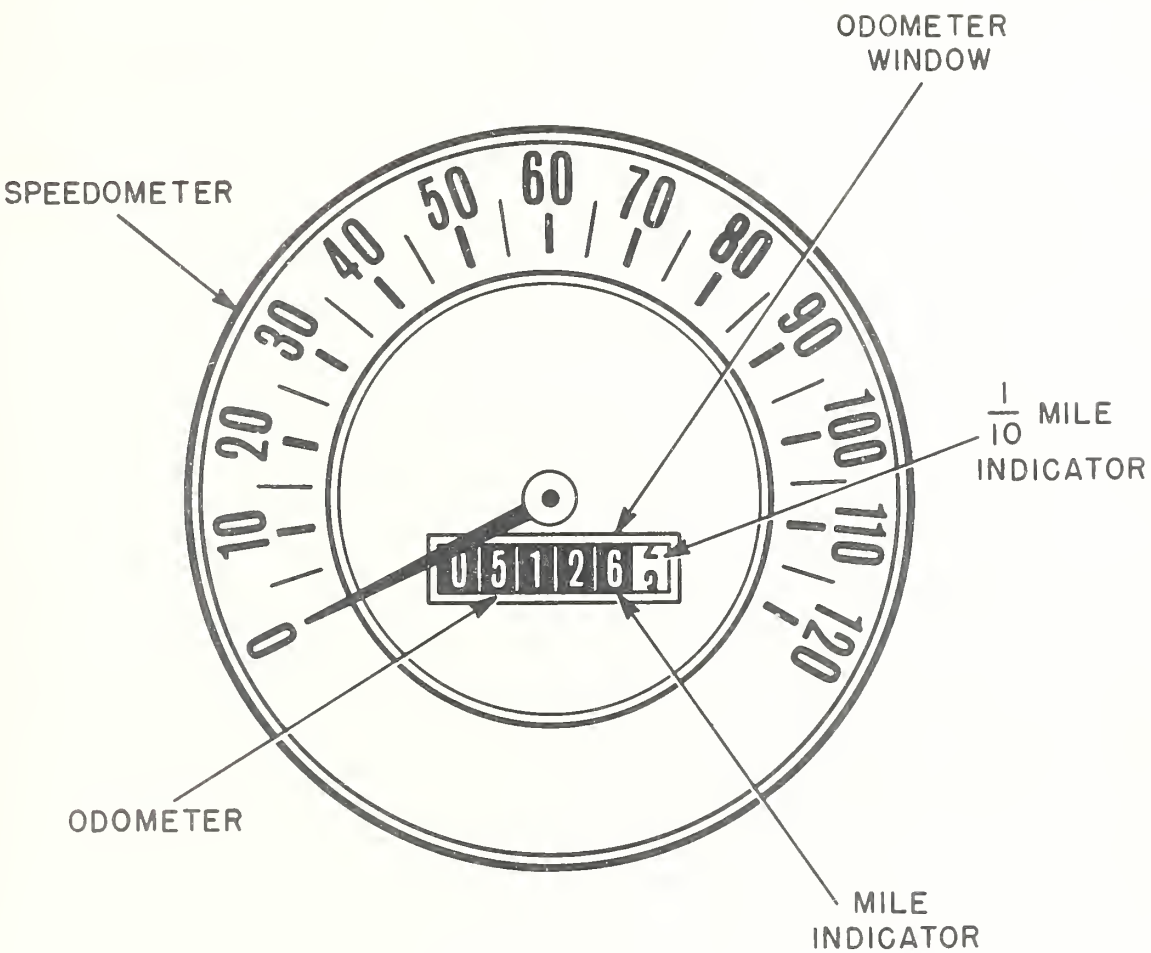


Figure 9. Typical speedometer-odometer assembly of a motor vehicle.

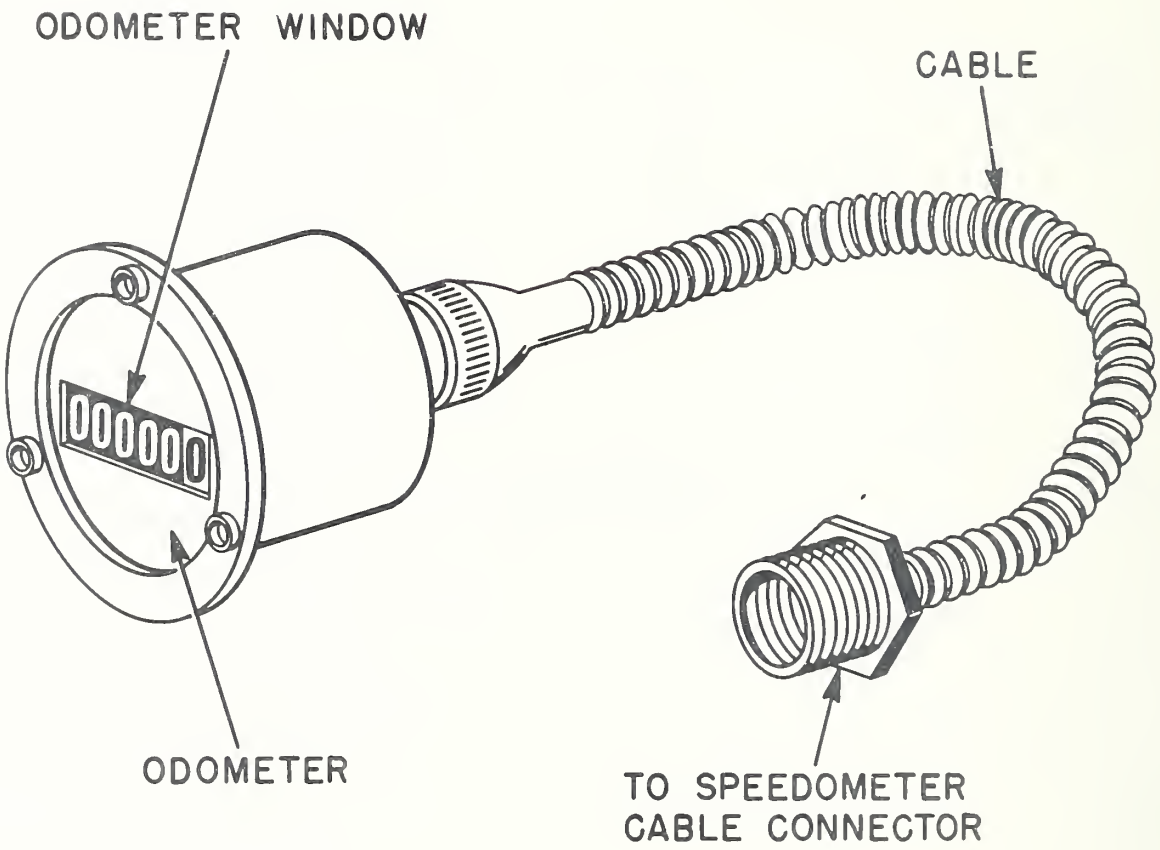


Figure 10. A special cable-driven odometer.

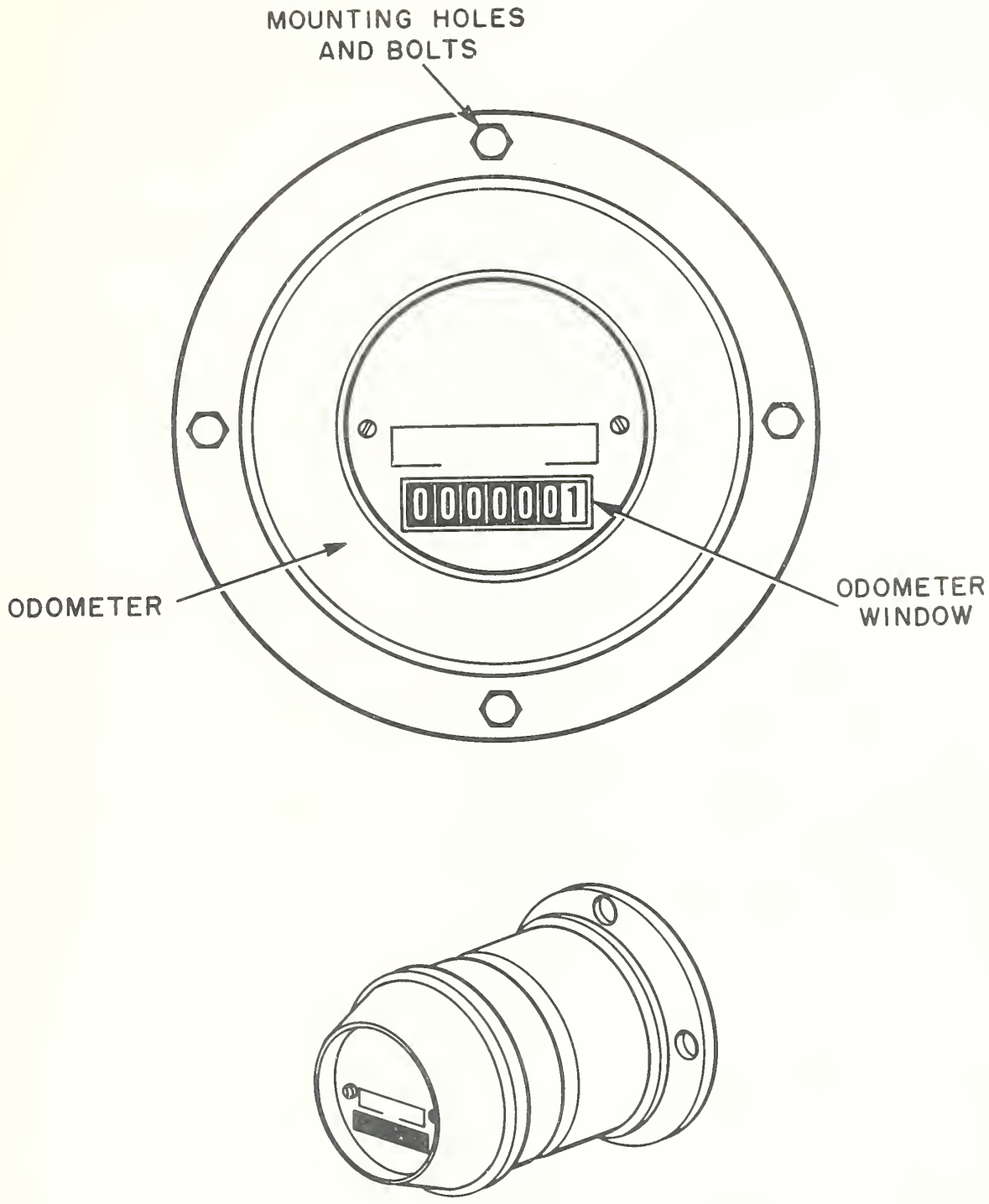


Figure 11. A hub odometer.

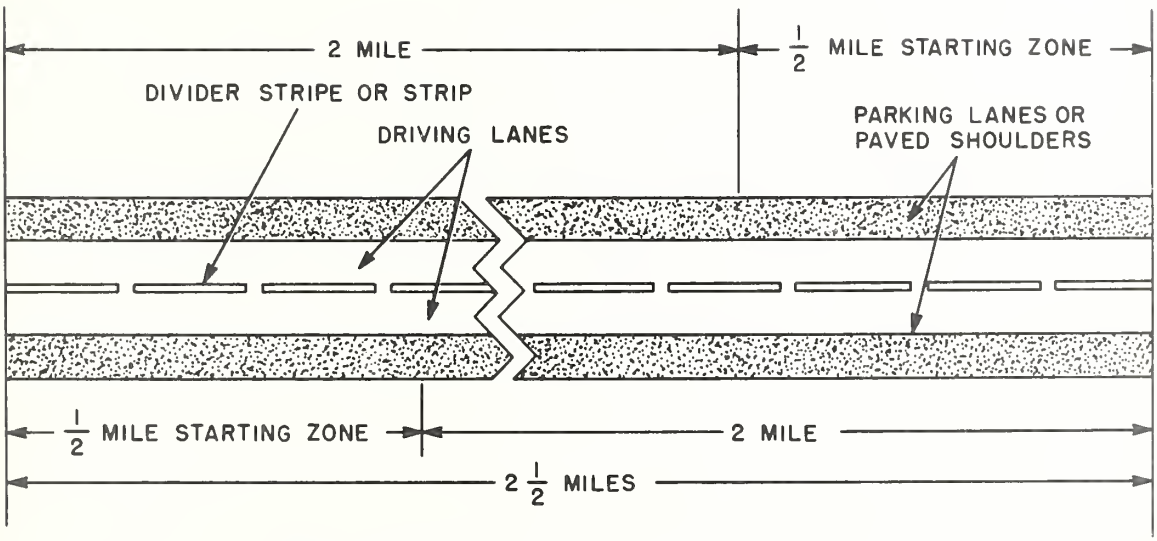
(Fig. 12.), (a) should be at least 2 1/2 miles long (to provide a half mile starting zone), (b) have a speed limit of at least 45 miles per hour, and (c) be free of traffic interference and traffic control devices. In addition, a paved shoulder or parking lane should be available where the test vehicle and attached fifth wheel may be temporarily parked before the test run is started and again at the conclusion of the test run, and the road crown should not exceed two percent. Every consideration should be given to a test site having good visibility. To save time the test site should be usable in both directions.

3. Test Preparation

Step (1): Inspect the vehicle under test. For a discussion of the purposes and scope of the "inspection" as distinguished from "testing" see Section 4, NBS Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices."

Step (2): Record the following information: Date, test number, vehicle owner, address, make, year, model, body style, serial number, license number, and identification number of vehicle under test. Also record the make, style, ply, and size of the rear tires. Note the temperature and road condition.

Step (3): Attach the fifth wheel to the rear bumper of the test vehicle



SPEED LIMIT: AT LEAST 45 MILES PER HOUR.

NO STOP SIGNS OR TRAFFIC LIGHTS.

REASONABLY STRAIGHT WITH NO SHARP TURNS.

GOOD VISIBILITY.

THE PARKING LANE OR PAVED SHOULDER IS A NECESSITY IN THE STARTING ZONE.

Figure 12. A suitable test site.

(See Fig. 13.) with the bumper clamp (and any auxiliary clamps--if needed). Do not install the fifth wheel in a position where the exhaust gases of the test vehicle blow directly on any part of the fifth wheel or its components (clamp, frame, rim, tire, or the electrical contactor). Make all necessary connections between the fifth wheel and the counting mechanism which should be placed on the front seat along side the inspector. Test conditions specify that the vehicle shall carry two persons. If the inspector is to examine the vehicle alone, he should have available three 50-pound test weights to be placed on the floor in front of the front seat opposite the driver.

Step (4): Inflate the rear tires of vehicle to 30 psi and the fifth wheel tire to 28 psi. Stabilize test vehicle and fifth wheel tires with a run of at least five miles. This may be accomplished on the way to the test course.

4. The Test

The four-way hazard warning signals of the vehicle under test should be operating whenever a test is being conducted.

Step (1): Drive slowly in the starting zone of the test course until the horizontal bar of the numeral 2, 4, 5, or 7 of the one-tenth mile indicator is lined up with the top or bottom of the odometer window and stop. The precision or repeatability of the test runs is dependent on how well the odometer is read. The position of the selected numeral of the one-tenth mile indicator

Figure 13. Fifth wheel in test position on test vehicle.

(See Fig. 14.) can be most easily reproduced if aligned closely to the upper or lower edge of the window of the odometer. The inspector should hold his head and eyes in the same position relative to the odometer to eliminate the possibility of error due to parallax.

Step (2): Drive the vehicle very slowly until a full number "clicks" into position on the fifth wheel counter and stop. The added distance required to obtain a full number "click" on the fifth wheel counter should not affect the alignment of the numeral on the tenth-mile indicator.

Step (3): Record odometer reading and reset counter to zero.

Step (4): Adjust rear tires of test vehicle to 28 psi and fifth wheel tire pressure to 25 psi.

Step (5): Accelerate to 45 mph without spinning wheels. Maintain speed until ready to decelerate, without skidding, to complete two-mile run on odometer. The one-tenth mile indicator should be at exactly the same position as at the start of the test.

Step (6): Record odometer reading.

Step (7): Record fifth wheel counter reading. If counter is not at a full number "click," record the highest full number in view.

Step (8): Recheck vehicle tire pressure.

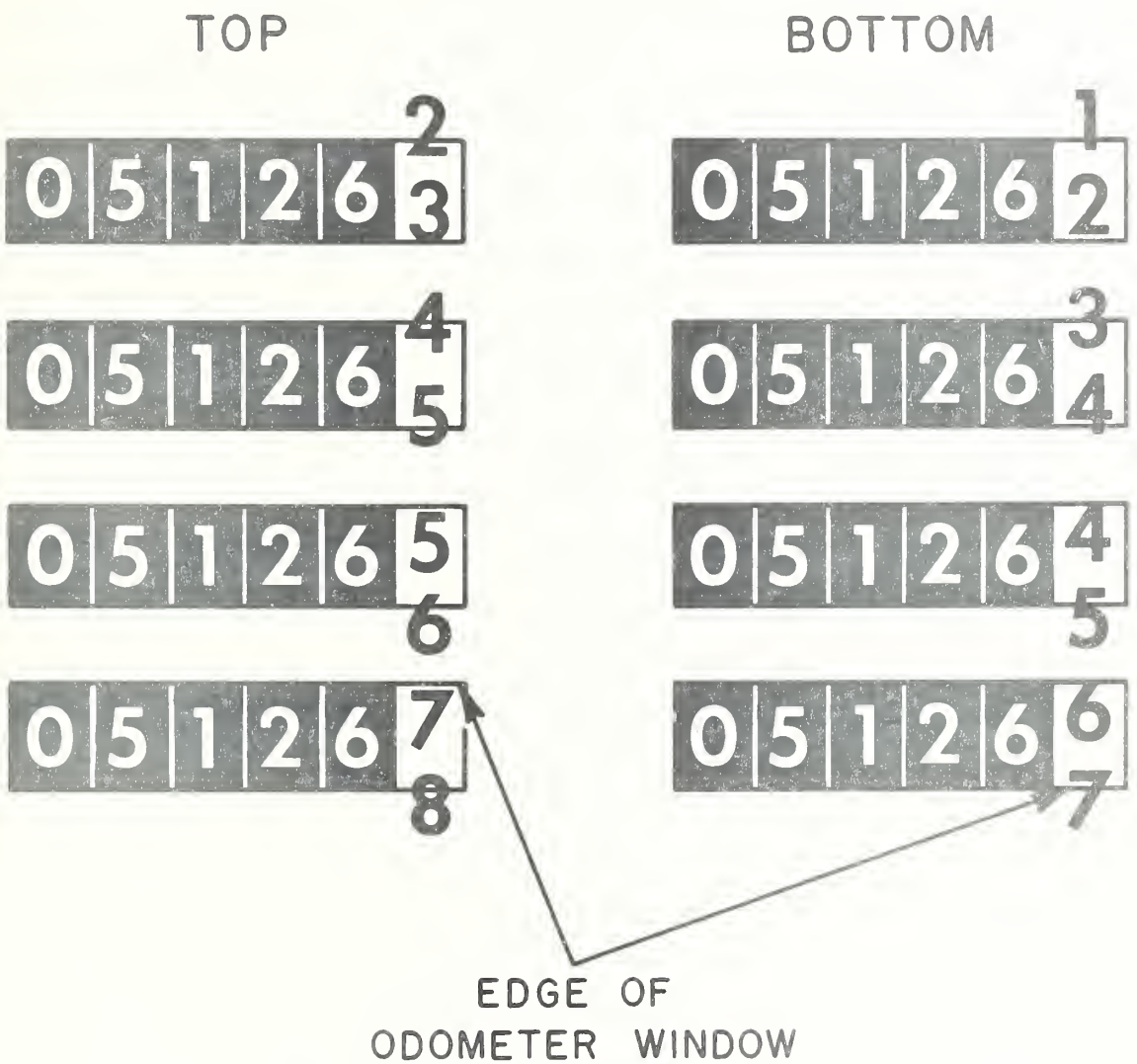


Figure 14. Alignment of numbers of tenth mile indicator.

Step (9): Repeat test run (steps 1 through 8) in opposite direction.

5. Test Report Form

A suggested Test Report Form is shown in Figure 15. The form provides space in sections A and B for the necessary owner, vehicle, and tire identification. Section C of the form provides space for recording the test data for as many as three separate test runs and for the calculations involved. Sections D and E provide space for indicating the official action taken as a result of the test, any remarks or instructions, the signature of the inspector, and the "acknowledgment" signature of the vehicle owner or operator. Sections A and B of the Report Form should be filled in completely prior to operation of the vehicle for test purposes. A separate form (or more than one form if more than three runs are made) should be used for each vehicle tested.

6. Reporting a Test

6.1. Test Data

The test data is entered at the appropriate spaces on the Report Form during and immediately following the test runs.

6.2. Test Calculations

In Figure 16 a sample Report Form has been filled out. In the test data section of the form, each line for each run is identified by a number.

Department Heading
Odometer Test Report Form

DATE_____ TEST NO._____

A. Vehicle Identification:

Owner_____ Address_____
Make of Car_____ Year and Model_____ Body Style_____
License No._____ Serial No._____ Co. Ident. No._____

B. Description of Rear Tires:

Make_____ Style_____ Ply_____ Size_____
Tire Pressure: After Stabilization_____ After 1st Run_____
After 2nd Run_____ After 3rd Run_____

C. Test Data:

Temperature_____ Road Conditions_____

	1st Run	2nd Run	3rd Run
1. Odometer end of test			
2. Odometer start of test			
3. Odometer mileage (Item 1-Item 2)			
4. Test Instrument Reading			
5. Calibration correction x 2			
6. True mileage (Item 4+Item 5)			
7. Error (see note)			
8. Percent error $\frac{(\text{Item 7} \times 100)}{(\text{Item 6} \quad)}$			

NOTE: If true mileage reading (Item 6) is smaller than the odometer reading (Item 3), the vehicle is overregistering and a minus sign should be used for the error. If the mileage reading is larger than the odometer reading, the vehicle is underregistering and a plus sign should be used for the error value.

D. Action Taken: Approved_____ Rejected_____ Condemned_____

E. Remarks: _____

_____

_____ _____
Inspector Owner/Operator

Figure 15. Suggested test report form.

Department Heading
Odometer Test Report Form

DATE 7-15-68 TEST NO. 3

A. Vehicle Identification:

Owner U-Rent-M Address 1510 South Ave, Wheaton, Maryland
Make of Car Metco Year and Model 1968 Arrow Body Style 4-door Sedan
License No. AD5824 Serial No. LL17891 Co. Ident. No. 3

B. Description of Rear Tires:

Make Goodenough Style Reg. Ply 2 Size 6.95-14
Tire Pressure: After Stabilization 28 psi After 1st Run 28 psi
After 2nd Run 28 psi After 3rd Run

C. Test Data:

Temperature 85 °F Road Conditions Dry

		1st Run	2nd Run	3rd Run
1.	Odometer end of test	23693.7	23696.2	
2.	Odometer start of test	23691.7	23694.2	
3.	Odometer mileage (Item 1-Item 2)	2.0	2.0	
4.	Test Instrument Reading	1.994	1.995	
5.	Calibration correction x 2	+ 0.002	+ 0.002	
6.	True mileage (Item 4+Item 5)	1.996	1.997	
7.	Error (see note)	- 0.004	- 0.003	
8.	Percent error (Item 7 x 100) / (Item 6)	- 0.20	- 0.15	

NOTE: If true mileage reading (Item 6) is smaller than the odometer reading (Item 3), the vehicle is overregistering and a minus sign should be used for the error. If the mileage reading is larger than the odometer reading, the vehicle is underregistering and a plus sign should be used for the error value.

D. Action Taken: Approved ✓ Rejected Condemned

E. Remarks: New tires

J. M. Forthright
Inspector

Owner/Operator

Figure 16. A completed test report form.

The several steps and appropriate entries in the data calculations in these runs will refer to the identifying numbers for the appropriate runs.

Step (1): The odometer mileage (Item 3) is the odometer reading at the end of the test (Item 1) minus the odometer reading at the start of the test (Item 2).

Step (2): The test instrument reading (Item 4) is the reading of the fifth wheel at the end of a run.

Step (3): The calibration correction x 2 (Item 5) is the fifth wheel calibration correction which is generally expressed in plus (+) or minus (-) thousandths of a mile per mile and is multiplied by 2 since the test runs are two miles in length.

Step (4): The true mileage (Item 6) is the sum of Item 4 and Item 5.

Step (5): The error (Item 7) is the true mileage (Item 6) minus the odometer mileage (Item 3). The proper plus (+) or minus (-) sign should be carried; thus, if the true mileage reading (Item 6) is smaller than the odometer reading (Item 3) the vehicle is over-registering and a minus sign should be used for the error. If the mileage reading is larger than the odometer reading the vehicle is under-registering and a plus sign should be used for the error.

Step (6): The percent (%) error (Item 8) is determined by dividing the error (Item 7) by the true mileage (Item 6) and multiplying by 100. Be sure to carry the appropriate plus (+) or minus (-) sign.

APPENDIX

Additional Test Equipment.

Additional test equipment used in these procedures.

Thermometers--Liquid-in-glass, total immersion type, -30 to 120° F., at least 1° F. graduations, at least 12 inches in length.

Master Gage--Calibrated 1 to 130 lbs in 1-lb units, 2 1/2-inch gage dial, dual chuck, pressure retaining valve, pressure release, plush-lined case.

Pencil Tire Gages--Calibrated 8 to 40 lbs in 1-lb units.

Steel Surveyor's Tape--100-ft standard, certified by proper authority.

Hand Spring Scale--Calibrated straight face, at least 10 pounds capacity, for measuring tension on steel tape.

Calibration of Pencil Tire Gages.

The pencil tire gages may be calibrated with the master gage in the following manner:

1) Inflate a vehicle tire to approximately one psi over the recommended test tire pressure.
2) Take tire pressure reading with master gage.
3) Take two tire pressure readings with the pencil tire gage and determine average.

4) Take another tire pressure reading with master gage.

5) Determine average of the two master gage readings, i.e., Item 2 and Item 4.

6) Difference between Item 5 and Item 3 is the pencil tire gage correction. (NOTE: Be sure to retain proper + or - sign.)

e.g., Correction = Item 5 - Item 3

or if Item 5 = 25 psi

and Item 3 = 26 psi

Correction = 25 - 26 = -1 psi

7) Repeat Steps 1 through 6 at least two more times to be sure that the correction is reproducible. Discard pencil tire gage if correction is not reproducible.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