SURFACE VEHICLE STANDARD

J1015™ AUG2024

Issued 1974-03
Revised 2012-07
Reaffirmed 2024-08

Superseding J1015 JUL2012

Tonne Kilometer Per Hour Test Procedure

RATIONALE

This document covers time tested procedures and applications. As such the methodology continues to be acceptable in its present form. Therefore the document is being revised with no significant technical changes.

SAE J1015 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This SAE Standard establishes the Tonne Kilometer Per Hour Test Procedure for off-the-road tires. This document is applicable to only those tires used on certain earthmoving machines referenced in SAE J1116.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1098 Tonne Kilometer Per Hour Application

SAE J1116 Categories of Off-Road Self-Propelled Work Machines

2.1.2 Tire & Rim Association Publications

Available from The Tire & Rim Association Inc., 175 Montrose West Avenue, Suite 150, Copley, OH 44313, Tel: 330-666-8121, www.us-tra.org..

Tire & Rim Association Yearbook

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
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For more information on this standard, visit
https://www.sae.org/standards/content/J1015_202408/

3. APPLICATION

The Tonne Kilometer Per Hour (TKPH) rating is one of several factors for evaluating the performance capability of off-the-road tires. The TKPH rating is a measure of work per unit time, and as such is intended to supplement information published by tire industry standards associations and manufacturers.

3.1 The TKPH test was developed using Tire & Rim Association (TRA) standards (Section 4, Off-the-Road, TRA Yearbook) and reference is made to these specifications throughout this procedure.

3.2 The test procedure is also applicable to tire and rim developments approved by the tire and rim manufacturers, although not published in the TRA Yearbook (see Section 8).

3.3 This test procedure does not define how the TKPH rating is applied in evaluating specific applications to machines or their performance. (Refer to SAE J1098 for application practice.)

4. FACILITIES

4.1 Test Machines

The tires are to be mounted on a suitable machine with a rim as specified in the TRA Yearbook. The test tires should be singles located on a drive (non steered) or trail axle. Care shall be exercised to eliminate any camber or toe-in of the wheels to prevent non-uniform loading (see 3.2).

4.2 Test Course

The test course shall be any dry, flat, highly compacted material, or paved road, laid out in a closed loop configuration. The course length and arrangement should be such that tire loading is not significantly affected by weight transfer due to turns and super-elevations. The intent is to operate the tire with a known constant load. Provision for a turnaround should be made to reverse the direction of travel. TKPH measurements shall be run only on a dry test course, as moisture will influence tire temperatures.

4.3 Instrumentation

4.3.1 Temperature Measurement System

The system shall be capable of measuring tire test temperatures with an accuracy of ±1 °C.

4.3.2 Thermocouple Probe Assembly

An instrument as described in Figure 1 is required to provide the functions of holding, guiding, and inserting the thermocouple; and a handle with connection to the reading or recording device.

4.3.3 Pressure Instrument

An instrument capable of measuring tire inflation pressure to an accuracy of ±6.9 kPa.

4.3.4 Weight Scale

A weight scale with an accuracy of 2%.

4.3.5 Timing Device

A standard stopwatch or stop clock capable of measuring 60 min or more, with graduations of 0.01 min.

5. PREPARATION FOR TESTS

5.1 Tires

Tires shall be prepared for thermocouple probes by drilling 3 mm diameter holes from the tread surface to the top of the topmost reinforcement; i.e., breaker cord, belt cord, or carcass ply. These holes, drilled normal or perpendicular to the tread surface, shall be located across the tread in such a pattern that one or more are within 25 mm or less of the hottest point in the tire. To insure this, the following procedure is recommended.

5.1.1 Drill Hole Location

5.1.1.1 With a caliper, measure the total tire thickness of each tread element around the tire at the centerline and shoulder. Determine the area around the circumference with the greatest total thickness.

5.1.1.2 Select a tread bar or contiguous tread element in this heavy gauge area as the probe location.

5.1.1.3 For tires of 16.00 cross section and smaller, locate holes in the center of the cross lug or contiguous tread element and at maximum increments of 25 mm from the tire centerline to each shoulder. For larger tires, locate holes at 50 mm increments.

5.1.1.4 Continuous rib design tires require holes in the center of each rib. Ribs wider than 76 mm will require additional holes 25 mm either side of the center, but not closer than 12.5 mm from the rib edge.

5.1.1.5 Mark off increments as described in 5.1.1.3 and 5.1.1.4 across the crown of the tire.

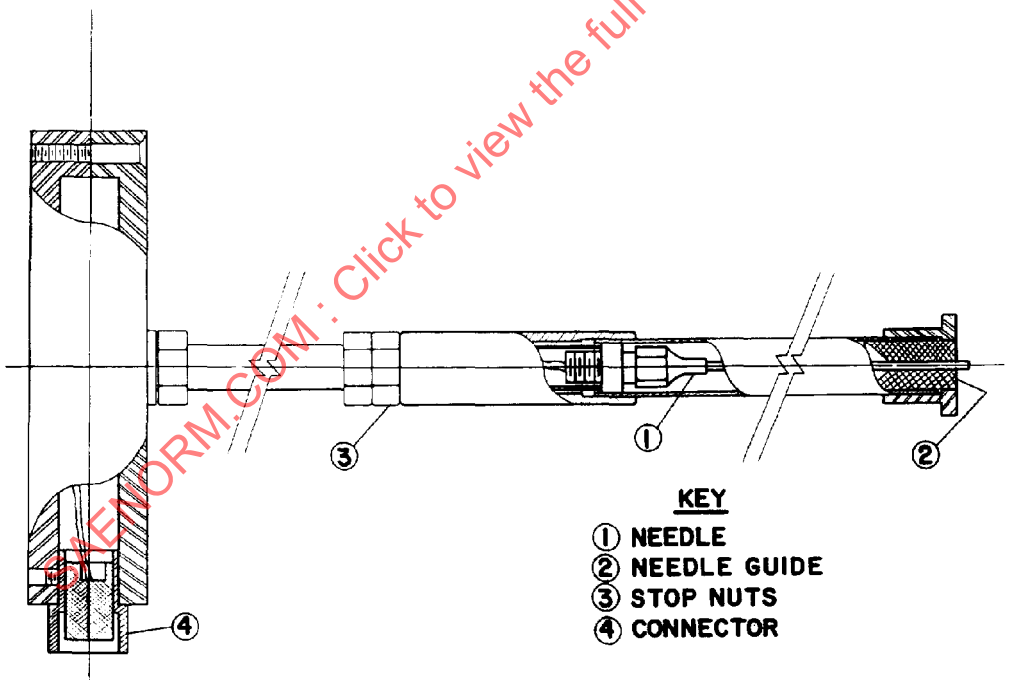

FIGURE 1 - THERMOCOUPLE NEEDLE AND HOLDER

5.1.2 Drill Hole Depth Determination

5.1.2.1 Depth of the drilled holes should be such that the bottom of the hole is within 2.5 mm of the top of the highest reinforcement cord, but not into or through this cord.

5.1.2.2 If the carcass thickness is known, measure the total tire thickness at the location determined in 5.1.1.3 and subtract the known carcass thickness from this measurement; the drill depth should be 2.5 mm less than the difference.

5.1.2.3 If the total thickness is not known, then the drill depth can be determined by drilling test core holes.

5.1.2.3.1 Make core drillings not to exceed 6 mm diameter at the prescribed intervals (see 5.1.1.3 and 5.1.1.4) from the centerline to both shoulders on a tread element immediately adjacent to the intended probe location. On rib design tires, the cored hole shall not be within 50 mm of the drill location. Cores should be drilled normal or perpendicular to the tread surface. Core drilling depths should not extend beyond breaker or belt plies into body plies or ply. In the case of steel cord construction tires, core drilling should not go deeper than when initial contact with the steel cord belt/breaker plies occurs.

5.1.2.3.2 Measure the reinforcement (carcass material) thickness on the plugs removed from the cored holes and subtract from the depth of the cored hole. This measurement less 2.5 mm determines the probe depth for that location.

5.2 Inflation

New tires shall be inflated for 24 h prior to the first test. Test tires should be inflated to the TRA Yearbook pressure for the subject ply rating or load range.

5.3 Break-In

New test tires are to be run for between 130 and 160 km at a load and speed combination estimated to produce an actual stable temperature within the limits listed as follows:

5.3.1 Bias ply (textile) tires, 87 to 107 °C.

5.3.2 Radial ply (steel cord) tires, 71 to 93 °C.

6. TEST PROCEDURE

6.1 Test Conditions

6.1.1 Selecting Test Load

The test load is determined by selecting a load of 85% of the TRA yearbook 50 km/h capacity table for both test tires. The load shall be measured for each tire within 2% of the selected test load. This load shall be used throughout the test.

6.1.2 Setting of Test Inflation Pressures

Immediately prior to the test, inflation pressures are to be adjusted with the tires at ambient conditions and the pressure corrected to a 15.6 °C standard. (See 5.2.)

6.1.3 Selection of Test Speeds

Three speeds are selected. These three speeds when multiplied by the test load (6.1.1) generate three corresponding TKPH values to be used in TKPH determination.

6.1.3.1 Definition of Speed

Speed is an average speed calculated by using the total distance traveled divided by the total time from the initial machine start to the final stop.

6.1.3.2 Method of Speed Selection

Three average speeds are selected such that each produces level-off tire temperatures in the approximate ranges shown in Table 1.

TABLE 1 - LEVEL-OFF TIRE TEMPERATURES

Tire Type	Approximate Temperature Normalized for Ambient °C
Textile	93
	107
	121
Steel cord	79
	93
	107

6.2 Test Cycle

The test cycle consists of running at a constant speed for approximately 60 min or 24.1 km and a fixed stop-period of minimum duration (not to exceed 10 min). The travel times or distances may be varied slightly to permit even laps around the course between stops. Once the speed or travel time of the cycle has been established, it shall be accurately controlled within ±1%.

6.3 Measurement and Recording of Data

6.3.1 Recommended Data Form

(See Figure 2)

TKPH DATA

TEST NO. _____ PAGE _____ OF _____ DATA BY _____ DATE _____
TIRE BRAND_____ SIZE _____ TYPE _____ PR _____
POSITION: (DRIVE OR TRAIL)
LEFT (_____) LOAD _____ kg SERIAL _____
RIGHT (_____) LOAD _____ kg SERIAL _____

TEST PLAN: GEAR _____ CYCLE TIME _____ Min TRAVEL SPEED _____

Probe Location	Meas. Temp.	Time After Stop	Meas. Temp.	Time After Stop	Meas. Temp.	Time After Stop	Meas. Temp.	Time After Stop	Remarks
LEFT									
TIRE C/L									
TEMP. C/L									
°C									
RIGHT									
TIRE C/L									
TEMP. C/L									
°C									

START TIME
STOP TIME
TRIP DIST.
TOTAL KILOMETERS
AMBIENT START °C
30 MIN. PRIOR STOP °C
TIRE kPa
(L) Start _____
(R) Start _____

TIRE TEMPERATURE:
(L) HOT SPOT ACT.
(R) HOT SPOT ACT.
ACT. AMB. CORR. ±
(L) CORRECTED
(R) CORRECTED

SUMMARY:
TOTAL DIST. _____ km TOTAL TIME _____ AVERAGE SPEED _____ TKPH _____
LEVEL-OFF TEMPERATURES:
LEFT: ACTUAL _____ °C AMB. CORR. _____ °C
RIGHT: ACTUAL _____ °C AMB. CORR. _____ °C

FIGURE 2 - DATA FORM

6.3.2 Tire temperatures are measured in the predrilled probe holes with instrumentation per 4.3.1 and 4.3.2. Temperatures should be taken as quickly as possible at the beginning of the stop-period. A specific measurement sequence should be maintained throughout the test. Measurements should be taken with the thermocouple probe within 1.3 mm of the bottom of the probe hole. With each temperature recorded, record the elapsed time from the beginning of the stop-period.

6.3.2.1 Hot Area Measurement

It is not necessary to probe each drilled hole after a sufficient number of readings have been obtained to determine the area of the hot spots on either side of the centerline. After this area has been established, continue to record the hot point in each area and each point adjacent to make certain that the hottest points are being measured.