

Road vehicles-Automatic transmission fluids-The friction characteristic test method

1. Scope

This standard specifies the procedures for evaluating the friction characteristic of automatic transmission fluid used in passenger vehicles, trucks, and buses.

2. Definitions

The following standards, when referred to in this standard, constitute a part of the specifications of this standard. As required, the most recently updated version of the applicable standard (including addenda) shall be applied.

2.1 Friction characteristics

This term refers to the characteristics of the friction force generated on the contact surface in the direction acting to hamper the movement when two contacting solid objects make (or are about to make) a relative movement caused by external force. Here the term refers specifically to the performance of the automatic transmission fluid indicated by the friction coefficient, which is obtained by a dynamic and static friction test using a friction clutch.

2.2 Reference transmission fluid

The standard automatic transmission fluid used in the test shall be T-III or RTF1.

2.3 Friction coefficient

This term refers to a numerical value rounded off to the third decimal place, which is calculated by the following equation, based on the results of the dynamic and static friction test.

$$\mu = \frac{T}{2 \cdot n \cdot r \cdot P \cdot A} \dots\dots\dots(1)$$

where, μ : friction coefficient

T : friction torque

n : number of friction plates (=3)

r : average friction effective radius (=57.4 mm)

P : surface pressure applied to the friction surface of the friction plate by a press load (=785 kPa)

A : friction area of friction plate (=4,434 mm²)

2.3.1 Dynamic friction coefficient

- a) μ_d : The dynamic friction coefficient calculated by Equation (1) based on the friction torque T_d shown in **Figure 1** in the dynamic friction test
- b) μ_0 : The dynamic friction coefficient calculated by Equation (1) based on maximum torque T_0 at 200 r/min or under shown in **Figure 1** in the dynamic friction test

2.3.2 Static friction coefficient

- a) μ_t : The static friction coefficient calculated by Equation (1) based on the stable torque T_t , 2 seconds after the start of dragging shown in **Figure 2** in the static friction test
- b) μ_s : The static friction coefficient calculated by Equation (1) based on the peak torque T_s after the start of dragging shown in **Figure 2** in the static friction test

2.4 Braking time t

In **Figure 2**, the time required from the point at which 30% of the specified pressure for applying the press load is applied to the point at which the rotational speed decreases to 60 r/min.

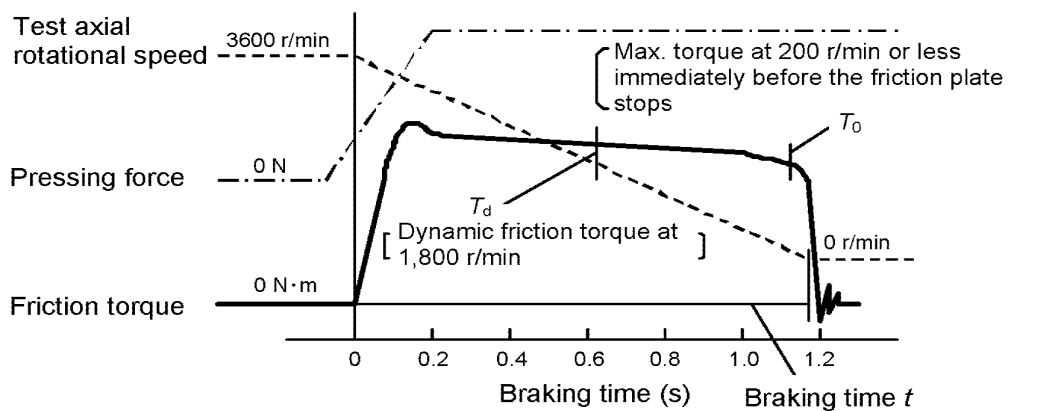


Figure 1 Dynamic friction test (measurement example)

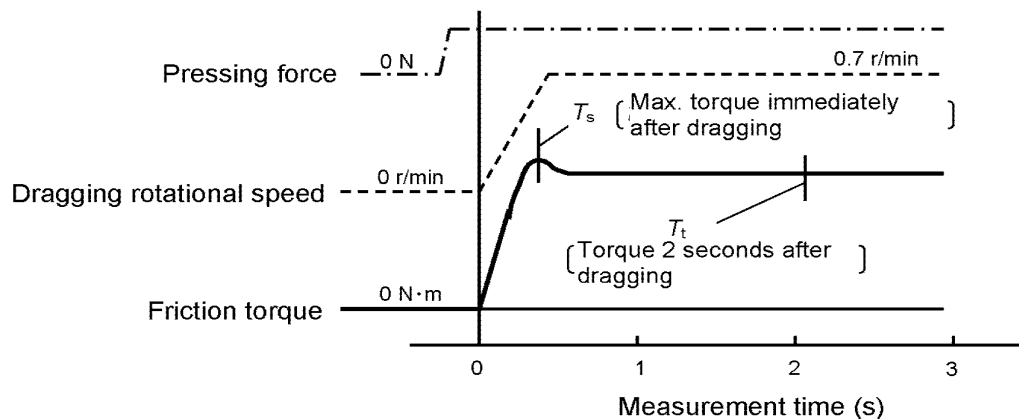


Figure 2 Static friction test (measurement example)

3. Test method

3.1 Test machine

A **SAE No.2** test machine with the structures shown in **Figures 3** and **4** consisting of the following components shall be used.

a) Electric motor for dynamic friction test

An electric motor having sufficient output and that can be used repeatedly up to and above the test rotational speed

b) Electric motor for static friction test

An electric motor having sufficient output and that can be used repeatedly up to and above the test rotational speed

c) Inertia disk

A disk having the specified moment of inertia and that can be installed on the axis of the electric motor for the dynamic friction test

d) Piston for press load

A piston with a structure that applies press load on both plates by air pressure or the like

e) Plate retainers

Retainers with an attached-plate structure that are located at the axis of the electric motor for the dynamic friction test and at the casing

f) Thermocouple for measuring oil temperature

A thermocouple that can measure the temperature of the test oil

g) Load meter for measuring friction force

A meter that can measure the torsional load of the casing arm

h) Test oil chamber

A metal chamber that is equipped with a piston for the press load, a plate retainer, and a thermocouple for measuring the oil temperature