Friction Measuring Apparatus 1009942

Instruction sheet

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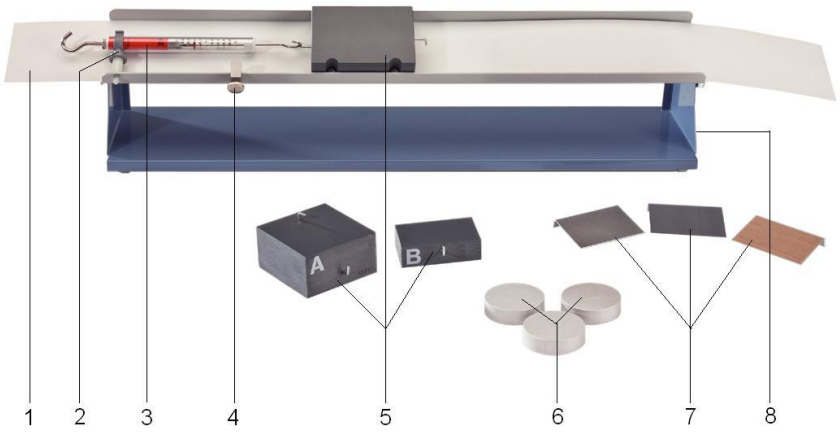

1 Friction surface
2 Clamp for dynamometer
3 Dynamometer
4 Stopper for the friction bodies
5 Friction bodies
6 Additional weights
7 Sliders
8 Protractor

1. Description

The friction measuring apparatus is used to measure static and rolling friction between different kinds of surfaces.

A friction track in the form of a mounted, rotating U-shaped structure made of aluminium serves as the basis for the experiments. Between the friction bodies and the friction plane, there is a long, inlaid friction surface made of plastic, which can be pulled at a uniform velocity. At the opposite end, a dynamometer is horizontally clamped to the friction track. The dynamometer shows the frictional forces between the surfaces, resulting from the movement of the sliding friction surface.

When the friction surface begins to move, the body resting upon it experiences static friction and is dragged along with the sliding surface. As the sliding friction surface continues to be moved at uniform velocity, the static friction changes to sliding friction and the friction body remains at a state of rest relative to the friction plane.

The friction bodies have surfaces of different areas and degrees of roughness. This makes it possible to investigate the influence the area of contact and the nature of the surface has on the frictional forces.

It is possible to vary the angle of the friction track, thereby creating an incline to the horizontal plane. In this way, the normal force with which the friction body acts upon the particular surface can be made to vary.

2. Scope of delivery

1 Friction plane
1 Friction body A
1 Friction body B
1 Friction body C
1 Sliding friction surface
1 Dynamometer
1 Stopper for the friction bodies
1 Sliders, rubber-coated
1 Sliders, Teflon-coated
1 Sliders, uncoated
3 Additional weights, 100 g

3. Technical data

Friction track

U-shaped track:	600 x 80 x 20 mm³
Protractor:	0° – 60°

Sliding friction surface

Material:	PVC, smooth on one side and coarse on the other side
Length:	850 mm

Friction body A

Dimensions:	79 x 38 x 73 mm³
Material:	PVC
Surface:	Uncoated
Surface area ratio:	2:1
Weight:	325 g approx.
Fastening rings:	2

Friction body B

Dimensions:	73 x 20 x 47 mm³
Material:	PVC
Surface:	Coated with velour paper
Weight:	100 g approx.

Additional weights

Design:	To fit friction body B
Weight:	100 g

Sliders

Design:	To fit friction body B
Material:	Aluminium
Surface:	Rubber-coated (No. 1), Teflon-coated (No. 2), Uncoated (No. 3)
Dimensions:	55 x 55 x 15 mm³

Friction body C

Dimensions:	75 x 31 x 105 mm³
Surface:	Coated with velour paper
Weight:	325 g
Securing rings:	2
Castors:	2, ball-bearings

Dynamometer

Measuring range:	2 N, tension and compression

4. Set-up

- Secure the dynamometer by means of the clamp.
- Attach a stopper for the friction body to the U-shaped track (the stopper prevents any sudden recoil of the friction body that might arise as the sliding friction surface is pushed back.)

5. Measurements conducted on a horizontal friction plane

- Align the friction track so that the pointer on the protractor is in the zero position.
- Insert the sliding friction surface into the friction track either with its smooth or coarse facing down. Then place a friction body onto the sliding friction surface. (See Fig. 1 and Fig. 2.)

5.1 Static friction

- Pull the sliding friction surface, making sure it is displaced with a uniform motion.
- Read the maximum value from the dynamometer while the friction body is still being dragged along with the sliding friction surface.
- Perform this measurement on several occasions and calculate the average.

This value represents a measure of the static frictional force.

5.2 Sliding friction

- Conduct measurements as described under 5.1. However, take the reading on the dynamometer as soon as the friction body has stopped moving along with the sliding friction surface.
- Perform this measurement on several occasions and calculate the average.

This value represents a measure of the sliding frictional force.

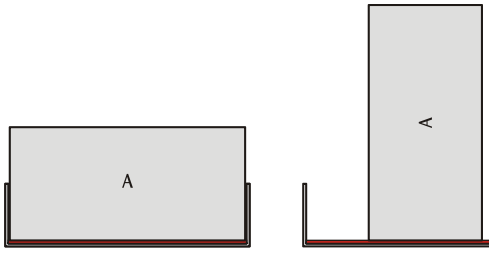

Fig. 1: Investigation of static and sliding friction with friction body A with two different contact areas.

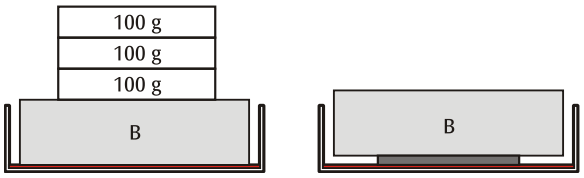

Fig. 2: Investigation of static and sliding friction with friction body B with different weights (left) and different materials constituting the contact surface, in that a different surface coating is glued to the sliders (right)

6. Measurements conducted when the friction plane is at an incline

The friction track can be inclined by an angle φ from the normal. As a result, the normal force F_N exerted by a weight G changes according to the equation: $F_N = G \cdot \cos\varphi$.

- Align the friction surface so that the pointer of the protractor is set to the desired inclination (0 – 60°).
- Insert the sliding friction surface into the friction track either with its smooth or coarse facing down.
- Place friction body C onto the sliding friction surface so that the castors on the narrow side face downwards towards the track wall (see Fig. 3).

6.1 Static friction

- Pull the sliding friction surface, making sure it is displaced with a uniform motion.
- Read the maximum value from the dynamometer while the friction body is still being dragged along with the sliding friction surface.
- Perform this measurement on several occasions and calculate the average.

This value represents a measure of the static frictional force.

6.2 Sliding friction

- Conduct measurements as described under 6.1. However, take the reading on the dynamometer as soon as the friction body has stopped moving along with the sliding friction surface.
- Perform this measurement on several occasions and calculate the average.

This value represents a measure of the sliding frictional force.

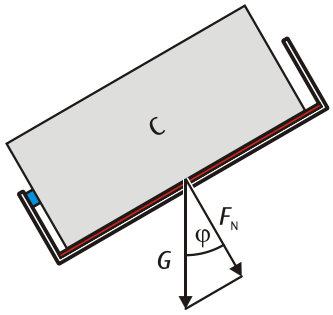

Fig. 3: Measurements conducted with friction body C when the friction track is inclined

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