



## Munro Stanley Portable Skid Resistance Tester

The Portable Skid Resistance Tester – also known as the British Pendulum Tester – was originally designed in the 1940s by Percy Sigler to measure the slip resistance of floors in government buildings. During the late 1950s the instrument was adopted and redesigned by the Road Research Laboratory (now known as the Transport Research Laboratory, TRL). Although basically unchanged, W F Stanley, now part of Munro Instruments Limited, has continually refined and improved the original design.

The instrument is used to study problems in the design and maintenance of public highways and to test the frictional resistance of new roads, road markings and iron works. It is also used to measure slip potential on pedestrian surfaces. Research by the Health and Safety Executive (HSE) has identified that in excess of 90% of slipping accidents in the UK occur on smooth, wet floors.

The Portable Skid Resistance Tester is regularly used to test the slip resistance of pedestrian walkways in offices, shopping malls, factories, airports and sports facilities – both at the design stage and in the investigation of accidents.

The Portable Skid Resistance Tester is based on the Izod principle. In operation, a pendulum of a known mass rotates about a vertical spindle. The head of the pendulum is fitted with a rubber slider with a specific hardness and resilience. When released from a horizontal position, the pendulum head strikes the sample surface with a constant velocity. The distance travelled by the pendulum after striking the sample is determined by the friction resistance of the sample surface. The Pendulum Test Value (PTV) is read directly from the clearly engraved scale.



# ***LAB Online Exhibition***



## Contents

1.0	Assembling the Tester.....	4
2.0	Setting the Tester.....	5
3.0	Rubber Sliders .....	9
3.1	Rubber Slider Storage.....	9
3.2	Slider Preparation.....	10
3.3	Pendulum Verification .....	12
4.0	Road Surface Tests.....	13
4.1	Test Method.....	13
4.2	Gradients .....	13
4.3	Factors affecting results .....	13
4.4	Suggested Minimum PTV (Wet Conditions).....	14
5.0	Testing Floor Surfaces (Slip Resistance).....	15
5.1	Scope.....	15
5.2	Selection of Test Site.....	15
5.3	Test Areas.....	15
5.4	Roughness Measurements .....	16
5.5	Profiled Floors .....	17
5.6	Test Procedure .....	17
5.6.1	Dry Conditions.....	17
5.6.2	Wet Conditions .....	17
5.7	Calculations.....	17
5.8	Temperature Corrections .....	18
5.9	Test Reports.....	18
5.10	Interpretation of Results .....	18
6.0	Laboratory Testing of Floor Materials (Slip Resistance) .....	19
6.1	Scope.....	19
6.2	Preparing the Test Sample.....	19
6.3	Test Conditions .....	19
6.5	Test Areas.....	20
6.6	Assembling and Setting the Tester .....	20

6.6	Test Procedure .....	20
6.6.1	Dry Conditions .....	20
6.6.2	Wet Conditions .....	20
6.7	Calculations.....	20
6.8	Interpretation of results .....	20
7.0	Determination of Polished Stone Value (PSV) .....	21
7.1	Scope.....	21
7.2	Laboratory Base Plate .....	21
7.3	Small Rubber Sliders .....	21
7.3.1.	Small Rubber Slider Storage.....	21
7.3.1.	Small Rubber Slider Preparation.....	22
7.4	Preparation of Test Specimens.....	22
7.5	Test Procedure .....	22
8.0	Maintenance, Servicing & Calibration .....	22
9.0	Warranty .....	23
10.0	Disclaimer.....	23

# 1.0 Assembling the Tester

- 1.1 Remove the main body of the instrument from the case. Fasten the hinged rear leg into position using the spanner provided.
- 1.2 Attach the pendulum arm to the rotating head, ensuring the location pin is engaged. Tighten the adaptor nut using the C-spanner provided.



- 1.3 Position the instrument on the test surface. Use the spirit level and the three levelling screws to set the tester. Knurled spring-loaded locking nuts are provided to allow adjustment of the levelling screw tension.

On floor surfaces, rubber pads or Spreader Feet should be placed under the levelling screws. This is to prevent the instrument from moving when the pendulum is released. It will also prevent damage to soft flooring.

A weight (minimum 6 kg) should be placed on the rear leg to ensure extra stability.

The tester may be used on sloping surfaces providing that the slope can be accommodated within the adjustment range of the levelling screws.

When preparing the rubber sliders, verifying the instrument or testing samples in the laboratory, a Sample Holder is required. This must be secured to a rigid horizontal surface.

## 2.0 Setting the Tester

- 2.1 Raise the head unit so that the pendulum arm swings clear of the surface. The head unit comprises the pendulum arm, graduated scale, pointer and release mechanism. Movement of the head unit is controlled by a rack and pinion on the rear of the vertical column. After unclamping the locking knob, the head unit can be raised or lowered by turning the vertical movement control knobs. When the required height is obtained, the head unit must be locked into position by tightening the locking knob.



- 2.2 Check the zero setting. Raise the pendulum arm to the horizontal release position on the right hand side of the apparatus. In this position it is automatically locked into the release catch. The pointer should then be brought round so that it is in line with the pendulum arm.

The pointer arm is released by pressing the button. The pointer is carried with the pendulum arm on the forward swing only. Catch the pendulum arm on its return swing and note the pointer reading. Return the pendulum arm to the release position.

- 2.3 As the pendulum arm has not come into contact with the test surface, a result of zero (0) should have been achieved. If this is not the case, adjustment can be made using the knurled friction rings.

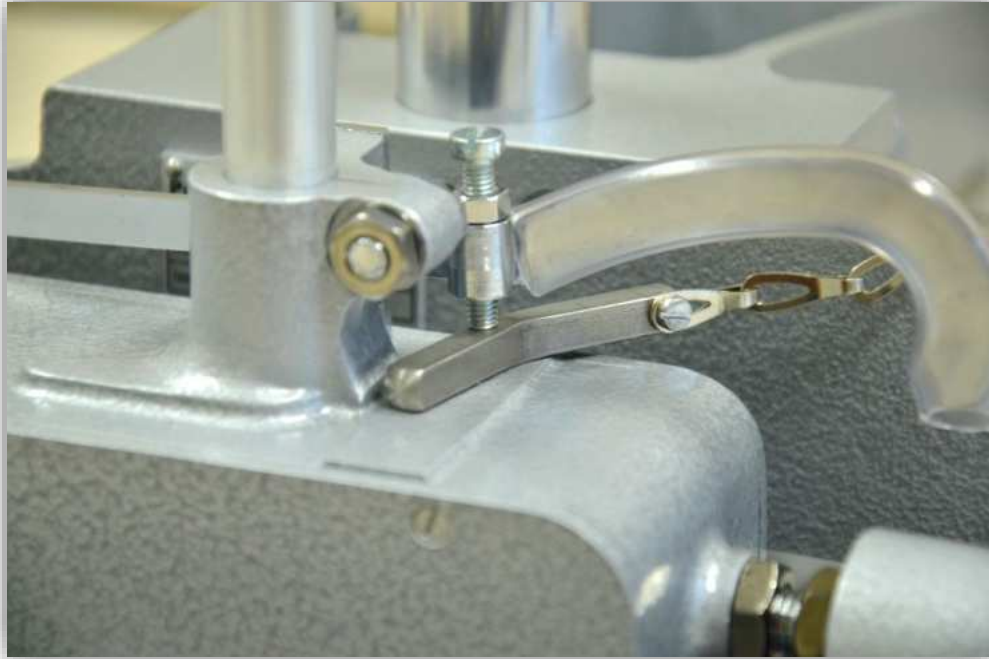
If the pointer swings past the zero position, the friction rings should be tightened. If the pointer does not reach zero, the friction rings should be loosened.

Repeat this procedure until three consecutive zero readings are obtained.

**Note:** There are two knurled friction rings. The outer friction ring must be unlocked before the inner friction ring can be adjusted.



- 2.4** With the pendulum arm free and hanging vertical, place the setting spacer under the slider lifting handle setting screw to raise the rubber slider. The spacer can be found attached by a chain to the rear leg. Unclamp the locking knob and lower the head unit using the vertical movement control knobs until the rubber slider just touches the test surface. Clamp the head unit in position using the locking knob. Remove the spacer. The *approximate* sliding length has now been set.



- 2.5** The sliding length (or ‘footprint’) is the distance that the rubber slider travels whilst in contact with the test surface. It is measured using the Perspex Setting Gauge.

To accurately set the sliding length, gently lower the pendulum arm until the rubber slider just touches the surface. Position the Perspex Setting Gauge so that the single line (datum) is in line with the back edge of the metal slider plate. Then, using the lifting handle, continue moving the pendulum arm from right to left. Release the lifting handle and gently bring the pendulum to rest on the second point of contact (on the left hand side). This should be between the two lines on the right hand side of the Setting Gauge.

**Note:** Using the lifting handle will prevent undue wear of the rubber slider.

If necessary, adjust the sliding length by raising or lowering the head unit. When using large rubber sliders, the sliding length should be  $124 \pm 1$  mm. If small rubber sliders are being used, the sliding length should be 76 mm.

**Note:** The outer marks on the Perspex Setting Gauge are 125 mm apart; the two marks on the left-hand side indicate the 2 mm tolerance allowed. The distance between the right-hand mark and the middle mark is 76 mm.

The sliding length should be measured on the trailing edge of the metal slider plate, not the rubber itself.

- 2.6** Raise the pendulum arm so that it is in a horizontal position and locked into the release mechanism. The instrument is now ready for use.



Munro Instruments, 44-45 Burnt Mill, Elizabeth Way, Harlow, Essex, CM20 2HU, UK  
Email [info@munroinstruments.com](mailto:info@munroinstruments.com) Phone +44 (0) 20 8551 7000 [www.munroinstruments.com](http://www.munroinstruments.com)  
Registered in England 06965050 Vat: GB 977 7939 30.

## 3.0 Rubber Sliders

Munro Instruments supplies three different types of rubber slider. The rubber slider that you use will depend on the test surface and the application.

**TRL(55) Rubber Slider:** This rubber slider has a hardness of 55±5 IRHD. It is specially designed to replicate the tyre of a car. It is normally used to test rough surfaces used by vehicles (roads, motorways, runways etc.).

The TRL(55) Rubber Slider is also used in areas used by barefoot pedestrians such as swimming pools, bathrooms and changing rooms.

Temperature	0°C	10°C	20°C	30°C	40°C
Lüpke Resilience	43-49	58-65	66-73	71-77	74-79
IRHD	55±5				

**CEN Rubber Slider:** This rubber slider has a hardness of 53 to 65 IRHD and is used to test rough surfaces.

**4S(96) Rubber Slider:** This rubber slider has a hardness of 96±2 IRHD. It is most commonly used to test smooth surfaces such as internal flooring, wooden flooring, ceramic tiles, as well as other walkways used by shod pedestrians.

Temperature	5°C	23°C	40°C
Lüpke Resilience	21±2	24±2	28±2
IRHD	96±2		

### Choosing the Correct Size

Munro Instruments supplies Rubber Sliders in two different sizes:

- Large (Dimensions of 76mm x 25.4mm x 6.35mm)
- Small (Dimensions of 31.75mm x 25.4mm x 6.35mm)

Large Rubber Sliders are used for most applications. They should be used for all tests that do not require the Detachable Scale.

Small Rubber Sliders are designed to be used in conjunction with the Detachable Scale (e.g. for Polished Stone Value (PSV) testing). In exceptional cases, they may also be used if there is insufficient space on the test surface for large rubber sliders.

## 3.1 Rubber Slider Storage

Rubber Sliders have a shelf life of 12 months. They should be stored in the dark in stable environmental conditions (preferably below 20±5°C).

Munro Instruments, 44-45 Burnt Mill, Elizabeth Way, Harlow, Essex, CM20 2HU, UK  
 Email [info@munroinstruments.com](mailto:info@munroinstruments.com) Phone +44 (0) 20 8551 7000 [www.munroinstruments.com](http://www.munroinstruments.com)  
 Registered in England 06965050 Vat: GB 977 7939 30.

## 3.2 Slider Preparation

Rubber Sliders must always be clean and free from contamination. Preparation of Rubber Sliders is crucial to ensure good reproducibility of results. It ensures that each slider begins the test in the same condition. Failure to follow this procedure may affect the validity of your results. This should be carried out in accordance with the relevant test standard.

The following equipment will be required to prepare your rubber sliders before use:

- Sample Holder
- Float Glass
- P400 Conditioning Paper
- Green Lapping Film (if using a TRL(55) Rubber Slider)
- Pink Lapping Film (if using a 4S(96) Rubber Slider)
- Water Spray Bottle

The exact preparation procedure required depends on two factors:

- The type of rubber slider: TRL(55) or 4S(96);
- Whether the rubber slider has been previously used or not.

### Preparing New Rubber Sliders

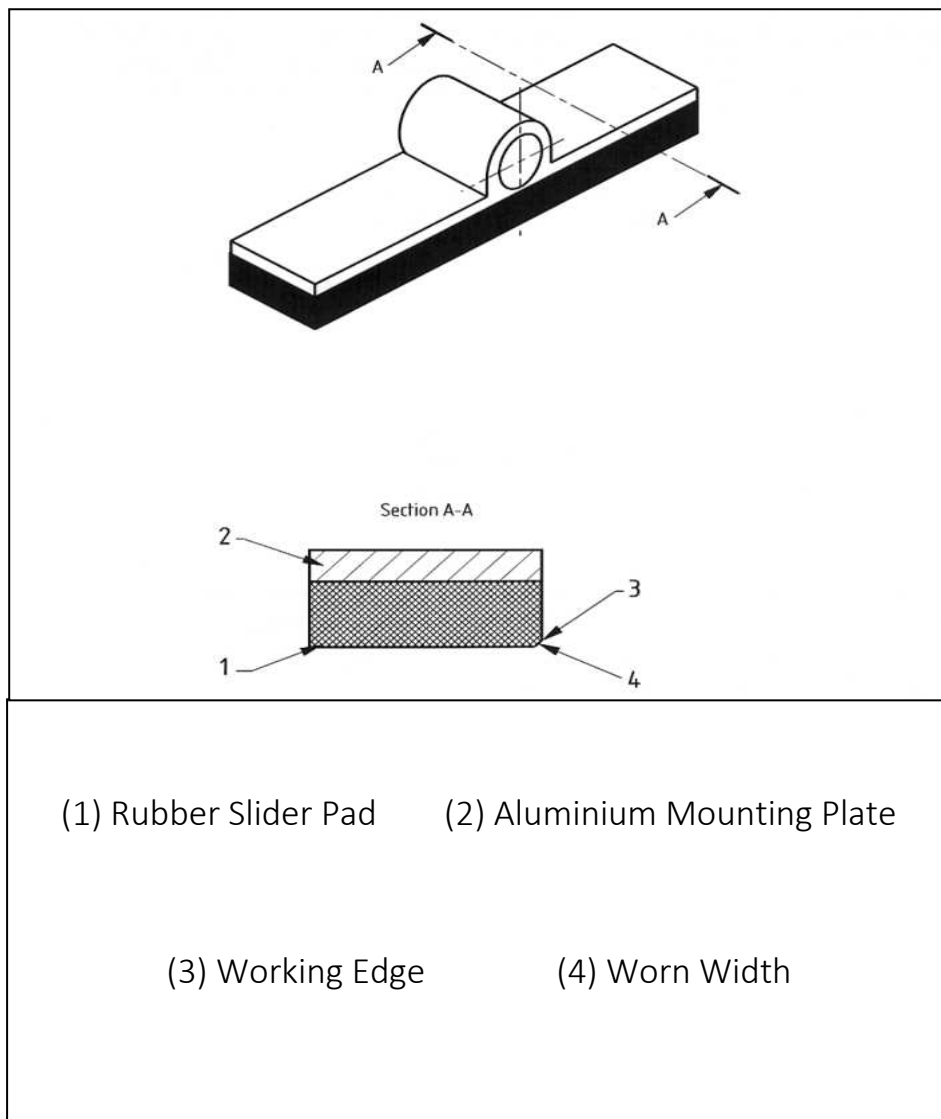
1. Fit the rubber slider to the foot of the pendulum arm.
2. Place a piece of clean float glass in the sample holder.
3. Securely fix a piece of P400 Paper on top of the float glass using the sample holder clip.
4. Set the sliding distance ('footprint') [see section 2.5].
5. Carry out 10 Swings across the P400 paper, reset the footprint and then carry out a further 10 swings. There is no need to record the results.
6. Replace the P400 paper with an unused piece of lapping film (matt side up). Reset the footprint. Spray the surface of the lapping film with water (this should be repeated between each swing). Carry out 20 swings across the lapping film.
  - If using 4S(96) Rubber Sliders pink lapping film should be used
  - If using TRL(55) Rubber Sliders green lapping film should be used
7. Wipe the rubber slider dry. Ensure that all burrs have been removed from the profiled edge of the rubber. You are now ready to verify the Pendulum Tester.

### Preparing Used Rubber Sliders

1. Clean the rubber slider with a paper towel to remove any contamination from previous testing.
2. Place a piece of clean float glass in the sample holder.
3. Securely fix a piece of P400 Paper on top of the float glass using the sample holder clip.
4. Set the footprint

5. Carry out a minimum of 3 swings across the P400 paper. The purpose of this is to eliminate any surface imperfections arising from previous testing.
6. Replace the P400 paper with an unused piece of lapping film (matt side up). Reset the footprint. Spray the surface of the lapping film with water (this should be repeated between each swing). Carry out 20 swings across the lapping film.
  - If using 4S(96) Rubber Sliders pink lapping film should be used
  - If using TRL(55) Rubber Sliders green lapping film should be used
7. Wipe the rubber slider dry. You are now ready to verify the pendulum tester.

**Please Note:** The working edge of the rubber slider should not exceed 4 mm. Once this threshold has been exceeded, a new rubber slider, or the other edge, should be used. Please also note that rubber sliders should be replaced after 12 months, regardless of the working edge.



### 3.3 Pendulum Verification

The Pendulum Tester should be verified at the start of each day of testing and after re-assembly or transportation. The verification procedure is an extremely important part of the testing procedure. It demonstrates to you, and all those making use of your results, that the instrument has been set up correctly and is functioning properly.

Verification is achieved by performing tests on a number of well-defined surfaces with a known Pendulum Test Value (PTV). These are given in the table below:

	<b>TRL(55) Rubber Slider</b>	<b>4S(96) Rubber Slider</b>
<b>Pink Lapping Film</b>	N/A	59-64 PTV
<b>Float Glass</b>	5-10 PTV	5-10 PTV
<b>Pavigrés Tile</b>	13-19 PTV	32-36 PTV

If these values are not obtained, you must not proceed with testing. The pendulum set-up procedure (including slider conditioning) should be re-performed, and the rubber slider should be checked for defects. If you continue to experience difficulties verifying your instrument, please contact Munro Instruments for further assistance.

## 4.0 Road Surface Tests

**NOTE: Testing should be carried out in accordance with the relevant standard or guidelines. However, where no standard or guidelines exist, we suggest the following procedure.**

### 4.1 Test Method

1. Inspect the road. The surface should be free of debris and contamination, unless this is required as a test variable (e.g. investigation of skid resistance following an accident).
2. Assemble and set the Pendulum Tester as described above in sections one and two. The pendulum should swing in the direction of the traffic. The surface should not have a gradient in excess of 10%. On surfaces with a regular pattern, such as ridged or brushed concrete, the rubber slider should strike the surface at an angle of approximately 80° to the ridges or grooves.
3. Condition the rubber slider (see section 3.2).
4. Verify the instrument (see section 3.3).
5. Measure the temperature of the test surface, the rubber slider and the water for wetting the surface. The temperature should be within the range 0°C to +40°C.
6. Wet the test surface. This should be repeated after each swing of the pendulum.
7. Perform at least five swings of the pendulum. Record the results and take the mean/median.

**NOTE: Some test methods require a different number of swings and a different calculation of the PTV. Follow the test standard closely.**

8. The slipperiness of some roads varies considerably across the width the road. Multiple tests should be carried out within the same area for a better understanding of the skid resistance.

### 4.2 Gradients

The Pendulum Tester is capable of performing tests on steep gradients and in the presence of crossfall. Sufficient levelling adjustment can be made for gradients of up to 10% (5.74°).

### 4.3 Factors affecting results

The PTV should be interpreted with due consideration for all factors (including environmental conditions) that could affect the skid resistance at the time of test:

- a) The swing of the pendulum is intended to correlate with the performance of a vehicle with patterned tyres braking with locked wheels on a wet road at 50 km/h. Additional methods may be required to measure high-speed performance.
- b) The skid resistance depends on the roughness of surface macro-texture. Smooth surfaces generally have a much lower skid resistance. Always take into account the appearance of the road and the surface texture.
- c) The skid resistance is generally (but not always) higher in winter than in summer. The date of the test and the environmental conditions should always be recorded.
- d) Temperature can affect rubber resilience and surface micro-texture. Slight adjustment to the PTV may be required depending on the temperature. See table below (reproduced from BS EN 13036-4:2011).

**Correction of PTV when the test is carried out at other than 20°C when using slider 57 [or TRL(55)]**

Slider Temperature (°C)	Correction applied to measured value (PTV)
36 to 40	+3
20 to 35	+2
23 to 29	+1
19 to 22	0
16 to 18	-1
11 to 15	-2
8 to 10	-3
5 to 7	-4

**NOTE: No temperature correction is required when using a 4S(96) Rubber Slider.**

- e) The skid resistance can vary across the width of the road. Care should be taken when selecting the test location. Always record the exact position of the test for future reference.

## 4.4 Suggested Minimum PTV (Wet Conditions)

Category	Type of Site	Minimum PTV (Wet Surface)
A	E.g. i. Roundabout ii. Bends with radius less than 150 m on unrestricted roads iii. Steep gradients iv. Approaches to traffic lights in unrestricted roads	65

B	Motorways, trunk and class 1 roads, heavily trafficked roads in urban areas (more than 2000 vehicles per day)	55
C	All other sites	45

## 5.0 Testing Floor Surfaces (Slip Resistance)

**NOTE: Testing should be carried out in accordance with the relevant standard or guidelines. However, where no standard or guidelines exist, we suggest the following procedure.**

### 5.1 Scope

This section covers the procedure for the on-site measurement of slip resistance on floors and flooring materials used by pedestrians. This procedure may not be appropriate for sports surfaces, stairs or roads used by vehicular traffic. Please consult the appropriate standard or guideline for these surfaces. In all cases, it is imperative that proper contact between the rubber slider and the test surface is achieved (along the whole working edge). Extra care should be taken on profiled or uneven floor surfaces.

### 5.2 Selection of Test Site

A variety of factors must be taken into account. These include:

- The amount of pedestrian traffic (e.g. a doorway).
- An area close to a source of contamination (e.g. a vending machine)
- Unused areas (e.g. behind a door)

If there has been an accident, it is best obtain results as soon as possible after the event, preferably before any cleaning has taken place. If this is not possible, it must be clearly stated on the report that the conditions at the test site may not be the same as those at the time of the accident.

### 5.3 Test Areas

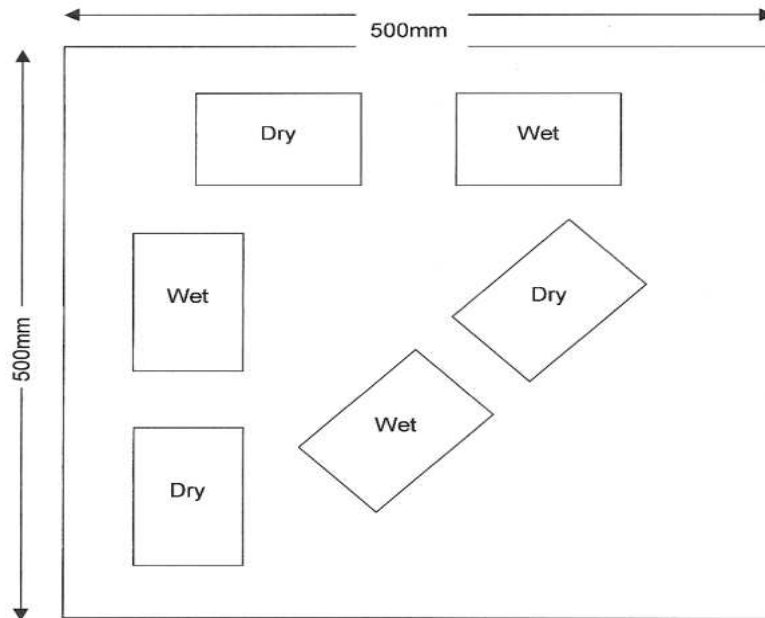
At least six test areas (150 mm x 100 mm or greater) are required to accommodate wet and dry measurements.

The test sequence on an area should consist of:

1. Slider preparation / re-preparation
2. Dry test in direction 1
3. Dry test in direction 2 (90° to direction 1)
4. Dry test in direction 3 (45° to direction n2)

5. Wet test in direction 1
6. Wet test in direction 2 (90° to direction 1)
7. Wet test in direction 3 (45° to direction 2)

**Note: Each test area should be used only once.**



## 5.4 Roughness Measurements

Surface roughness may improve slip resistance in wet conditions. Surface irregularities can break up a water film, helping to establish contact with the shoe sole or heel. Peaks are more helpful than troughs in this respect.

Surface roughness measurements are not a definitive guide to slip resistance, but they help to give a better understanding of the micro-properties of a surface. Wherever possible, the roughness meter should be used alongside the Pendulum Tester.

Research suggests that hard floors require a higher Rz roughness than polymeric floors to achieve the same degree of safety in wet conditions. A Rz roughness of 10 µm should be considered a minimum value for all flooring surfaces. In areas where wetness is normal or expected, this figure may need to be slightly higher.

## 5.5 Profiled Floors

Floor surfaces intended for installation in wet areas, such as swimming pool surroundings, are often profiled. The profiling serves two purposes: first, it helps to drain water away; second, it enables soft shoe/heel materials or bare feet to deform and obtain a better grip.

While, in general, profiled floors in wet or contaminated conditions are safer than flat floors, this is not universally the case. Some profiled floors, particularly those with rounded profiles, can be very slippery in wet conditions.

## 5.6 Test Procedure

### 5.6.1 Dry Conditions

1. Assemble and set the Pendulum Tester as described above in sections one and two.
2. Using the thermometer provided, measure and record the temperature of the test surface.
3. Unless the surface is being tested in contaminated condition ('as found'), thoroughly clean and dry the test surface. For dry testing, it is essential that the surface and the rubber slider are completely free from water, contamination and cleaning products.
4. Place the pendulum arm in the release catch. Bring the pointer round so that it is in line with the pendulum arm. Release the pendulum arm by pressing the button and catch it on its return swing. Record the reading.
5. Lift the handle, ensuring that the rubber slider does not come into contact with the test surface, and return the pendulum arm to the release catch. Perform eight swings in total (or as many as is described by the appropriate standard).
6. After conducting the test, raise the head unit so that the pendulum arm swings freely without touching the test surface. Check the zero setting for error. If the zero setting is incorrect, adjust the unit as described in section 2.3 and repeat the test procedure.

### 5.6.2 Wet Conditions

The test method for wet testing is the same as 5.6.1, but the test surface must be thoroughly wetted before each swing of the pendulum.

## 5.7 Calculations

The PTV can be calculated in various ways. The number of swings required and the type of average calculation will be specified by the relevant standard or guideline. This should be followed closely.

Munro Instruments, 44-45 Burnt Mill, Elizabeth Way, Harlow, Essex, CM20 2HU, UK  
Email [info@munroinstruments.com](mailto:info@munroinstruments.com) Phone +44 (0) 20 8551 7000 [www.munroinstruments.com](http://www.munroinstruments.com)  
Registered in England 06965050 Vat: GB 977 7939 30.

## 5.8 Temperature Corrections

Temperature can affect rubber resilience and surface micro-texture. Slight adjustment to the PTV may be required depending on the temperature. See table below (reproduced from BS EN 13036-4:2011).

**Correction of PTV when the test is carried out at other than 20°C when using slider 57 [or TRL(55)]**

Slider Temperature (°C)	Correction applied to measured value (PTV)
36 to 40	+3
20 to 35	+2
23 to 29	+1
19 to 22	0
16 to 18	-1
11 to 15	-2
8 to 10	-3
5 to 7	-4

**Note: No temperature correction is required for 4S(96) Rubber Sliders.**

## 5.9 Test Reports

The test report should contain the following information as a minimum:

- Number, description and date of the applicable standard
- Location of the site and a drawing showing the position(s) of the tests
- Description of the test surface
- Temperature of the test surface
- Slider material and batch number
- Verification results
- PTV value obtained at each position
- Operator's name and organisation

## 5.10 Interpretation of Results

As a guide, the UK Slip Resistance Group (UKSRG) advise the following slip potential classifications:

Slip Potential	PTV
High	0-24
Moderate	25-35
Low	36+

All surface characteristics should be taken into account before a final categorisation is reached.

These include gradient, directional properties of the surface (e.g. profiling), the effect of wear and polishing over time, the possibility of surface contamination, floor maintenance and cleaning

Munro Instruments, 44-45 Burnt Mill, Elizabeth Way, Harlow, Essex, CM20 2HU, UK  
 Email [info@munroinstruments.com](mailto:info@munroinstruments.com) Phone +44 (0) 20 8551 7000 [www.munroinstruments.com](http://www.munroinstruments.com)  
 Registered in England 06965050 Vat: GB 977 7939 30.

routines etc. Pedestrian surfaces installed on a slope require a higher PTV than that of an adjacent horizontal surface if consistent slip resistance is to be maintained.

## 6.0 Laboratory Testing of Floor Materials (Slip Resistance)

**NOTE: Testing should be carried out in accordance with the relevant standard or guidelines. However, where no standard or guidelines exist, we suggest the following procedure.**

### 6.1 Scope

This section covers the procedure for the measurement of slip resistance of flooring materials (tiles, floor samples etc.) in the laboratory. The main parameters to consider are the friction between the rubber slider and the floor surface in wet conditions and the surface roughness of the flooring materials.

In some instances, where the surface roughness of the flooring materials is below 15  $\mu\text{m Rz}$ , a true reading of the wet slip resistance may not be obtained, as the surface roughness of the 4S(96) Rubber Slider is greater than that of the flooring material and inhibits the formation of a water film.

In all cases, it is imperative that proper contact between the working edge of the rubber slider and the test surface is maintained throughout the contact length.

### 6.2 Preparing the Test Sample

Laboratory tests are usually carried out on new flooring products as supplied by the manufacturer, or samples of flooring materials removed from a site. All samples should be placed on a clean, flat bench, covered with clean tissue and conditioned at  $23\pm 2^\circ\text{C}$  and ambient humidity for a minimum of 16 hours before testing.

At the time of testing, the sample should be flat. It should be securely restrained using a Sample Holder or, if this is not available, with adhesive tape, clamps, weights or other means.

### 6.3 Test Conditions

Initial tests should be performed 'as received'. Once these tests are complete, the sample can be wiped with a clean, dry industrial towel. Other methods of cleaning the test sample, such as washing, may be used as appropriate to the investigation. However, cleaning the sample with a solvent should be avoided unless this has been specifically recommended to remove sealer or oil-based contaminants.

The bench or table on which the tests are performed should be firm and stable. Any movement caused by the swing of the pendulum could affect the results.

## 6.5 Test Areas

Samples should be large enough for 6 tests without risk of overlap. The test sequence on a sample of flooring should consist of:

1. Slider preparation / re-preparation
2. Dry test in direction 1
3. Dry test in direction 2 (90° to direction 1)
4. Dry test in direction 3 (45° to direction n2)
5. Wet test in direction 1
6. Wet test in direction 2 (90° to direction 1)
7. Wet test in direction 3 (45° to direction 2)

If the test sample is grained, it may be necessary to perform additional tests to take into account the direction of the grain.

**Note: Each test area should be used only once.**

## 6.6 Assembling and Setting the Tester

Assemble and set the Pendulum Tester as described in sections one and two.

### 6.6 Test Procedure

#### 6.6.1 Dry Conditions

See section 5.6.1.

#### 6.6.2 Wet Conditions

See section 5.6.2.

### 6.7 Calculations

The PTV can be calculated in various ways. The number of swings required and the type of average calculation will be specified by the relevant standard or guideline. This should be followed closely.

### 6.8 Interpretation of results

See section 5.10 above.

When performing a laboratory test, due consideration should be given to the site where the sample will be installed. Pedestrian surfaces installed on a slope require a higher PTV than that of an adjacent horizontal surface if consistent slip resistance is to be maintained.

## 7.0 Determination of Polished Stone Value (PSV)

**NOTE: Testing should be carried out in accordance with the relevant standard or guidelines (e.g. BS EN 1097-8:2009). Where no standard or guidelines exist, we suggest the following procedure.**

### 7.1 Scope

This section covers the procedure for determining the Polished Stone Value (PSV) of an aggregate prepared beforehand using an Accelerated Polishing Machine. Samples should be prepared in accordance with the appropriate standard or guideline.

The Polished Stone Value gives a measure of the resistance of road-stone to the polishing action of vehicle tyres (as would occur on a road surface).

Where the surface consists largely of road-stone, the amount of polishing will be one of the factors affecting skid resistance. The actual relationship between PSV and skid resistance will vary depending on the volume of traffic, the type of surface and the environmental conditions. These factors should be taken into account when determining the PSV.

### 7.2 Laboratory Base Plate

The Base Plate is used to hold polished sample. It should be secured to a rigid, horizontal surface. The sample is then placed in the curved test specimen holder.

### 7.3 Small Rubber Sliders

Small Rubber Sliders are required for PSV testing (31.75 x 25.4 x 6.35 mm). They are used in conjunction with the Detachable Scale (F Scale) and Laboratory Base Plate.

The hardness and resilience of the Rubber Slider should conform to the specifications outlined in the table below:

Temperature	0°C	10°C	20°C	30°C	40°C
Lüpke Resilience	43-49%	58-65%	66-73%	71-77%	74-79%
Hardness (IRHD)	55±5	55±5	55±5	55±5	55±5

The Rubber Slider should always be clean and free from contamination.

#### 7.3.1. Small Rubber Slider Storage

The Rubber Slider should be stored in a constant environment ( $20\pm 5^{\circ}\text{C}$ ), preferably in the dark. The Rubber Slider should be withdrawn from use after 12 months, or once the working edges become excessively scored or rounded.

### 7.3.1. Small Rubber Slider Preparation

Preparation of the Rubber Slider is crucial and should be conducted in accordance with the appropriate standard. Where no standard exists, we suggest the following procedure to prepare new Rubber Sliders.

Swing the pendulum five times over the dry surface of a polished Criggion specimen, followed by twenty swings over the wetted surface.

Both working edges of the Rubber Slider can be used.

Keep the Criggion specimen used for conditioning Rubber Sliders apart from the Criggion calibration specimens.

## 7.4 Preparation of Test Specimens

The samples should be prepared in accordance with the appropriate standard or guidelines.

## 7.5 Test Procedure

**7.5.1** Place the Skid Resistance Tester on the Laboratory Base Plate and set the machine as described in section 2.0. Ensure that the pendulum swings parallel to the sides of the Base Plate.

**7.5.2** As PSV testing requires the use of small rubber sliders, the sliding distance should be 76 mm

**7.5.3** Wet the surface of the sample and perform the requisite number of swings. Note down the results and perform the relevant calculation to obtain the Polished Stone Value (PSV).

## 8.0 Maintenance, Servicing & Calibration

The Munro Stanley Portable Skid Resistance Tester is manufactured by hand at our premises in London, UK. It meets the requirements of all relevant international standards. These include (but are not limited to):

- BS 7976-2002: Method of Operation and Calibration of the Pendulum Tester
- BS EN 13036-4-2003/11: Road and Airfield Surface Characteristics. Method for measurement of slip/skid resistance of a surface. The Pendulum Test
- BS EN 1097-8:2009: Tests for mechanical and physical properties of aggregates. Determination of the polished stone value
- BS 812 pt. 114 [see BS 1097-8:2009]

- BS EN 1436:2007: Road Marking Materials. Road Marking Performance for Road Users
- BS 7188:1998: Impact Absorbing Playground Surfacing. Performance Requirements and Test Method
- ASTM E303 – 93 (2013): Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester
- AS 4586:2013: Slip Resistance Classifications for New Pedestrian Surface Materials
- AS 4663:2013: Slip Resistance Measurement of Existing Pedestrian Surfaces

We use high-grade metal castings to ensure that the instrument is strong, durable and not susceptible to de-calibration. Under normal service and use, a Munro Pendulum will last several decades.

However, as with all scientific instruments, servicing and calibration is necessary from time to time. Most international standards, as well as the UK Slip Resistance Group guidelines, advise that the instrument is calibrated on a yearly basis. This will ensure that the instrument continues to function correctly and provide accurate results.

## 9.0 Warranty

Munro Instruments guarantees its products to be free from defects in materials and workmanship (under normal use and service) for twelve months from the date of shipment unless specified otherwise.

## 10.0 Disclaimer

This instructions manual is intended as a user aid only. Every care has been taken to provide information that is reliable, up to date and free from error. Munro Instruments accepts no liability for the quality of results obtained, nor any damage that may occur as a result of misuse.