

The standard for motorcyclists' protective footwear

SIMON COURTNEY examines the EN 13634:2017 standard covering protective footwear for motorcycle riders.

Riders of motorcycles are highly vulnerable to injury in an accident, so it is important for them to wear a helmet, protective clothing and footwear that are designed to prevent or reduce the severity of any resulting injuries.

Aside from motorcycle helmets (which are covered by separate regulations) and products for leisure use that only protect against non-extreme weather conditions, all other protective wear for motorcyclists intended for the European market should

be assessed against the requirements of the Personal Protective Equipment (PPE) Regulation (EU) 2016/425.

Motorcyclists' footwear is intended to provide a degree of mechanical protection to the foot – and optionally the ankle and shin in accidents – without significantly reducing the rider's ability to control the motorcycle and operate the foot controls.

The particular hazards for motorcyclists who are involved in road

traffic accidents are falling from the motorcycle and suffering impacts with the road surface, their motorcycle, other road users or other obstacles. When impacting and sliding across the surface of the road, there is a significant risk of suffering abrasion. This type of damage is often called 'road rash', and can cause significant life-changing injuries if the rider is not adequately protected.

The standard includes test procedures and performance requirements for the



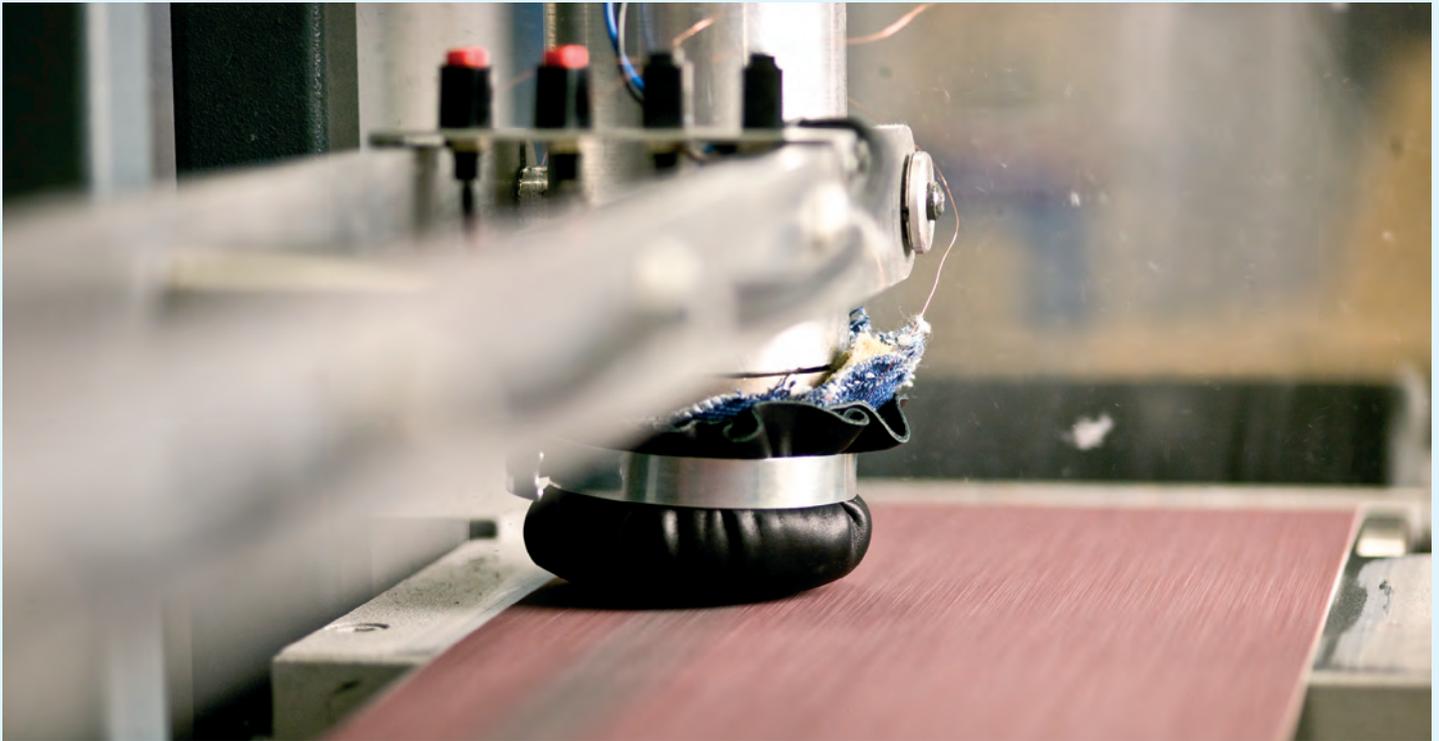


Figure 1: Testing a material's resistance to abrasion

specific protective properties for motorcycle riders' footwear that provide the wearer with a degree of protection from these hazards. The standard also contains a number of other component and whole shoe tests that are drawn from other footwear standards.

Two performance levels

EN 13634:2017 – 'Protective footwear for motorcycle riders. Requirements and test methods' contains two performance levels for the degree of protection provided to the wearer for four specific motorcycle footwear properties, which will be discussed later in this article. The standard also contains specific design requirements and a series of simple ergonomic assessments.

In terms of upper height, 'performance level 1' is the lower level of protection (for ankle boots) and 'performance level 2' is for boots of mid-calf height or higher, which are defined in terms of minimum heights within the standard. The standard also describes the levels in terms of the degree of protection given to the wearer, and that level 2 is for riders who feel that their riding style or sport exposes them to an increased accident risk. This increased protection has an increased penalty for weight and comfort, so may not be acceptable to all riders. The standard contains minimum height

requirements for each of the two performance levels and for a size range as measured at two locations. The first of these is from the wear surface of the outside to the top of the upper at its lowest point, which is usually at the rear of the boot. The second distance is from the top surface of the insole/insock to the highest point on the collar of the boot

The standard contains performance requirements for the footwear components, including the upper, lining, insole, insock and soling materials, and a number of whole footwear properties. The properties are tested in accordance with EN ISO 20344:2011 – 'Personal protective equipment. Test methods for footwear'. This standard is primarily used with the performance standards EN ISO 20345 for safety footwear, EN ISO 20346 for protective footwear, and EN ISO 20347 for occupational footwear. EN ISO 20344 contains a comprehensive list of testing procedures, which are referenced in the EN 13634 standard.

The upper sections of motorcycle footwear may be designed and constructed in such a way that they include several combinations of layers of upper, lining and padding material in different locations. For example, a boot's vamp region may comprise different materials to its padded collar region. It is therefore necessary to test all the layers

of materials that comprise the whole thickness of the boot, including any linings and padding materials in each combination.

Due to the size and shape of footwear components, it is usually difficult to take the necessary sized test specimens directly from the boot. Hence, the standard permits the use of sheets of the materials featured in the footwear.

Mandatory and optional tests

The standard contains both mandatory and optional requirements. The mandatory requirements cover components and the whole shoe, and five optional properties can be tested if the manufacturer wishes to make specific claims. These optional tests are impact protection to the shin and ankle, resistance to water penetration, resistance to fuel oil of the outsole, slip resistance of the outsole, and water vapour permeability of the upper. The inclusion of specific marking codes that inform the rider of these additional properties at the point-of-sale is permitted – see table 1.

Testing components

Tests on the upper, lining and insole components of the boot include pH value and for chrome VI content of any leather materials, as well as tear strength and



Figure 2: Assessing impact cut resistance

Table 1: EN 13634 optional performance requirements and marking codes		
Property	Standard	Code
Impact protection to the ankle	EN 13634:2017	IPA
Impact protection to the shin	EN 13634:2017	IPS
Resistance to water penetration	EN ISO 20345:2011	WR
Resistance to fuel oil of outsole	EN ISO 20345:2011	FO
Slip resistance of outsole	EN ISO 20345:2011	SRA, SRB or SRC
Permeable uppers	EN ISO 20345:2011	B
Insoles/insocks, Water absorption and desorption	EN 13634:2017	WAD

abrasion resistance for linings, and abrasion resistance and water absorption/desorption for insole boards. All materials must also be assessed for colour fastness to water. Specialised protective tests on the upper include an assessment of abrasion resistance (figure 1) and impact cut resistance (figure 2) using the tests defined in EN 13595. The outsole components of the footwear must be tested for resistance to abrasion and hydrolysis (if made from polyurethane), in addition to an assessment of strength of any interlayer bonds. There are also requirements for the design of the cleats and overall thickness of the outsole.

Specific motorcycle footwear tests

Impact abrasion resistance: One of the most common types of wound from a

motorcycle accident is an abrasion injury. This can be caused by the motorcyclist sliding across a rough road surface, thus causing abrasion damage to the skin and, in severe cases, into the underlying muscle tissue. If such an open wound becomes contaminated by dirt and grit, the treatment and healing process becomes far more prolonged and difficult. It therefore follows that one of the most important functions of motorcyclists’ PPE is to act as a protective layer to prevent open wounds being caused.

The impact abrasion test simulates what would happen during a real-life motorcycle accident when a rider falls from his or her machine and slides across the abrasive road surface at speed. The standard refers to the test method which is contained within

EN 13595-2:2002 – ‘Protective clothing for professional motorcycle riders. Jackets, trousers and one piece or divided suits. Test method for determination of impact abrasion resistance’. While this standard was designed to be used in testing apparel, the test method is also suitable for assessing footwear.

The test equipment incorporates a belt of a standard abrasive grit paper moving at a fixed speed over a horizontal surface, and a test head onto which the test materials are mounted. The test starts with the specimen being impacted against the moving abradant. These remain in contact until the sample is holed, which is indicated by an electric ‘trip’ wire underneath the test specimen being broken. The result reported is the time (in seconds) before holing occurs. To ensure consistent results, the abrasive power of the belt is assessed using two layers of a standard reference fabric and the specimen’s abrasion time is corrected accordingly.

Impact cut resistance: There is a risk of injury to a motorcyclist from impact with sharp items during an accident or even from road debris during normal riding. This may include broken sections of vehicles that would be sharp enough to penetrate the rider’s PPE and cause injury.

The standard refers to the test method which is contained within EN 13595-4: 2002 – ‘Protective clothing for professional motorcycle riders. Jackets, trousers and one piece or divided suits. Test methods for the determination of impact cut resistance’. As with impact abrasion resistance, while this standard was created for the testing of apparel, the test method is also suitable for the assessment of footwear.

The impact cut resistance test simulates a sharp object impacting at speed with the rider’s PPE. In this test, a specimen is mounted over a rectangle hole so that it is under a predefined tension. An impact striker of fixed mass, with a sharp blade fitted to its lower surface, is dropped vertically from a predetermined height onto the specimen over the centre hole. The maximum penetration of the blade through the material(s) is measured and recorded in millimetres.

To ensure consistent results, the sharpness of the test blade is assessed

using two layers of a standard reference fabric and the penetration distance of the blade is corrected accordingly.

Transverse rigidity of the whole footwear: During and immediately following an accident, there is a risk of the rider's foot becoming compressed or trapped under the weight of the motorcycle or some other heavy object. The transverse rigidity test (figure 3) is designed to examine the resistance of footwear to compression transversely across the joint of the footwear.

In this test, samples of whole footwear are placed onto test platens, with the outsole placed perpendicular to the platen surface. The footwear is then slowly compressed in a transverse direction in the joint region using a tensile test machine until a set load is reached. The standard requires that the footwear withstands the test load without showing significant compression, which is defined as 'more than 20mm'. Should the footwear not withstand the test loads or over 20mm compression occurs, the footwear is considered to have failed the requirements of this test.

Impact protection to the ankle and/or part of the shin: While riding and as a result of an accident, a rider is at risk of an impact to the foot. Therefore, the impact protection test is used to assess the degree of protection that the footwear offers to the wearer in two locations – the ankle and shin.

Motorcycle footwear is often designed and manufactured with additional protection at these two locations.

Test samples comprise of one pair of footwear in each of three sizes – one from the lower end of the size range, one from the upper end of the size range and one from the middle. To identify the test position, the footwear is donned by an appropriate subject with feet of a suitable size for the product being assessed, with he or she standing upright while wearing correctly fastened motorcyclists' protective trousers. Using a simple procedure, the centre of the wearer's ankle bone and midline of the shin bone can be located and then marked.

It is important that the actual position of the ankle bone is located and that the test is conducted at this position, while not being influenced by any protective components incorporated in the test footwear, as these components may not be located in the correct position.



Figure 3: The transverse rigidity test

In this test, specimens of the ankle and/or shin region of the footwear containing protection are mounted over a shaped metal anvil which is fitted to a load cell. When testing ankle protection, the anvil is hemispherical in shape and is designed to mimic the shape of the wearer's ankle bone. For the testing of shin protection, the anvil consists of three vertical steel plates attached to a flat base. The test specimens need to be partially disassembled in order to mount them onto the anvil.

A striker is dropped vertically from an appropriate distance to deliver a pre-set impact energy to the test specimens. During each impact, the force transmitted through the protector is measured, recorded and assessed against the standard's performance criteria.

SATRA service

Some footwear and clothing worn by motorcyclists comes under the category

of 'fashion', and is not claimed to provide any meaningful protection. However, motorcyclists' protective footwear and clothing placed on the European market that has been designed to provide protection to the wearer against injury during an accident must meet strict performance requirements and be certified under the PPE Regulation. Motorcycle riders can look to products' certification and the performance standards marking codes to select the correct product for them.

How can we help?

Please contact SATRA's footwear testing team for help with the assessment of PPE footwear for motorcycle riding and other applications.



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