HEALTH & SAFETY LABORATORY

The GRIP Scheme

Footwear Slip Resistance Ratings

Handbook for Participants

Issued by: Rob Shaw

Authorised by: Derek Morgan

Issue Status

Issue	Issue Date	Page	Amendments	Authorised By
1.1	27.10.14	1	Changed owner from Kevin Hallas to Rob Shaw	Derek Morgan
1.1	27.10.14	7	Updated 6.1 to remove ambiguities around shoe size and include new ordering procedure.	Derek Morgan
1.1	27.10.14	9	Updated table in 6.2 to new flooring specification and included footwear preparation	Derek Morgan
1.1	27.10.14	10	Added rating to 6.3	Derek Morgan

Note: Latest issue supersedes all previous issues.

Contents

1 Purpose

The purpose of the scheme is to allow footwear users to identify suitable slip resistant footwear as a control measure to reduce their risk of slipping accidents.

2 Management

The GRIP scheme is managed by the Health and Safety Laboratory (HSL). Participation in the GRIP scheme does not constitute recognition or approval of footwear by the Health and Safety Executive (HSE).

3 Limitations

The GRIP scheme deals only with the slip resistance of footwear. Other safety requirements arising from risk assessments, such as toe protection, should be considered in parallel with the GRIP ratings when selecting footwear for use as Personal Protective Equipment (PPE).

4 Introduction

Slip resistant footwear identified through HSL ramp testing has proven to reduce employee slips across a range of businesses. The GRIP scheme aims to disseminate valid and useful information regarding the slip resistance of footwear through the use of easy to understand star-ratings. Participation in the scheme is voluntary. The cost of testing and administration will be recovered by operating the scheme on a fee-for-rating basis.

5 Background

Falls due to slip accidents remain a significant contributor to injury and ill health at work. Recent statistics for Great Britain show that 37% of reported injuries to employees were due to a slip, trip or fall from height. Whilst, 56% of all major injuries, and 31% of over 7-day injuries, resulted from a slip, trip or fall (HSE, 2013). The estimated number of working days lost from such accidents in Great Britain is 2 million, with numerous major injuries to employees and significant costs to employers.

Footwear as PPE can provide an effective control in the prevention of slips when used alongside other reasonably practicable measures. “Pedestrian slip resistance is determined by the Coefficient of Friction (CoF) between two interacting surfaces, specifically the frictional properties or slipperiness of floors and footwear in actual conditions during locomotion” (Grönqvist, 1995). Friction is considered to be a direct indicator of slip risk. It is suggested that any test to measure slip resistance should replicate, as closely as possible, the parameters of slipping (Strandberg and Lanshammar, 1981; Grönqvist *et al*, 1989). A valid test should replicate the critical point in pedestrian gait at which traction is lost, when the friction required just exceeds the friction available.

The European PPE Directive recognises the need for slip resistance as a protective property of footwear. Demonstration of compliance with this requirement is often claimed through the use of mechanical tests. One such mechanical test (BS EN ISO 13287: 2012) forms the basis of the commonly used standards BS EN ISO 20345:2011, BS EN ISO 20346:2004 + A1: 2007 and BS EN ISO 20347:2012. There are concerns that this test does not closely replicate the critical point in pedestrian gait at which traction is lost. There are also concerns that the test conditions and criteria used to determine the slip resistant marking do not reflect actual friction requirements of normal walking activities (Hallas et al, 2009). Other work has questioned the validity of the test, due to its inability to predict slip potential (Blanchette and Powers, 2011).

The work carried out at HSL using the ramp test to investigate the slip resistance properties of footwear has provided a valuable knowledge base enabling businesses to reduce slipping accidents. The close correlation between the slip resistance of footwear measured in the laboratory and the performance in the workplace environment is the ultimate indication of the validity of a test method.

6 Operation of the Scheme

6.1 Samples

a. Ratings are to be associated with a soling unit, regardless of the upper to which it is attached.
b. Manufacturers agree that the rating will only be applied to shoes manufactured with the soling units tested. Variations in soling compound, even where the tread pattern is identical, will therefore require a separate rating.
c. Footwear submitted for rating must be supplied in **one** of the following UK sizes:
    - 6,
    - 9 **or**
    - 10.
d. Rating requires the submission of 3 pairs of footwear of any of the above sizes, an example of each size is not needed.
e. Dynamic Mechanical Thermal Analysis (DMTA) will be undertaken on one pair of footwear to determine the material properties of the sole. This testing will destroy the footwear.
f. Footwear will be retained by HSL unless a return request is submitted. Two pairs can be returned subject to shipping and handling fees. All retained footwear will be destroyed after 18 months.
g. Annual re-rating will be required for each rated soling unit in order to maintain the rated status. One pair will be required for re-rating as long as the results obtained fall within the expected range of the 3 pairs previously tested. Where the soling unit test result falls outside of the expected range, the rating will be treated as a new rating, therefore requiring a further 2 pairs to be supplied.
h. HSL reserve the right to analyse aggregated and anonymised test data in future research.
i. In order to participate in the scheme, users should register on the HSL website and complete the electronic checkout process at http://www.hsl.gov.uk/hsl-shop/grip/grip-full-rating.
j. The Sample Submission Form (SSF) found on the webpage detailed above should be enclosed with footwear samples. Samples should be addressed as follows:
   GRIP Rating Scheme Submission
   Falls Prevention Team
   Health & Safety Laboratory
   Harpur Hill
   Buxton
   SK17 9JN
   United Kingdom

k. A photograph of the footwear sole should be supplied electronically with each order to productsupport@hsl.gsi.gov.uk. Photographs need to satisfy the following requirements:
   - Labelled clearly as to which sole it depicts
   - Landscape
   - 300 dpi
   - 1000 pixels wide
   - Jpeg format

l. Footwear must be labelled with model details, soling unit identifier, etc using the terminology that the manufacturer would like HSL to use in the report detailing the test results.

6.2 Testing

a. Footwear will be tested using the HSL Ramp test

b. The ramp (Figure 1) consists of an adjustable platform (1), upon which the test flooring material is positioned. A fall arrest device (2) is attached to an overhead frame (3) to prevent injury to the operator during a test.

c. Test operators will be trained and verification will be undertaken prior to testing.

d. The flooring material used for tests shall have the following properties:

Floor Type	Ceramic tile
Pendulum Test Value (UKSRG, 2011)	10 – 12
Rz Surface Microroughness	5.0 – 7.0µm

e. The test requires the operator to carry out a series of controlled walks over the floor surface.
f. Footwear will be prepared by lightly abrading with P400 grit silicon carbide abrasive paper, using an orbital sander, before each operator begins their set of walks.
g. The walking method involves the operator taking a series of half steps forward then backward, returning to their start position.
h. The walking speed is controlled at 144 steps per minute using a metronome.
i. If the operator completes the walk without a slip they increase the angle of inclination of the platform by approximately 1° and repeat the walks.
j. The process is repeated until an inclination is reached where a slip occurs; which is defined as the slip angle.
k. The slip angle is recorded by an observer, from a display that is hidden from the operator such that knowledge of the slip angle does not influence their walk.
l. The platform is returned to an angle of inclination a few degrees below the slip angle and the process is repeated until the operator generates ten slip angles.
m. The first two slip angles are discarded, and a mean slip angle is calculated from the remaining eight values, giving the operator result.
n. A second operator repeats this process, generating a further 10 slip angles, and a second operator result is calculated.
o. The range of the eight slip angles used to calculate the operator result must be no greater than 2.4° for glycerol tests and 3.6° for water tests, otherwise a third operator will generate a third operator result.
p. The difference between two operator results must be no greater than 1.8° for glycerol and 2.5° for water, otherwise a third operator will generate a third operator result.
q. Where the third operator result fails to meet the acceptance criteria set out in (o) or (p) a fourth operator will generate a fourth operator result.
r. The test result is the mean of all of the operator results obtained.
s. The test result will be converted into the coefficient of friction by taking the tangent of the test result.

6.3 Reporting of Test Results

a. Manufacturers will receive a report detailing the test procedure and the coefficient of friction and rating obtained for each pair of footwear tested.

6.4 Ratings

a. The test result for each of the three pairs tested must be within 4.0° of the other two test results in order for the footwear to achieve a rating.

b. The mean coefficient of friction for the three pairs of footwear will then be calculated and used to generate the rating.

c. Ratings will be assigned as follows:

CoF ≥0.19 Water

CoF ≥0.27 Water

CoF ≥0.36 Water

CoF ≥0.36 Water & CoF ≥0.19 Glycerol (75%)

CoF ≥0.36 Water & CoF ≥0.27 Glycerol (75%)

6.5 Rating Year

a. The Testing Year will run from 1st April to 31st March, with resulting ratings given a Rating Year, for example.

Testing Year	Rating Year
1st April 2014 to 31st March 2015	2015
1st April 2015 to 31st March 2016	2016
1st April 2016 to 31st March 2017	2017
1st April 2017 to 31st March 2018	2018
1st April 2018 to 31st March 2019	2019
1st April 2019 to 31st March 2020	2020

b. Manufacturers will be entitled to use the rating until the end of the Rating Year (i.e. 31st December).

6.6 Re-Rating

a. Annual re-rating will be required for each rated soling unit in order to maintain the rated status.
b. Re-rating of the soling unit is required to claim a rating for subsequent Rating Years.
c. One pair of footwear will be required for re-rating as long as the results obtained fall within the expected range of the 3 pairs previously tested. Where the soling unit test result falls outside of the expected range, the rating will be treated as a new rating, therefore requiring a further 2 pairs of footwear to be supplied.
d. DMTA will also be carried out and compared with the results from the original sample.

6.7 Indicative Ratings

a. A single pair of footwear can be submitted for an indicative rating.
b. Indicative ratings can be upgraded to a full rating by submitting two additional footwear samples and paying the difference in cost between an indicative rating and full rating.
c. Indicative ratings can be undertaken for any organisation as part of their risk assessment process.

6.8 Reporting of Ratings

d. The rating will be provided to the manufacturer along with the test results outlined above.
e. The Rating Year will be incorporated into the scheme logo, with updates supplied as footwear is re-rated.
f. Logo image files will be supplied to the manufacturer for use associated specifically with the rated soling unit (i.e. the logo should be closely associated with the rated product, and not be reproduced on a catalogue cover if only one shoe on offer in the catalogue has been rated)
g. By participating in the scheme and submitting footwear for rating, manufacturers agree that HSL will publish details of all rated footwear on the HSL website, with supplied details of make, model and soling identifier and a photograph showing the soling unit tested.
h. Footwear that has been submitted for rating, but fails to meet the minimum requirements will not be detailed on the website, but the total number of un-rated soling units tested will be quantified.
i. The website will be updated with newly rated (and re-rated) footwear at the end of each month.
j. Results from indicative ratings will be reported to the participant and are not to be published.

7 Records and Confidentiality

Paper and computer records of manufacturer and footwear details are maintained and include information such as manufacturer name, contact name, e-mail address, postal address, and telephone number and the soling unit identifier as well as well as the make and model of footwear tested. It is the responsibility of the participant to notify the HSL Falls Prevention Team of any changes to the details that are required, contact details can be found in 8d. Changes to product information that result in the need to re-issue reports will be subject to the charges detailed in 8c.

HSL will publish details of all rated footwear on the HSL website, with supplied details of footwear make, model and soling identifier and a photograph showing the soling unit tested.

Footwear that has been submitted for rating, but fails to meet the minimum requirements will not be detailed on the website, but the total number of un-rated soling units tested will be quantified.

The website will be updated with newly rated (and re-rated) footwear at the end of each month.

8 Queries

a. The SSF should be enclosed with footwear samples. Participants shipping samples from outside the EU are advised to label samples as "Footwear samples for destructive laboratory testing".

b. Samples should be addressed as follows:
GRIP Rating Scheme Submission
Falls Prevention Team
Health & Safety Laboratory
Harpur Hill
Buxton
SK17 9JN
United Kingdom

c. RETURNS: Footwear will be retained by HSL unless a return request is submitted. Two pairs can be returned subject to shipping and handling fees. All retained footwear will be destroyed after 18 months.

d. Re-issue of reports without any changes will be charged at £75. Amendments, for instance, changes to product identification, incur a cost dependent on the changes required, subject to the £75 minimum charge.

e. Technical queries should be directed to:

Rob Shaw
Falls Prevention Team
Health & Safety Laboratory
Harpur Hill, Buxton, SK17 9JN
Tel. 01298 218 339
Email. Robert.shaw@hsl.gsi.gov.uk

f. Contractual queries should be directed to:

Email. productsupport@hsl.gsi.gov.uk

9 Advertising by Participants

Ratings are to be associated with a soling unit, regardless of the upper to which it is attached. Manufacturers agree that the rating will only be applied to shoes manufactured with the soling units tested. Variations in soling compound, even where the tread pattern is identical, will therefore require a separate rating.

Manufacturers will be entitled to use the rating and the relevant GRIP logo in advertising and promotional material relating to that specific soling unit until the end of the Rating Year (i.e. 31st December). It is expected that the GRIP logos will be used throughout the supply chain in association with the rated footwear.

Use of the HSL or HSE logos is not granted as part of participation in the scheme.

10 Annex 1

10.1 Responsibilities, Terms & Conditions

HSL will operate the GRIP scheme in accordance with its obligations as set out in the handbook for participants. In turn, a condition of submitting footwear to the scheme is that participants abide by the rules and responsibilities of the scheme set out in this handbook and in particular as detailed below. Likewise participants should comply with the HSL's standard conditions of business, a copy of which is available upon request.

10.2 Participant Responsibilities

Participant responsibilities are outlined below:

Participants need the express written permission of the footwear manufacturer in order to submit footwear for full rating. Where the participant is not the manufacturer of the footwear HSL will require a letter from the manufacturer giving this permission. Where this is not possible only indicative ratings can be obtained; these cannot be published.

The Participant will pay invoices in full, including any amount shown in respect of VAT, within 30 days of the date of the invoice.

An invoice shall not be regarded as paid until funds (GBP) are received into a UK sterling bank account operated by HSL or by the Health and Safety Executive.

Invoices must be paid promptly. Failure to do so will result in HSL withholding samples and reports until full payment is received. Unpaid invoices & scheme fees will result in exclusion from participating in the next financial year.

All queries should be directed to the relevant email address, as listed in section 8, and we will endeavour to answer your query as soon as possible.

To ensure we can keep you updated with important information it is the participant's responsibility to inform the administration team of any changes to any contact details.

Participants must ensure that any required paperwork / permit applications are in place to allow samples through national border controls / customs (additional charges from the courier will be passed on to participants should there be further fees payable). Failure to do so may result in delays in sample shipment and hence participation.

For a copy of HSL standard conditions of business, or if you have any queries regarding the GRIP scheme please contact us via the relevant email address given in section 8.

11 Annex 2

11.1 References

HSE, 2013, *Annual Statistics Report for Great Britain 2012/13*, accessed 13/5/2014, http://www.hse.gov.uk/statistics/overall/hssh1213.pdf

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Grönqvist R., Roine J., and Järvinen E., (1989), *An Apparatus and a Method for Determining the Slip Resistance of Shoes and Floors by Simulation of Human Foot Motions*, Ergonomics, Vol 32, No. 8, 979-995, Taylor & Francis Ltd., London.

BS EN ISO 13287: 2012 *Personal Protective Equipment. Footwear. Test Method for Slip Resistance*, British Standards Institute, London.

BS EN ISO 20345: 2011 *Personal Protective Equipment. – Safety Footwear*, British Standards Institute, London.

BS EN ISO 20346: 2004 + A1: 2007 *Personal Protective Equipment – Protective Footwear*, British Standards Institute, London.

BS EN ISO 20347: 2012 *Personal Protective Equipment – Occupational Footwear*, British Standards Institute, London.

Hallas K., Thorpe S., Liddle M., Thomas M., (2009), *The Role of Safety Footwear in Slipping Accidents*, Proceedings of the 17th IEA World Congress on Ergonomics, August 9-14, 2009, Beijing, China.

Blanchette M. G., and Powers C. M., (2011), *Validity and Accuracy of a Slip Resistance Measurement Protocol for the Assessment of Slip Potential*, American Society of Biomechanics, accessed 13/5/2014, http://www.asbweb.org/conferences/2011/pdf/38.pdf.

The United Kingdom Slip Resistance Group, (2011), *The Assessment of Floor Surface Slipperiness: The UK Slip Resistance Group Guidelines*, Issue 4, 2011, The UK Slip Resistance Group (UKSRG).