

The logo consists of the letters 'FLH' in a bold, sans-serif font. The 'F' is red, the 'L' is white with a blue outline, and the 'H' is blue.

HOCKEY TURF & FIELD STANDARDS

Engineered
for Hockey



Part 2. Requirements for Hockey Turf Products

2017 Edition

FIH Hockey Turf and Field Standards

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Contents

Foreword	4
1 Introduction	5
1.1 Scope	5
1.2 Principal Changes from Previous Edition	5
1.3 Implementation	5
2 Definitions	6
3 Types of Playing Surface.....	7
4 Classification	8
5 Test Conditions	9
5.1 Preparation of Wet Test Specimens	9
5.2 Preparation of Irrigated Test Specimens.....	9
5.3 Preparation of Dry Test Specimens	10
6 Test Specimen Preparation.....	10
7 Laboratory Conditions	10
8 Requirements	10
8.1 Ball Rebound.....	10
8.2 Ball Roll	11
8.3 Ball Roll Deviation	13
8.4 Shock Absorption and Vertical Deformation.....	14
8.5 Shoe – Surface Friction	15
8.6 Skin – Surface Friction.....	15
8.7 Effects of Simulated Wear	16
8.8 Abrasion Resistance.....	18
8.9 Water Permeability	18
8.10 Toxicology	18
8.11 Carpet Strength	19
8.12 Tuft Bind of Synthetic Turf Carpets	19
8.13 Joint Strength	19
8.14 Dimensional Stability	19
8.15 Tensile Strength of Pile Yarns and Fibres.....	20
8.16 Resistance of Pile Yarns And Fibres to Ultra Violet Degradation	20
8.17 Properties of Shockpads and Elastic Layers.....	21
8.19 Product Identification	24

9	Reporting.....	26
10	Validity of Product Approval.....	26

Foreword

A new hockey field is a major investment therefore it is important that it meets the expectations of hockey players, hockey associations and clubs. To help ensure good quality fields are built for all levels of play, from elite level competition to community development, the FIH has developed its internationally recognised quality-assurance programme - the **FIH Quality Programme for Hockey Turf**. The programme was launched as part of an initiative of the Hockey Revolution - FIH's ten-year strategy for hockey aimed at making hockey a global game that inspires the next generation.

The programme provides consistent and dependable industry standards and ensures the appropriate quality of performance for the intended level of play - whether it is community development, international competition, or anything in between. It is based on the principles of quality assurance, and only companies that meet the demanding standards set by the FIH are able to join. The Hockey Turf products they produce are independently tested by internationally recognised test institutes accredited by the FIH. Once installed hockey facilities are also independently tested to verify the construction and performance is as required for the games of hockey and Hockey 5s.

The technical requirements of the programme are detailed in the FIH Hockey Turf and Field Standards, which are published in four parts:

Part 1 – Introduction & General Guidance

Part 2 – Requirements for Hockey Turf Products

Part 3 – Requirements for Hockey Fields

Part 4 - Requirements for Hockey 5s Courts

This document is Part 2. It specifies the performance and durability requirements for hockey turf products.

Full details of the **FIH Quality Programme for Hockey Turf**, including a list of the companies who are part of it, their approved products and the hockey fields and Hockey 5s courts that are currently certified can be found at www.fih.ch/hockeyturf.

1 Introduction

1.1 Scope

This document is Part 2 of the *FIH Hockey Turf and Field Standards*. It specifies the performance and durability requirements for Approved Hockey Turf Products. It supersedes the 2014 edition.

The requirements have been established after consultation with players, members of the FIH Quality Programme and FIH accredited laboratories. They embrace products upon which hockey can be played safely and comfortably.

For a Hockey Turf to be approved it must be manufactured by a FIH Preferred Supplier or Certified Manufacturer and meet the requirements of this Standard.

1.2 Principal changes from Previous Edition

The principal changes from the 2014 Standard are:

- New classification of Hockey Turf products
- New categories of Multi-Sports surfaces including short pile and textile surfaces
- Additional requirements for surfaces requiring irrigation
- Enhanced durability testing
- Enhanced player/surface interaction tests
- More robust testing for the resistance to UV degradation of pile yarns
- Enhanced requirements for shockpads
- Introduction of toxicology and environmental requirements

1.3 Implementation

The Standard becomes effective from 1st June 2017 and any Hockey Turf submitted for approval testing from that date shall be tested in accordance with this Standard.

1.3.1 Resistance to artificial weathering

This Standard includes an enhanced resistance to artificial weathering test that takes approximately 200 days to complete. Any new Hockey Turf products that incorporate pile yarns that were tested and shown to satisfy the relevant requirements of the 2014 edition of the FIH Standard will be granted temporary Product Approval through till June 2018, providing the manufacturer confirms the pile yarns are being re-tested to the requirements of this document.

Any Hockey Turf products that use pile yarns that have not been shown to satisfy the requirements of this Standard by 31st May 2018 will lose their temporary Product Approval.

1.3.2 Existing Approved Products

Manufacturers are required to upgrade all current Approved Products to the requirements of this Standard by 31st May 2018. It is not necessary to retest properties previously measured, results may be carried forward from the existing FIH test report. The upgrade tests do not have to be undertaken by the Test Institute that carried out the previous product testing. When carrying out an upgrade test, the Test Institute has



responsibility for ensuring the product submitted for upgrading is the same as that previously tested and approved.

1.3.3 Previously Tested Components

When components in a Hockey Turf surface (e.g. pile yarns or fibres, shockpads, etc.) have been tested previously by a FIH Test Institute, the results may be carried forward for inclusion in a test report providing the Test Institute can confirm the component is the same as that previously tested.

2 Definitions

Approved Product – a Hockey Turf surface that has been tested and certified in accordance with this Standard.

ASTM – standard published by ASTM International.

Dressed synthetic turf or textile surface - a surface that is only partly filled with sand or other particulate material, so that the infill depth does not exceed 75% of the pile height.

Dry test specimen - a test specimen to which no water has been applied.

EN - Standard published by the European Standards Committee (CEN).

ESTO - European Synthetic Turf Organisation.

FIFA TM - test method specified by FIFA in their *Handbook of Test Methods for Football Turf*.

Filled synthetic turf or textile surface - synthetic turf or textile surface whose pile is filled (>75%) with an unbound particulate material, typically sand.

Free pile height – the height of the pile above any infill or the carpet backing.

Hockey Turf - a synthetic turf or textile surface designed to have the quality and performance characteristics required to allow the game of hockey to be played.

Irrigated test specimen - a test specimen watered to simulate the controlled application of water by a field irrigation system. Normally only required for Global category products.

ISO - Standard published by the International Standards Organisation.

Long pile synthetic turf surface - synthetic turf surface whose un-stretched pile length is equal to or greater than 30 mm.

Non-filled synthetic turf - synthetic turf surface that does not contain any form of unbound particulate fill within the carpet pile.

One Turf Concept - a joint initiative between FIFA, World Rugby and FIH setting performance requirements for long pile synthetic turf surfaces that can be used by all three sports.

Playing surface - the synthetic turf or textile surface forming the upper surface of the Hockey Turf.

Shockpad and elastic layer - prefabricated foam or elastomeric sheets or tiles or insitu laid elastomeric granulate and binder mixes, laid beneath the synthetic turf or textile surface and designed to aid the provision of the required sport's performance.

Short pile synthetic turf - synthetic turf surface whose un-stretched pile length is less than 30 mm.

Synthetic turf surface – a carpet designed for sports use, having a tufted, knitted or woven construction.

Textile surface – a carpet designed for sports use, having a needle-punched or fibre bonded sports surface.

Trimmed mean - a method of averaging test results that removes a small designated percentage of the largest and smallest values before calculating the mean.

Wet test specimen - a test specimen that has been soaked in water to replicate the conditions of the surface after rain.

3 Types of playing surface

The type of playing surface used in a Hockey Turf shall be described as follows. The FIH do not wish to stifle innovation by being unnecessarily restrictive so if a new type of Hockey Turf is found not to comply with these descriptions the FIH should be consulted.

	Non-filled synthetic turf	Sand dressed synthetic turf ⁽¹⁾	Sand filled synthetic turf
Carpet type	Synthetic turf	Synthetic turf	Synthetic turf
Non-filled / dressed / filled	Non-filled	Dressed	Filled
Pile height ⁽²⁾	10mm – 18mm	13mm – 22mm	18mm – 30mm
Minimum stitch rate ⁽³⁾	60,000/m ²	37,500/m ²	-
Free pile above infill	N/A	≥ 25%	<25%
Requires irrigation	Yes	Optional	No
Requires a shockpad	Yes	Yes	Yes

	Filled Textile	Dressed Textile	Unfilled Textile
Carpet type	Textile surface	Textile surface	Textile surface
Non-filled / dressed / filled	Filled	Dressed	Non-filled
Pile height ⁽²⁾	12mm – 25mm	12mm – 25mm	12mm – 25mm
Free pile above infill	<25%	≥ 25%	N/A
Requires irrigation	No	No	No
Requires a shockpad	Yes	Yes	Yes

	Semi-filled long pile synthetic turf	Non-filled long pile synthetic turf
Carpet type	Synthetic turf	Synthetic turf
Non-filled / dressed / filled	Dressed	Non-filled
Pile height ⁽²⁾	> 30mm	> 30mm
Free pile above infill	<30%	N/A
Requires irrigation	No	No
Requires a shockpad	Optional	Yes

1 Also known as sand obscured synthetic turf

2 The pile height (or tuft leg) above the carpet backing, when assessed in accordance with ISO 254

3 The number of stitches per metre square when measured in accordance with ISO 1763.

4 Classification

Based on the performance of the Hockey Turf (as defined in Section 8) and the type of playing surface (as defined in Section 3) and the shockpad or elastic layer on which it is laid, the Hockey Turf shall be classified as follows:

Classification		Type of Hockey Turf
Global		Non-filled synthetic turf ⁽¹⁾
National	Class 1	Sand dressed synthetic turf
	Class 2	Sand filled synthetic turf
Multi-Sport	Class 1	Sand dressed synthetic turf Sand filled synthetic turf Textile surface (filled, dressed or non-filled)
	Class 2	Sand dressed synthetic turf Sand filled synthetic turf Textile surface (filled, dressed or non-filled)
	Class 3	Long pile synthetic turf (filled or non-filled)

(1) Non-filled synthetic turf surfaces may also be used in National and Multi-Sport surfaces.

5 Test Conditions

Hockey is played under a number of different conditions depending on the category of surface. Potentially all surfaces will be played on when wet due to rain. Therefore, all surfaces need to have acceptable performance under wet conditions.

The FIH currently requires Global Elite and Global category fields to be irrigated before play to ensure acceptable performance. The amount of water required will depend on the particular Hockey Turf and this shall be determined by the Hockey Turf manufacturer and accredited test institute. To ensure uniform and adequate wetting the quantity of water shall be no less than 1l/m² (1mm).

Players expect consistent performance from Global Elite and Global category surfaces. As some properties change as a surface dries, it is important that this does not occur too quickly. Therefore, certain properties are measured 15 and 45 minutes after watering.

If a Global Category Hockey Turf is to also be used on national or multi-sports fields without watering, the surface shall also be tested in dry conditions.

Test condition	Hockey Turf classification				
	Global	National	Multi-Sport		
			MS1	MS2	MS3
Wet	✓	✓	✓	✓	✓
Irrigated	✓	Optional	-	-	-
Dry	Optional	✓	✓	✓	✓

5.1 Preparation of wet test specimens

The test specimen shall be wetted by evenly applying a volume of water, using a hose fitted with a spray nozzle, that thoroughly soaks the specimen (if in doubt this should be at least equal to the volume of the test specimen). Tests shall commence 5 ± 1 minutes after the application of the water

All tests shall be completed within 15 minutes of the application of water. If required, the wetting procedure shall be repeated to allow further testing.

5.2 Preparation of irrigated test specimens

The test specimen shall be mounted on a free draining sub-structure and irrigated using the procedure specified by the manufacturer. The quantity of water applied to the test specimen shall be specified in terms of millimetres' depth or litres per metre squared. The water shall be uniformly applied to the test specimen.

Following watering the test specimen shall be allowed to drain for the time specified for the property being measured (15 ± 1 or 45 ± 1 minutes), before testing begins.

If required by the test method, the test specimen shall be moved onto a suitable rigid unyielding test platform prior to being tested.

All tests shall be completed within 15 minutes of the tests commencing (i.e. all tests commencing 15 minutes after the application of water shall be completed within 30 minutes from the application of water). If required, the irrigation procedure shall be repeated on a new (dry) test specimen to allow further testing.

5.3 Preparation of dry test specimens

Dry tests shall be undertaken on test specimens that have not been subjected to any form of watering prior to test.

6 Test specimen preparation

Test specimens of the size specified in the appropriate test method shall be prepared in accordance with the manufacturer's instructions and EN 12229.

If the Hockey Turf carpet is intended to be bonded to a shockpad during field installation the test specimens for ball rebound, shock absorption, vertical deformation, rotational resistance and water permeability shall be formed in the same way. The preparation of these samples should be undertaken by the manufacturer prior to them being sent to the Test Institute.

7 Laboratory Conditions

Laboratory tests and sample conditioning shall be undertaken at a controlled laboratory temperature of $23 \pm 2^{\circ}\text{C}$ and relative humidity of $50 \pm 20\%RH$.

8 Requirements

The Hockey Turf system shall fully comply with all the relevant requirements detailed below:

8.1 Ball Rebound

8.1.1 Test method

Ball rebound shall be measured in general accordance with EN 12235 using an acoustic timer and an FIH Approved Hockey Ball. When tested on concrete the ball shall have a rebound of $700 \pm 50\text{mm}$.

Ten tests shall be made and the trimmed mean (40%) calculated and reported.

8.1.2 Test conditions

All surfaces shall be tested under wet conditions.

Global category Hockey Turfs shall also be tested after irrigation in accordance with the manufacturer's instructions. Tests shall be made at 15 minutes and 45 minutes after irrigation.

National and Multi-Sport category surfaces shall also be tested under dry conditions.

8.1.3 Requirements

Under each appropriate test condition, the Hockey Turf shall satisfy the following requirements:

Surface Condition	Global	National	Multi-Sport		
			MS1	MS2	MS3
Dry	-	100 – 425mm	100 – 450mm	100 - 500mm	≥75mm
Wet	100 – 400mm	100 – 425mm	100 – 450mm	100 - 500mm	≥75mm
Irrigation + 15 min	100 – 400mm	-	-	-	-
Irrigation + 45 min	100 – 400mm	-	-	-	-

Notes:

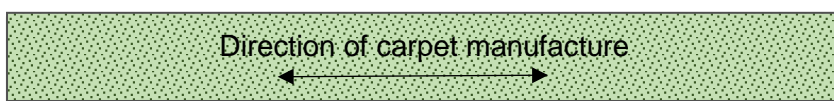
- 1 Based on the requirements of EN 15330, Multi-Sport MS2 category surfaces should have a tennis ball rebound under dry and wet conditions of $\geq 1.12\text{m}$, when tested in accordance with EN 12235.
- 2 The tennis pace of Multi-Sport MS2 category surface may be measured and classified in accordance with EN 13865 and EN 15330.
- 3 Based on the requirements of the One Turf Concept, Multi-Sport MS3 category surfaces should have a football rebound under dry and wet conditions of $\leq 1.00\text{m}$, when tested in accordance with EN 12235.

8.2 Ball Roll

8.2.1 Test method

Ball roll shall be measured in accordance with EN 12234 using an FIH Approved Hockey Ball. Three tests shall be made in each direction and the mean calculated.

For Global, National and Multi-Sport categories MS1 and MS2 Hockey Turfs, two test specimens are required. The first shall be taken in the direction of manufacture (to simulate a ball rolling across a field).



The second shall be taken at 90° to the direction of manufacture and be made from a series of carpet rolls joined together to form the test specimen (to simulate a ball rolling along a field).



For Multi-Sport category MS3 Hockey Turfs only one test specimen, taken in the direction of manufacture, is required.

The length of the test specimen shall be approximately 1m longer than the anticipated ball roll length. If this is not known, the length shall be 18m for all categories other than MS3, which should be 10m long. All test specimens shall be at least 1m wide.

Tests shall be undertaken from either end of each test specimen and the following calculated:

- overall mean ball roll (each direction and each test specimen)
- consistency between mean result in each direction and the overall mean (designated *a* in the requirements below)
- for Global category surfaces, consistency between overall mean results 15 minutes and 45 minutes after irrigation (designated *b* in the requirements below)

Note: If a Hockey Turf has been tested previously the results may be carried forward for reuse providing the free pile height is the same ($\pm 1\text{mm}$).

8.2.2 Test conditions

All surfaces shall be tested under wet conditions.

Global category Hockey Turfs shall also be tested 15 minutes and 45 minutes after irrigation.

National and Multi-Sport category surfaces shall also be tested under dry conditions.

8.2.3 Requirements

Under each test condition, the surface shall satisfy the following requirements:

8.2.3.1 Ball roll & ball roll consistency

Surface Condition	Global			National	
	Ball roll	Ball roll consistency		Ball roll	Ball roll consistency
		<i>a</i>	<i>b</i>		
Dry	-	-	-	$\geq 9.0\text{m}$	$\leq \pm 20\%$
Wet	$\geq 10.0\text{m}$	$\leq \pm 10\%$	-	$\geq 9.0\text{m}$	$\leq \pm 20\%$
Irrigation + 15 min	$\geq 10.0\text{m}$	$\leq \pm 10\%$	-	-	-
Irrigation + 45 min	$\geq 10.0\text{m}$	$\leq \pm 10\%$	$\leq \pm 10\%$	-	-
	Multi-Sport MS1			Multi-Sport MS2	
Dry	$\geq 8.0\text{m}$	$\leq \pm 20\%$		$\geq 8.0\text{m}$	$\leq \pm 20\%$
Wet	$\geq 8.0\text{m}$	$\leq \pm 20\%$		$\geq 8.0\text{m}$	$\leq \pm 20\%$
	Multi-Sport MS3				
Dry	$\geq 5.0\text{m}$	-			
Wet	$\geq 5.0\text{m}$	-			

Notes: Based on the requirements of the One Turf Concept Multi-Sport MS3 category surfaces should have a football roll under dry and wet conditions of $\leq 12.00\text{m}$, when tested in accordance with EN 12234.

8.3 Ball Roll Deviation

8.3.1 Test method

Whilst undertaking ball roll tests in accordance with EN 12234 using an FIH Approved Hockey Ball place a graduated gate over the test specimen. The gate shall allow the ball to roll unimpeded underneath it. It shall be graduated in at least 1cm increments with 0cm being at its mid-point.

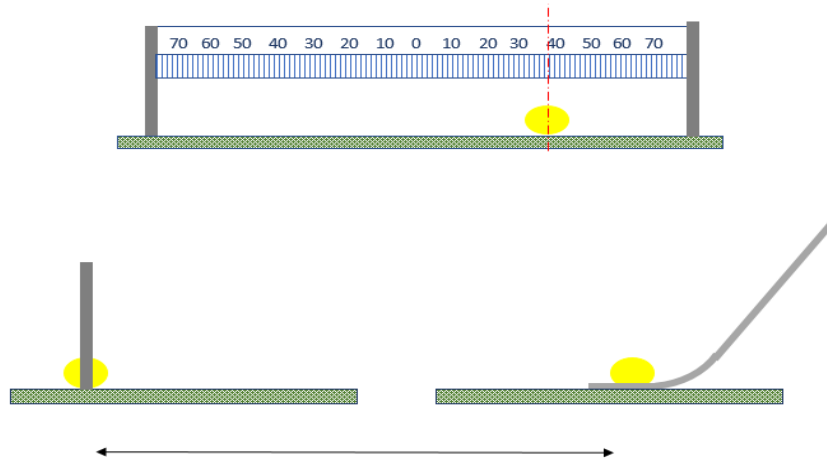


Figure 1 Distance as detailed in the Table in clause 8.3.3

The graduated gate shall be positioned above the test specimen at the distance detailed in 8.3.3 below, measured from the point at which the ball first meets the test specimen.

As the ball rolls under the graduated gate record the deviation from the mid-point (0cm) of the centre-line of the ball

From the five ball roll tests in each direction/test specimen calculate the mean deviation and report to 0.01m.

8.3.2 Test conditions

All surfaces shall be tested under wet conditions.

Global category Hockey Turfs shall also be tested 15 minutes after irrigation.

National and Multi-Sport category surfaces shall also be tested under dry conditions.

8.3.3 Requirements

Under each appropriate test condition, the surface shall satisfy the following requirement:

	Global	National	Multi-Sport		
			MS1	MS2	MS3
	Measuring distance from ramp				
	9.5 ± 0.01m	8.5 ± 0.01m	7.5 ± 0.01m	7.5 ± 0.01m	Test not necessary

Surface Condition	Maximum deviation from centre line				
	Global	National	Multi-sport		
			MS1	MS2	MS3
Dry	-	≤ 0.45m	≤ 0.40m	≤ 0.40m	Test not necessary
Wet	≤ 0.50m	≤ 0.45m	≤ 0.40m	≤ 0.40m	
15 minutes after irrigation	≤ 0.50m	-	-	-	

8.4 Shock Absorption and Vertical Deformation

8.4.1 Test method

Shock Absorption and Vertical Deformation shall be measured in accordance with EN TS 16717.

8.4.2 Test conditions

All surfaces shall be tested under wet conditions.

National and Multi-Sport category surfaces shall also be tested under dry conditions.

Tests shall be made in three locations each at least 0.3m apart and at least 0.25m from the edge of the test specimen.

8.4.3 Requirements

Under each test condition the surface shall satisfy the following requirements:

8.4.3.1 Shock Absorption

Surface Condition	Global	National	Multi-Sport		
			MS1	MS2	MS3
Dry	-	40% - 65%	40% - 70%	30% - 65%	55% - 70%
Wet	45% - 60%	40% - 65%	40% - 70%	30% - 65%	55% - 70%

8.4.3.2 Vertical Deformation

Surface Condition	Global	National	Multi-Sport		
			MS1	MS2	MS3
Dry	-	4mm – 9mm	4mm - 10mm	2mm - 9mm	4mm - 12mm
Wet	4mm – 9mm	4mm – 9mm	4mm - 10mm	2mm - 9mm	4mm - 12mm

8.5 Shoe – Surface Friction

8.5.1 Test method

Shoe-Surface Friction shall be measured in accordance with EN 15301-1 using the dimpled test sole. The test specimen shall measure at least 1m x 1m. Tests shall be made in three locations each at least 0.3m apart and at least 0.25m from the edge of the test specimen.

8.5.2 Test conditions

All surfaces shall be tested under wet conditions.

National and Multi-Sport category surfaces shall also be tested under dry conditions.

8.5.3 Requirements

Under each appropriate test condition, the surface shall satisfy the following requirements:

Surface Condition	Global	National	Multi-Sport		
			MS1	MS2	MS3
Dry	-	25Nm – 45Nm	25Nm – 45Nm	25Nm – 45Nm	25Nm – 50Nm
Wet	25Nm – 45Nm	25Nm – 45Nm	25Nm – 45Nm	25Nm – 45Nm	25Nm – 50Nm

Notes:

- Multi-Sport category 1 and 2 surfaces intended for netball should also have a slip resistance in dry and wet conditions of ≥ 75 , when tested in accordance with EN 13036-4.
- To satisfy the recommendations of the One Turf Concept Multi-Sport category 3 surfaces should also have a Rotational Resistance value of 25Nm – 50Nm when tested in accordance with EN 15301-1 using the studded test plate.

8.6 Skin - Surface Friction

As players, particularly competing on wet Global category fields, make sliding tackles it is important they can do this without the risk of carpet burns occurring. Therefore, Global category Hockey Turfs shall be tested and comply with the requirements of clauses 8.6.1 and 8.6.2.

8.6.1 Test Method

The value of Surface Friction shall be determined using the procedure specified in FIFA TM 08. Prior to test the surface shall be irrigated in accordance with the manufacturer’s instructions and all three tests shall be made between 40 and 45 minutes after irrigation.

8.6.2 Requirement

The mean Coefficient of Friction shall be no greater than 0.75.

Note: If the synthetic skin is torn from the test foot during the test meaning a result cannot be obtained the result shall be expressed as being > 0.75 and classified as a failure.

8.7 Effects of Simulated Wear

8.7.1 Test procedure

Test specimens shall comprise the synthetic turf or textile surface, shockpad and any infill. They shall be subjected to simulated wear conditioning for the specified number of cycles on a Lisport simulated wear machine in accordance with EN 15306 and the conditioning roller specified below. The simulated wear conditioning shall be undertaken on a dry test specimen. Infill replacement during the conditioning shall be undertaken as specified in EN 15306.

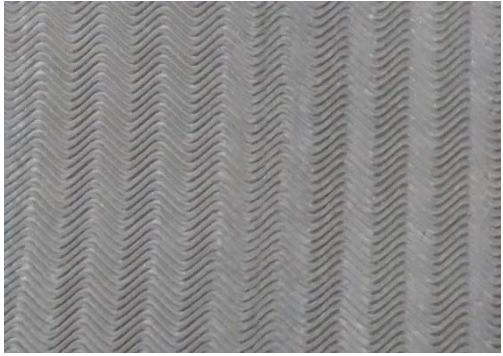
Following simulated wear conditioning, the test specimen shall be tested in the following order:

1. microscopic examination & photographs
2. ball rebound
3. shock absorption & vertical deformation
4. rotational resistance

Note: When moving dressed or filled test specimens from the Lisport machine and undertaking the various performance tests and microscopic examinations, care shall be taken to minimise disturbing the infill and relieving any infill compaction that has occurred.

8.7.1.1 Global, National and Multi-Sport categories MS1 and MS2 Hockey Turfs

For Global, National and Multi-Sport categories MS1 and MS2 Hockey Turfs the Lisport rollers shall be covered with a profiled rubber sheet made from vulcanised styrene butadiene rubber (SBR). The test sole shall have a wave profile on one face and comply with the following requirements:

Thickness (mm)	2.5 ± 0.3	
Hardness (Shore A)	90 ± 3	
Wave length (mm)	13.0 ± 0.5	
Amplitude (mm)	2.0 ± 0.3	
Profile height (mm)	0.6 ± 0.1	

Note: The test sole is available from TQS Belgium BVBA, Hofveldstraat 13, 9688 Maarkedal, Belgium (reference Lisson test sole; EN 1963).

The test specimen shall be subjected to 10,200 Lisport cycles.

8.7.1.2 Multi-Sport category MS3 Hockey Turfs




Multi-Sport category MS3 Hockey Turfs shall be tested using the studded roller specified in accordance EN 15306.

Test specimens shall be subjected to 20,200 Lisport cycles.

8.7.2 Photographic examination of pile yarns

Before and after simulated wear conditioning a sample area measuring 150mm x 150mm in the centre of the Lisport test specimen shall be examined for signs of damage to the pile using a Dino-lite Edge Type AM4815ZT Digital Microscope. Using the microscope’s extended depth of field (EDOF) function and using 20x and 100x magnification, any splitting, cracking, tearing or other damage to the pile yarns shall be recorded and reported. This shall include an estimate of the percentage of the yarns affected.

Photographs showing the test specimen before and after simulated wear conditioning shall be reported. The photographs below illustrate the types of photograph required.

Sample before simulated wear conditioning			
	x 20		x 100
Sample after 10,200 cycles of simulated wear conditioning			
	x 20		X 100

Notes:

- 1 Note: If the FIH considers a product to show very poor resistance to simulated use they reserve the right to not grant it FIH Approved Product status.
- 2 As experience is gained with this test, the FIH plan to introduce a classification of fibre wear and maximum limits of damage. This will eventually replace the Abrasion Resistance test detailed in 8.6 below. At this initial stage, it is intended that by requiring all products to be tested and reported consumers will be able to compare the wear resistance of different Hockey Turf products.

8.7.3 Performance requirements after simulated wear conditioning

Following the simulated wear conditioning the Hockey Turf shall comply with the relevant Ball Rebound, Shock Absorption, Deformation and Shoe-Surface Friction requirements detailed in clauses 8.1, 8.3, 8.4 and 8.5.

As the size of the test specimens produced by the apparatus described in EN 15306 is smaller than the test specimens specified in EN 12235, EN TS 16717 and EN 15301-1, the test pieces used shall conform to the requirements given in EN 15306. No test shall be carried out within 50 mm of the edge of the test piece or within 50 mm of where another test has been carried out.

Global category Hockey Turfs shall be irrigated in accordance with manufacturer's requirements following the simulated wear conditioning and prior to the measurements of ball rebound, shock absorption & vertical deformation and rotational resistance. The tests shall be made 15 minutes after irrigation.

8.8 Abrasion Resistance

8.8.1 Non-filled and sand dressed synthetic turf surfaces

When tested in accordance with EN 13672 the maximum pile weight loss after 2000 cycles shall be ≤ 350 mg. Sand dressed carpets shall be tested without any infill.

8.8.2 Textile surfaces

When tested in accordance with EN 13672, but modified so that each wheel is acting under a load of 250 g, the maximum percentage weight loss after 2000 cycles shall be 2%.

8.9 Water Permeability

When tested in accordance with FIFA TM 24 the water permeability rate of the Hockey Turf (including any infill and shockpad) shall be at least 150mm/h.

8.10 Toxicology

The pile yarn or fibre from which the Hockey Turf carpet is manufactured shall either satisfy the requirements of Table 2 Category III of EN 71-3 or the requirements of ASTM 3188 -16. Tests shall be undertaken on each colour of Hockey Turf being offered for the field of play and perimeter run-offs.

Results obtained previously may be carried forward providing the tests were undertaken by an FIH Accredited Test Institute and the following conditions are met:

1. The Differential Scanning Calorimetry trace of the yarn or fibre, when tested in accordance with FIFA TM 22 shows the same profile. The main points of reference when comparing yarns shall be obtained from the second heating of the polymer sample and comprise the peak temperature, peak area and overall curve shape, all of which should be similar (peak temperature $\pm 3^\circ$).
2. The colour of the the yarn or fibre is the same as that previously tested.

Notes:

In addition to satisfying the requirements of this clause, a Hockey Turf and shockpad (including any polymeric infills) should comply with all toxicology and environmental regulations applicable in the country in which it is being sold. Certification to this requirement does not form part of FIH Approval.

8.11 Carpet Strength

8.11.1 Synthetic turf carpets

Synthetic turf carpets having a mass per unit area of less than 3.5kg/m² shall be tested in accordance with EN ISO 13934-1 and the tensile strength of the carpet shall be ≥ 15 N/mm. If the tensile strength in either the direction of manufacture or at 90° to the direction of manufacture is ≤ 20 N/mm the maximum percentage variation between the two directions shall be $\leq 30\%$ of higher value.

Note: experience has shown carpets with a mass per unit area of 3.5kg/m² or greater have adequate tensile properties, meaning there is no need to measure this property.

8.11.2 Textile carpets

When tested in accordance with EN ISO 13934-1 the tensile strength of the carpet shall be ≥ 7.5 N/mm.

8.12 Tuft Bind of Synthetic Turf Carpets

When tested in accordance with ISO 4919 the tuft withdrawal force for the tuft bundle shall be ≥ 25 N.

Following immersion in hot water, in accordance with EN 13744, the tuft withdrawal force shall be at least 75% of the unaged value and equal to or greater than 25N.

8.13 Joint Strength

8.13.1 Stitched and bonded joints

When tested in accordance with Method 1 of EN 12228, the unaged tensile strength of stitched and bonded joints shall be equal to or greater than 1000 N/100 mm.

Following immersion in hot water, in accordance with EN 13744, the aged tensile strength of the joints shall be at least 75% of the unaged value and equal to or greater than 1000 N/100 mm.

8.13.2 Bonded joints

When tested in accordance with Method 2 of EN 12228 the unaged peel strength of bonded joints shall be equal to or greater than 50 N/100 mm.

Following immersion in hot water in accordance with EN 13744, the peel strength of bonded joints shall be at least 75% of the unaged value and equal to or greater than 50 N/100mm.

8.14 Dimensional Stability

When tested in accordance with EN 13746 the dimensional stability of the Hockey Turf surface shall be $\leq \pm 0.5\%$ after each stage of the test.

This requirement does not apply to:

- Hockey Turf carpets having a mass per unit area ≥ 3.5 kg/m²
- Hockey Turf carpets that are intended to be fully bonded to a shockpad.
- Hockey Turf carpets containing at least 15 kg/m² of infill

Note: experience has shown that Hockey Turf carpets satisfying these criteria have acceptable dimensional stability.

8.15 Tensile Strength of Pile Yarns and Fibres

8.15.1 Synthetic turf pile yarns

When tested in accordance with EN 13864, the minimum tensile strength of the yarn(s) used to form the pile of a synthetic turf shall be 5N for monofilament yarns and 30N for fibrillated yarns.

Monofilament yarns shall be tested as individual ribbons or strands.

8.15.2 Textile carpet pile fibres

When tested in accordance with EN ISO 5079, the minimum tensile strength of the fibres used to form the pile of a textile surface shall be 3N.

8.16 Resistance of Pile Yarns and Fibres to Ultra Violet Degradation

8.16.1 General

Tests shall be undertaken on each colour of Hockey Turf being offered, including field of play, perimeter run-offs and line markings.

Results obtained previously on a family of yarns or fibres may be carried forward providing the tests were undertaken by an FIH Accredited Test Institute and the following conditions are met:

1. The Differential Scanning Calorimetry trace of the yarn, when tested in accordance with FIFA TM 22 shows the same profile. The main points of reference when comparing yarns shall be obtained from the second heating of the polymer sample and comprise the peak temperature, peak area and overall curve shape, all of which should be similar (peak temperature $\pm 3^\circ$).
2. The thickness of the yarn shall be at least 90% of the previously tested yarn, when tested in accordance with FIFA TM 25.
3. The shape of the yarn is the same.

8.16.2 Synthetic turf pile yarns

Pile yarns shall be artificially weathered in accordance with EN 14836 but the level of irradiation shall be increased to $9600 \pm 125 \text{ kJ/m}^2/340\text{nm}$.

Following artificial weathering, the strength of the pile yarn shall be greater than 5N for monofilament yarns and 30N for fibrillated yarns. Additionally, the loss in strength and tenacity after artificial weathering shall be no greater than 50% of the strength and tenacity of the unaged yarn.

8.16.3 Textile carpet pile fibres

Pile yarns shall be artificially weathered in accordance with EN 14836 with an irradiation of $4896 \pm 125 \text{ kJ/m}^2/340\text{nm}$.

Following artificial weathering, the strength of the pile yarn shall still be greater than 3N. Additionally, the loss in strength after artificial weathering shall be no greater than 50% of the strength of the unaged yarn.

8.17 Properties of Shockpads and Elastic Layers

8.17.1 Tensile strength

8.17.1.1 Shockpads and elastic layers less than 25mm thick





When tested in accordance with EN 12230 the minimum tensile strength of the shockpad or elastic layer shall be 0.15 MPa.

Following air ageing in accordance with EN 13817 the minimum tensile strength shall be 0.15 MPa and the loss in tensile strength shall be no greater than 25% of the tensile strength of the unaged shockpad or elastic layer.

8.17.1.2 Shockpads and elastic layers 25mm or thicker

The transverse tensile strength shall be measured in accordance with DIN 18035-7: 2014. In this a test specimen of 100 mm x 100 mm is subjected to a vertical tensile stress transmitted to it by means of the tensile testing machine compliant with EN 12230, Clause 5.

Test specimens of dimensions 100 mm x 100 mm shall be cut out and glued between two plates (metal, hardwood or the like) arranged so that their top and bottom sides are parallel, as illustrated in the pictures below:

	
<p>View of test specimen and mounting plates</p>	<p>Suitable adhesive</p>
	
<p>Application of adhesive (approx. 15g adhesive used per surface)</p>	

	
<p>Clamping test specimen as the adhesive cures</p>	<p>Test specimen with test machine plates mounted to plates</p>
	
<p>Test specimen under test</p>	<p>Test specimen after test</p>

A minimum of five test specimens shall be tested.

The test specimens shall be conditioned immediately prior to test in a standard atmosphere of $23 \pm 2^\circ\text{C}$ and $50 \pm 5\% \text{RH}$ for a period of not less than 24h.

The test specimens shall be clamped in the testing machine and a tensile force applied at a speed of 50 ± 5 mm/min until failure.

The transverse tensile strength is calculated using formula:

$$\sigma_{QZ} = F_B / A$$

σ_{QZ} = transverse tensile strength in N/mm^2

F_B = force in N exerted on the test piece at the point of failure

A = the stressed area of the test piece in mm^2 .

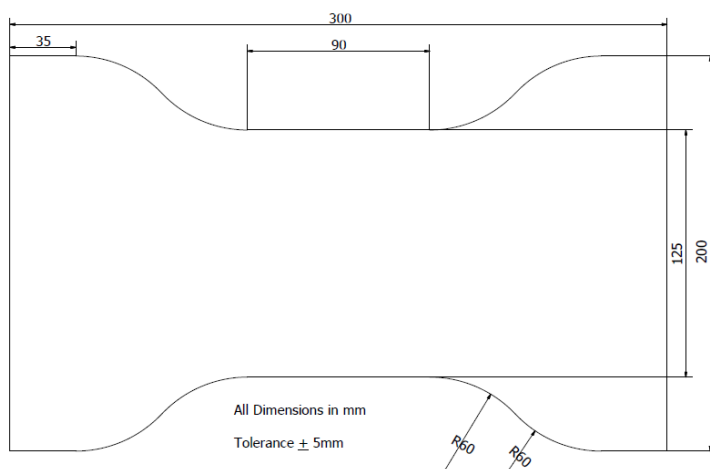
When tested in accordance with the method given above, the minimum transverse tensile strength of the shockpad or elastic layer shall be 0.08 MPa.

Following air ageing in accordance with EN 13817 the minimum tensile strength of a shockpad or elastic layer shall be 0.08 MPa and the loss in transverse tensile strength shall be no greater than 25% of the tensile strength of the unaged shockpad or elastic layer.

8.17.1.3 Shockpad with channels and slots

When tested in accordance with EN 12230, but using a test specimen as shown in the figure below, the minimum tensile strength of the shockpad or elastic layer shall be 0.10 MPa. The test specimens shall be cut from the shockpad roll/tile to ensure that they contain the maximum number of channels or slots.

Following air ageing in accordance with EN 13817 the minimum tensile strength shall be 0.10 MPa and the loss in tensile strength shall be no greater than 25% of the tensile strength of the unaged shockpad or elastic layer.



Dimensions of test specimen dumbbell

8.17.2 Loss of shock absorption due to ageing

Following air ageing in accordance with EN 13817 the shock absorption of the shockpad or elastic layer shall be $\pm 5\%$ SA (absolute) of the unaged shockpad or elastic layer.

8.17.3 Resistance to Dynamic Fatigue

Following dynamic fatigue testing in accordance with Annex D of the *ESTO Performance Guide for Shockpads* (2013 edition) the shockpad or elastic layer shall satisfy the following requirements:

8.17.3.1 Loss of shock absorption

When tested in accordance with EN TS 16717 the change in shock absorption shall not exceed $\pm 5\%$ FR (absolute) of the unaged specimen.

8.17.3.2 Loss of thickness

When tested in accordance with EN 1969 the thickness of the shockpad or elastic layer shall be $\geq 85\%$ of unaged specimen.

8.17.3.3 Physical damage

There shall be no tearing, splitting or delamination of the shockpad.

8.17.4 Resistance to bowing and curling

When tested in accordance with Annex C of the *ESTO Performance Guide for Shockpads* (2013 edition) the maximum bowing or curling recorded shall be 5mm.

8.18 Properties of Sand Infills

Sands used as infill in National and Multi-Sport category surfaces shall satisfy the following requirements:

8.18.1 Particle grading

The particle grading of the infill shall be in the range 0.3mm – 1.0mm.

The particle grading shall be determined in accordance with FIFA TM 20.

8.18.2 Particle shape

When tested in accordance with EN 14955 the particle shape shall be classified as rounded or sub-rounded; classes C1 – C3.

8.19 Product Identification

The components that form the tested Hockey Turf surface shall be characterised using the following test methods and the results obtained shall comply with the manufacturer's product declaration, subject to the tolerances specified.

Component / property	Characteristic
Carpet type	Synthetic turf or textile surface
Method of carpet manufacture	Tufted, Woven, Knitted or Needle-punch
Carpet pile colour – FOP, run-offs and line markings	RAL Classic number(s)
Carpet pile type – FOP, run-offs and line	Straight, curled, monofilament, split film
Shockpad	Type of construction, product name
Infill	Type / composition

Component	Characteristic	Test Method	Tolerance
Properties of synthetic turf carpet	Pile height above backing	ISO 2549	± 10%
	Tufts per unit area	ISO 1763	± 10%
FOP, Run-offs and line markings	Filaments/m ²	See note 1	± 10%
	Pile weight	ISO 8543 – see note 2	± 10%

	Pile dtex	FIFA TM 23	$\pm 10\%$
	Pile Thickness	FIFA TM 25	$\geq 90\%$
	Pile Profile	FIFA TM 25	-
	Pile polymer characterisation	ISO 11357-3 / FIFA TM 22	Same polymer
	Carpet mass per unit area	ISO 8543	$\pm 10\%$
	Water permeability of carpet	FIFA TM 24	-

Properties of shockpads and elastic layers	Thickness	EN 1969	90% - 130%
	Mass per unit area	ISO 8543	$\pm 10\%$
	Shock Absorption	EN TS 16717	$\pm 5\%$ SA
	Water permeability	FIFA TM 244	$\geq 90\%$

Properties of infills	Particle Grading	FIFA TM 20	60% between d and D
	Particle Shape	EN 14955	Similar shape
	Bulk density	EN 1097-3	$\pm 15\%$
	Polymer composition (polymeric infills only)	FIFA TM 11	$\pm 15\%$

Properties of textile carpets	Thickness of pile above the substrate	ISO 1766	$\leq 10\%$
	Fibre polymer characterisation	ISO 11357-3 / FIFA TM 22	Same polymer
	Carpet mass per unit area	ISO 8543	$\leq 10\%$
	Water permeability	FIFA TM 244	-

Notes

- 1 The number of filaments per square metre shall be calculated by multiplying the number of tufts per square metre by the number of filaments per tuft; this figure being the mean value of 20 tufts extracted at random from a 200mm x 200mm sample.

- 2 If it is not possible to extract tufts from the carpet backing (e.g. when there is an integral shockpad or the carpet is of a knitted construction, etc.) the pile weight per unit area above the substrate shall be determined in accordance with ISO 8543. This shall be noted in the test report.

9 Reporting

The results of a product assessment to determine compliance with this Standard shall be reported on an official FIH Test Report. The completed test report shall be sent to the FIH (facilities@fih.ch) for review.

If the FIH concludes the Hockey Turf meets the requirements of this Standard, the FIH will issue a Certificate of Product Approval and a copy of the test report to the FIH Preferred Supplier or FIH Certified Manufacturer. They will also place the product on the list of FIH Approved Hockey Turf Products on the FIH website (www.fih.ch/hockeyturf).

10 Validity of Product Approval

A Hockey Turf product shall remain approved by the FIH until one of the following occurs:

- The FIH Preferred Supplier or the FIH Certified Manufacturer ceases to be a member of the FIH Quality Programme for Hockey Turf;
- The composition of the Approved Product changes so it no longer complies with the product identification requirements of this Standard;
- This Standard is updated or replaced.

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