QUALITY PROGRAMME

FIH

ENGINEERED FOR HOCKEY

Hockey Turf & Field Standards

PART 1 – FIH APPROVED HOCKEY TURFS

Performance & quality requirements

VER. 2.1

INTERNATIONAL HOCKEY FEDERATION
FÉDÉRATION INTERNATIONALE DE HOCKEY

fih.ch/qp

Foreword

Hockey is the world's third most popular team sport; the *2018 Global Hockey Survey* conducted by the FIH, showed that there are now over 30 million people playing hockey. Fast, technically skilful, and requiring good levels of personal fitness, the sport is renowned for its social inclusiveness, gender equality, and ability to attract players of all ages.

During much of the 20th century, hockey was played on natural grass, and even today this is till the surface used by many. In 1976, however, our sport was transformed when elite level hockey was played on synthetic turf for the first time.

Today synthetic turf, and especially the versions produced specifically for hockey (which we now call hockey turf) has allowed the game to develop into the fast, technically skilful, and exciting sport we know today.

Not all hockey turfs are the same and selecting the most appropriate type for the grades of hockey that will take place on a field is important. Therefore, to help guide those planning a new hockey facility we have produced our *Facilities Guidance – Outdoor Hockey Surfaces,* which may be downloaded at www.fih/ch/qp.

When determining which form of surface is the most appropriate for a specific facility it is very important that the requirements of the various competitions that will be held on it are considered, as well as the policies and recommendations of the National Hockey Association.

FIH Quality Programme

People need suitable facilities to play, but these require major investment, so it is very important that hockey courts are designed and constructed correctly. To help ensure this occurs, the FIH has developed its FIH Quality Programme. The programme provides guidance and quality assurance through internationally recognised standards. These are based on over 40 years' experience and have been developed to ensure the appropriate levels of performance and durability are achieved by a facility, irrespective of whether it is intended for community hockey, international competition, or anything in between.

The FIH Quality Programme also endorses companies that manufacture high quality hockey surfaces, and contractors that have a proven ability to build great hockey facilities.

FIH Preferred Suppliers are companies that manufacture hockey turf products and build hockey courts allowing customers to benefit from a one-stop approach to the construction of their new hockey facility. FIH Preferred Suppliers have a global commitment to work with the FIH to provide high-quality hockey facilities suitable for international, national, club, and development hockey.

FIH Certified Manufacturers are companies that specialise in the manufacturing of hockey turfs. These companies have a proven ability to produce surfaces to the standards the

game requires, whilst operating quality management systems that ensure consistency in their products.

FIH Certified Field Builders are companies that specialise in building hockey fields. Due to the nature of hockey, a small ball moving quickly across the surface, the tolerance to which a facility needs to be constructed are much more demanding than those required by large-ball sports. FIH Certified Field Builders have a proven ability to construct fields, and HOCKEY5s courts, to the standards the game requires.

The FIH recommends that whenever you are planning a new hockey field or HOCKEY5s court you always:

- select an FIH approved hockey turf
- appoint either an FIH Preferred Supplier or FIH Certified Field Builder to design and build the field or court.

Details of FIH Approved Products, FIH Preferred Suppliers and FIH Certified Field Builders can be found at www.fih.ch/qp.

1 Introduction & scope

This document is Part 1 of the *FIH Hockey Turf and Field Standards*. It specifies the performance and durability requirements for FIH approved hockey turf products. It supersedes the 2017 edition. The requirements have been established after consultation with National Hockey Associations, members of the FIH Quality Programme, and our FIH accredited laboratories.

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.

The principal changes to the 2017 edition of this Standard are:

- New classification of hockey turfs
- Revisions to the definitions of the different types of synthetic turf used for hockey
- Enhanced minimum transversal tensile strength requirement for homogenous shockpads more than 25 mm thick
- Revised particle grading range for sand infills
- Additional toxicology requirements for polymeric infill materials
- Revised tensile strength requirements for fibres used in textile hockey surfaces

2 Definitions

Approved product – a hockey turf surface that has been tested and certified in accordance with this Standard.

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 Organisation (CEN).

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 sports 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 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.

Playing surface – the synthetic turf or textile surface forming the upper surface of the hockey turf.

Shockpad or elastic layer – prefabricated foam or elastomeric sheets, rolls, 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 30 mm or less.

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

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

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 Classification

Based on the performance of the hockey turf (as defined in Section 4) and the type of playing surface and shockpad on which it is laid, the hockey turf shall be classified as follows:

FIH Global	
Intended use:	Tier 1 international and national competitions and training
Type of carpet	Non-filled short pile synthetic turf
Irrigation	Required
FIH National	
Intended use:	Tier 2 international, national & local competitions and training
Types of carpet	Sand-dressed short pile synthetic turf, Non-filled short pile synthetic turf
Irrigation	Optional

FIH Community – Hockey Plus multi-sport	
Intended use:	Community and school competitions, and training.
Types of carpet	Hockey friendly synthetic turf or textile multi-sports surfaces on which other sports such as football can be played at the lower levels of community and school competition.
Irrigation	Not required
FIH Community – Gen 2 multi-sport	
Intended use:	Hockey friendly multi-sport surfaces intended for fields on which sports such as recreational tennis, netball, and futsal, etc are also played. Community and school competitions, and training.
Types of carpet	Sand-dressed short pile synthetic turf, Textile sport surface, Non-filled short pile synthetic turf.
Irrigation	Not required
FIH Community – 3G Multi-sport	
Intended use:	Community and school competitions, and training.
Type of carpet	Longer pile synthetic turfs primary intended for large ball sports, with hockey being a secondary sport. Playing characteristics similar to natural grass.
Irrigation	Not required
Note: The use of long-pile synthetic turfs in national/regional/local hockey competitions is prohibited in some countries	

The type of playing surface used in a hockey turf shall be described as follows:

	Non-filled synthetic turf	Sand dressed synthetic turf	Sand filled synthetic turf
Carpet type	Synthetic turf	Synthetic turf	Synthetic turf
Non-filled / dressed / filled	Non-filled	Dressed	Filled
Pile height	10 mm – 18 mm	12 mm – 22 mm	18 mm – 30 mm
Free pile above infill	N/A	≥ 25%	<25%
Requires irrigation	Yes	Optional	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 / semi filled	Semi-filled	Non-filled	
Pile height [(2)]	≥ 30 mm	≥ 30 mm	
Free pile above infill	≥ 30%	N/A	
Requires irrigation	No	No	
Requires a shockpad	Optional	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	12 mm – 25 mm	12 mm – 25 mm	12 mm – 25 mm
Free pile above infill	<25%	≥ 25%	N/A
Requires irrigation	No	No	No
Requires a shockpad	Yes	Yes	Yes

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.

4 Requirements

To be approved by the FIH a hockey turf must comply with the appropriate requirements of Clauses 4.1 – 4.7 of this Standard. In addition, the components that form the tested hockey turf shall be characterised using the test methods detailed in Section 4.2 and the results obtained shall comply with the manufacturer's product declaration, subject to the tolerances specified in Section 4.2.

Tests shall be undertaken by an FIH Accredited Test Institute (see www.fih.ch/qp for details) using the test methods specified in this Standard.

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.

4.1 Performance requirements

Property	Unit	Test condition	Global	National	Community		
					Hockey Plus Multi-sport	Gen 2 Multi-sport	3G Multi-sport
Hockey ball rebound	mm	Dry		100 – 425	100 – 450	≤ 500	≥ 75
		Wet	100 – 400	100 – 425	100 – 450	≤ 500	≥ 75
		Irrigation + 15 minutes	100 – 400	–	–	–	–
		Irrigation + 45 minutes	100 – 400	–	–	–	–
		After simulated wear	100 – 400	100 – 425	100 – 450	≤ 500	≥ 75
Hockey ball roll & consistency between directions of test	m	Dry		≥ 9.0 ≤ ± 20	≥ 8.0 ≤ ± 20	≥ 8.0 ≤ ± 20	≥ 5.0 ≤ ± 20
	%	Wet	≥ 10.0 ≤ ± 10	≥ 9.0 ≤ ± 20	≥ 8.0 ≤ ± 20	≥ 8.0 ≤ ± 20	≥ 5.0 ≤ ± 20
		Irrigation + 15 minutes	≥ 10.0 ≤ ± 10	–	–	–	–
		Irrigation + 45 minutes	≥ 10.0 ≤ ± 10	–	–	–	–
Hockey ball roll deviation	m	Dry		≤ 0.45 @ 8.5 m	≤ 0.40 @ 7.5 m	≤ 0.40 @ 7.5 m	–
		Wet	≤ 0.50 @ 9.5 m	≤ 0.45 @ 8.5 m	≤ 0.40 @ 7.5 m	≤ 0.40 @ 7.5 m	–
		Irrigation + 15 minutes	≤ 0.50 @ 9.5 m	–	–	–	–

Property	Unit	Test condition	Global	National	Community		
					Hockey Plus Multi-sport	Gen 2 Multi-sport	3G Multi-sport
Shock absorption	%	Dry	–	40 – 65	40 – 70	30 – 60	55 – 70
		Wet	45 – 60	40 – 65	40 – 70	30 – 60	55 – 70
		Irrigation + 15 minutes	45 – 60	–	–	–	–
		After simulated wear	45 – 60	40 – 65	40 – 70	30 – 60	55 – 70
Surface deformation	mm	Dry	–	4 – 9	4 – 10	2 – 9	4 – 12
		Wet	4 – 9	4 – 9	4 – 10	2 – 9	4 – 12
		Irrigation + 15 minutes	4 – 9	–	–	–	–
		After simulated wear	4 – 9	4 – 9	4 – 10	2 – 9	4 – 12
Shoe – surface friction Dimple test sole	Nm	Dry	–	25 – 45	25 – 45	25 – 45	25 – 50
		Wet	25 – 45	25 – 45	25 – 45	25 – 45	25 – 50
		Irrigation + 15 minutes	25 – 45	–	–	–	–
		After simulated wear	25 – 45	25 – 45	25 – 45	25 – 45	25 – 50
Skin – surface friction	μ	Irrigation + 45 minutes	≤ 0.75	–	–	–	–
Water permeability	mm/h	Wet	≥ 150 mm/h	≥ 150 mm/h	≥ 150 mm/h	≥ 150 mm/h	≥ 150 mm/h

Additional multi-sport performance requirements for Gen 2 hockey turfs

Property	Unit	Test condition	Requirement		
Tennis ball rebound	%	Dry	≥ 80		
		Wet	≥ 80		
Tennis pace	Pace classification	Dry	≤ 29	Category 1	Slow
			30 – 34	Category 2	Medium-slow
			35 – 39	Category 3	Medium
			40 – 44	Category 4	Medium-fast
			≥ 45	Category 5	Fast
Netball slip resistance	PTV	Dry	≥ 75		
		Wet	≥ 75		
		After simulated wear	≥ 75		
Netball & Tennis Rotational Resistance (smooth rubber test sole)	Nm	Dry	15 – 45		
		Wet	15 – 45		

4.2 Hockey turf product component characterisation

Component	Characteristic	Test Method	Tolerance compared to manufacturer's declaration
Properties of synthetic turf carpet (see also section 4.3)	Pile height above backing	ISO 2549	± 10%
	Tufts per unit area	ISO 1763	± 10%
	Filaments/m^2	See note 1	± 10%
	Pile weight	ISO 8543 – see note 2	± 10%
	Pile dtex	FIFA TM 23	± 10%
	Pile Thickness	FIFA TM 25	≥ 90%
	Pile Profile	FIFA TM 25	Same profile
	Pile polymer characterisation	FIFA TM 22	Same profile ± 3 °C (mean peak)
	Carpet mass per unit area	ISO 8543	± 10%
	Water permeability of carpet	FIFA TM 24	≥ 90%

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

Component	Characteristic	Test Method	Tolerance compared to manufacturer's declaration
Properties of inlaid / tufted line markings	Colour	RAL Classic	Same as approved product
	Polymer characterisation	FIFA TM 22	Same profile ± 3 °C (mean peak)
Properties of shockpads and elastic layers (see also section 4.5)	Thickness	EN 1969	90% – 130%
	Mass per unit area	ISO 8543	± 10%
	Shock Absorption	EN TS 16717	± 5% SA
	Water permeability	FIFA TM 244	≥ 90%
Properties of infills (see also section 4.6)	Particle Grading	EN 933–1 / FIFA TM 20	90% between d and D
	Particle Shape	EN 14955	Similar shape
	Bulk density	EN 1097–3	± 15%
	Polymer composition (polymeric infills)	FIFA TM 11	Same polymer type, ± 15% of TGA value
Properties of textile carpets (see also section 4.7)	Thickness of pile above substrate	ISO 1766	≤ 10 %
	Fibre polymer characterization	FIFA TM 22	Same profile ± 3 °C (mean peak)
	Carpet mass per unit area	ISO 8543	≤ 10 %
	Water permeability	FIFA TM 24	≥ 90%

4.3 Synthetic turf carpets

4.3.1 Abrasion Resistance of non-filled short pile and sand dressed carpets

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.

4.3.2 Carpet Strength

Synthetic turf carpets having a mass per unit area of less than 3.5kg/m^2 shall be tested in accordance with EN ISO 13934-1 and the tensile strength of the carpet shall be ≥ 15N/mm. If the tensile strength in either the direction of manufacture or at 90^0 to the direction of manufacture is ≤ 20 N/mm the maximum percentage variation between the two directions shall be ≤ 30% of higher value.

Note: experience has shown carpets with a mass per unit area of 3.5kg/m^2 or greater have adequate tensile properties, meaning there is no need to measure this property.

4.3.3 Tuft Bind

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

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.

4.3.4 Joint Strength

4.3.4.1 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 tensile strength of the joints shall be at least 75% of the unaged value and equal to or greater than 1000 N/100 mm.

4.3.4.2 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.

4.3.5 Dimensional Stability

When tested in accordance with EN 13746 the dimensional stability of the hockey turf surface shall be ≤± 0.5% after each stage of the test.

This requirement does not apply to:

- hockey turf carpets having a mass per unit area $\geq$ 3.5kg/m^2
- hockey turf carpets that are intended to be fully bonded to a shockpad
- hockey turf carpets containing at least 15 kg/m^2 of infill

Note: experience has shown that hockey turf carpets satisfying these criteria have acceptable dimensional stability.

4.4 Synthetic turf pile yarns

4.4.1 Toxicology and Environmental Properties

The yarns used in the hockey turf carpet shall either satisfy the requirements of Table 2 Category III of EN 71–3, or the requirements of ASTM 3188 –16.

Notes: In addition to satisfying the requirements of this clause, a hockey turf surface 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.

4.4.2 Tensile strength of pile yarn

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
- 30N for fibrillated yarns

Monofilament yarns shall be tested as individual ribbons or strands.

4.4.3 Resistance of pile yarns to ultraviolet degradation

4.4.3.1 General

Tests shall be undertaken on each colour of hockey turf being offered for the field of play, perimeter run–offs, line markings and any logos located within the field of play or inner run–offs.

Results obtained previously on a family of yarns 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 ± 3°).
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.

4.4.3.2 Artificial weathering test method

Pile yarns shall be artificially weathered in accordance with EN 14836 Method 2 (9600±125 kJ/m^2/340nm).

4.4.3.3 Requirements

Following artificial weathering, the strength of the pile yarn shall be greater than:

- 5N for monofilament yarns
- 30N for fibrillated yarns

Additionally, the losses in strength and tenacity after artificial weathering shall be no greater than 50% of the strength and tenacity of the unaged yarn.

4.5 Shockpads

4.5.1 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.

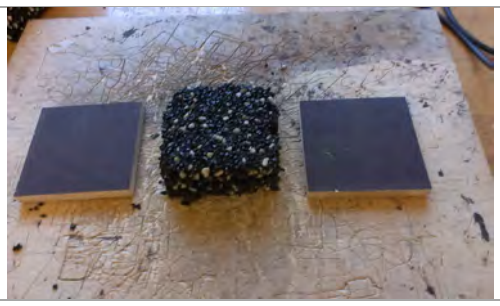
Following air ageing in accordance with EN 13817 the minimum tensile strength shall be

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.

4.5.2 Shockpads and elastic layers 25mm or thicker

When measured in accordance with DIN 18035-7: 2014 (and summarized below) the minimum transverse tensile strength of the shockpad or elastic layer shall be 0.10 MPa.

The test specimens, of dimensions 100 mm x 100 mm, should 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:

	
View of test specimen and mounting plates	Suitable adhesive

<table>
<tr><td colspan="2">   </td></tr>
<tr><td colspan="2">Application of adhesive (approx. 15g adhesive used per surface)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Clamping test specimen as the adhesive cures</td><td>Test specimen with test machine plates mounted to plates</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Test specimen under test</td><td>Test specimen after test</td></tr>
</table>

A minimum of five test specimens shall be tested using a tensile testing machine compliant with Clause 5 of EN 12330.

The test specimens shall be conditioned immediately prior to test in a standard atmosphere of 23 ± 2°C and 50 ± 5%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: $\delta_{QZ} = F_B / A$

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

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

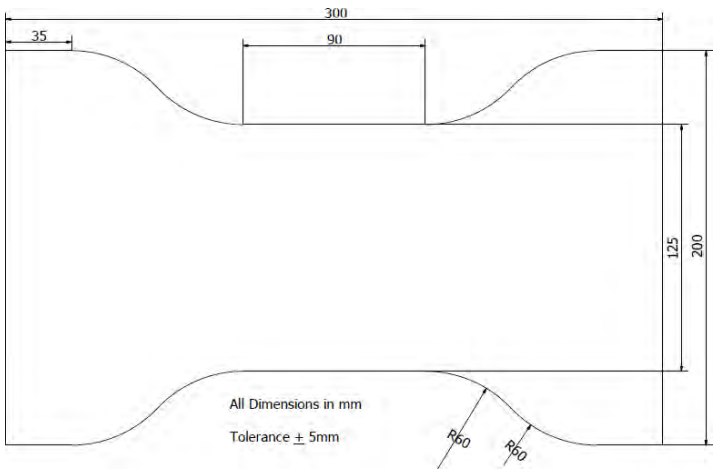
failure A = the stressed area of the test piece in mm^2.

Following air ageing in accordance with EN 13817 the minimum tensile strength of a shockpad or elastic layer shall be 0.10 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.

4.5.3 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

4.5.4 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 ± 5% SA (absolute) of the unaged shockpad or elastic layer.

4.5.5 Resistance to Dynamic Fatigue

Following dynamic fatigue conditioning in accordance with EN 17324 the shockpad or elastic layer shall satisfy the following requirements:

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

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

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

4.5.6 Dimensional stability

When tested in accordance with EN 17326 the maximum bowing or curling recorded shall be 5mm.

4.6 Infill materials

4.6.1 Dust content

When measured in accordance with EN 15051 the Inhalable Dust Content of the infill shall be classified as Very Low or Low

4.6.2 Sand infills

Sands used as infill shall satisfy the following requirements:

4.6.2.1 Particle grading

The particle grading of the infill shall be in the range 0.2 mm – 1.0 mm. The grading shall be determined in accordance with EN 933–1 using a range of sieves that have aperture sizes between *d* and *D* of the designated product size, and shall include 0.00, mm, 0.150 mm, 0.200 mm, 0.250 mm, 0.315 mm, 0.500 mm, 0.630 mm, 0.800 mm, 1.00 mm and 1.25 mm sieves. The apertures shall be as specified in EN 933–2 and conform to the requirements of ISO 3310–1 and ISO 3310–2.

The sieves shall be mounted in a mechanical device that applies a 3–dimentional vibrating movement. The equipment shall have a timer and amplitude settings; the amplitude shall be set at 1.5 mm. The duration of the sieving operation shall be 12 min ± 15 s.

4.6.2.2 Particle shape

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

4.6.2.3 Water permeability

When tested in accordance with EN 12616 the water infiltration rate of a 20 ± 2 mm depth of the infill shall be ≥ 150 mm/h.

4.6.3 Polymeric infills

Polymeric infills shall satisfy the following requirements:

4.6.3.1 Particle grading

The particle grading of the infill shall be in the range 0.3 mm – 3.0 mm. The particle grading shall be determined in accordance with FIFA TM 20.

4.6.3.2 Water permeability

When tested in accordance with EN 12616 the water infiltration rate of a 20 ± 2 mm depth of the infill shall be ≥ 150 mm/h.

4.6.3.3 Resistance to weathering

Following artificial weathered in accordance with EN 14836 Method 2 (9600±125 kJ/m^2/340nm), the infill shall not have agglomerated or show a significant change in colour.

4.6.3.4 Polycyclic Aromatic Hydrocarbon (PAH) content

When tested using the procedure described in AfPS GS 2019:01 PAK, published by the German Federal Institute for Occupational Safety and Health, the sum of the eight PAHs listed below shall be ≤ 20.0 mg/kg:

PAH	CAS Registry No.	PAH	CAS Registry No.
Benzo[a]pyrene (BaP)	50–32–8	Benzo[b]fluoranthene (BbFA)	205–99–2
Benzo[e]pyrene (BeP) C	192–97–2	Benzo[j]fluoranthene (BjFA)	205–82–3
Benzo[a]anthracene (BaA)	56–55–3	Benzo[k]fluoranthene (BkFA)	207–08–9
Chrysen (CHR)	218–01–9	Dibenzo[a,h]anthracene (DBAhA)	53–70–3

Prior to chemical analysis to verify compliance, samples shall be prepared in accordance with Appendix A of EN 17409.

Testing to demonstrate compliance with this requirement should be undertaken by an independent test laboratory accredited to ISO 17025 for this test.

Notes:

1 Compliance with legal regulations (laws) shall always take precedence over FIH Standards.

2 For infills manufactured from end of life products (tyres, etc) compliance with this requirement will be depend on the polymer composition of the product and this may vary production–batch to production–batch. Therefore, testing to verify compliance with this requirement is also recommended when a field is initially tested.

4.7 Textile sports surfaces

4.7.1 Abrasion resistance

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%.

4.7.2 Carpet strength

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

4.7.3 Joint Strength

As detailed in clause 4.3.4

4.7.4 Dimensional Stability

As detailed in clause 4.3.5

4.7.5 Toxicology and environmental properties

As detailed in clause 4.4.1

4.7.6 Tensile Strength of pile fibres

4.7.6.1 Surfaces intended to form the field of play

When tested in accordance with EN ISO 5079, the minimum tensile strength of at least 70% of fibres used to form the pile of the textile surface shall be 3N.

4.7.6.2 Surfaces intended to form line markings and perimeter run–offs

When tested in accordance with EN ISO 5079, the minimum tensile strength of at least 70% of fibres used to form the pile of the textile surface shall be 2N.

4.7.7 Resistance of Pile Fibres to Ultraviolet Degradation

4.7.7.1 General

As per clause 4.4.3.

4.7.7.2 Artificial weathering test method

Fibres shall be artificially weathered in accordance with EN 14836 Method 1 (irradiation of 4896 ± 125 kJ/m^2/340nm).

4.7.7.3 Pile fibres for surfaces intended to form the field of play

Following artificial weathering, the strength of the pile yarn shall still be greater than 2.0N. Additionally, the loss in strength after artificial weathering shall be no greater than 35% of

the strength of the unaged yarn.

4.7.7.4 Pile fibres for surfaces intended to form line markings and perimeter run-offs

Following artificial weathering, the strength of the pile yarn shall still be greater than 1.5N. Additionally, the loss in strength after artificial weathering shall be no greater than 50% of the strength of the unaged yarn.

5 Product assessment test methods

5.1 Test methods

The following test methods shall be used to assess the performance of hockey turfs seeking FIH Approval:

5.1.1 Hockey ball rebound

Tests shall be made in accordance with EN 12335 made using an acoustic timer and an FIH Approved Hockey Ball. When tested on concrete the ball shall have a rebound of 800 ± 50 mm.

5.1.2 Hockey ball roll

Tests shall be made in accordance with EN 12334 using an FIH Approved Hockey Ball. Three tests shall be made in each direction and the mean calculated.

For Global, National, Community and Gen 2 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 3G Multi-Sport 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;
- for Global category surfaces, consistency between overall mean results 15 minutes and 45 minutes after irrigation

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 (±1mm).

5.1.3 Ball roll deviation

Whilst undertaking ball roll tests in accordance with EN 12234 using an FIH Approved Hockey Ball place a graduated gate over the test specimen at the distance detailed in the table below, measured from the point at which the ball first meets 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.

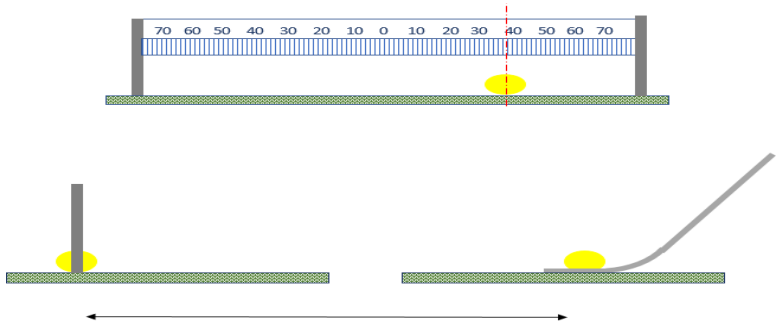


Figure 1 Distance as detailed in the Table below

Measurement distance from end of ball roll ramp				
Global	National	Community	Gen 2 Multi- Sport	3G Multi-Sport
9.5 ± 0.01m	8.5 ± 0.01m	7.5 ± 0.01m	7.5 ± 0.01m	Test not necessary

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

5.1.4 Shock Absorption and Vertical Deformation

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

5.1.5 Shoe – surface friction

Shoe-Surface Friction shall be measured in accordance with EN 15301-1 using the dimpled test sole. On Gen 2 Multi-sports surfaces tests shall also be made with the smooth rubber 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.

5.1.6 Skin friction

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.

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.

5.1.7 Water Permeability

Water permeability shall be measured in accordance with FIFA TM 24. Tests shall be made on the complete hockey turf (including any infill and shockpad) shall be at least 150mm/h.

5.2 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 Category 1 and 2 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/m^2 (1mm).

Players expect consistent performance from Category 1 and 2 fields. As some properties change as a surface dries, it is important that this does not occur too quickly. Therefore, certain characteristics 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 conditions	Hockey turf classification				
	Global	National	Community	Gen 2 Multi-sport	3G Multi-Sport
Irrigated	✓				
Wet	✓	✓	✓	✓	✓
Dry		✓	✓	✓	✓

Laboratory tests and sample conditioning shall be undertaken at a controlled laboratory temperature of 23 ± 2°C and relative humidity of 50 ± 20%RH.

5.3 Preparation of test specimens

5.3.1 General

Test specimens of the size specified in the appropriate test method must 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.

5.3.2 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.

5.3.3 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.

5.3.4 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.

5.4 Effects of simulated wear

5.4.1 General

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.

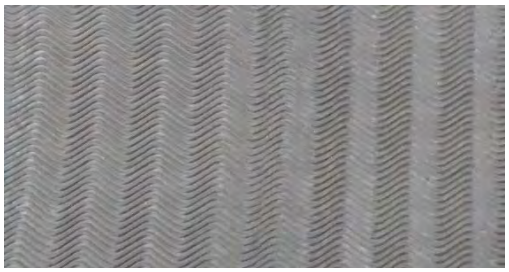
Following simulated wear conditioning, the test specimen shall be tested in the following order:

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

4. rotational resistance
5. Netball slip resistance (Community Gen 2 surfaces only)

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.

For Global, National, Community and Gen 2 Multi-Sport 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	
Wavelength (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.

3G 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.

5.4.2 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. 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.

5.4.3 Performance requirements after simulated wear conditioning

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.

Netball slip resistance on Community Gen 2 hockey turfs shall be measured in dry and wet conditions.

Use of this Standard

Whilst every effort has been made to ensure the accuracy of the information contained in this publication, any party who makes use of any part of the Standard in the development of a hockey facility shall indemnify the International Hockey Federation (FIH), its servants, consultants or agents against all claims, proceedings, actions, damages, costs, expenses and any other liabilities for loss or damage to any property, or injury or death to any person that may be made against or incurred by the FIH arising out of or in connection with such use.

Compliance with the requirements detailed in this Standard by a User does not of itself confer on that User immunity from their legal obligations but does constitute acceptance of the terms of this disclaimer by that User.

FIH reserve the right to amend, update or delete sections of this Standard at any time, as they deem necessary.

Any questions about this Standard should be addressed to facilities@fih.ch

FIH facilities guidance – helping you win

This Standard is part of a series of facilities documents produced by the FIH. Other information that might assist you is available at www.fih.ch/qp. It includes:

- Facilities Guidance – Outdoor Hockey Facilities
- Facilities Guidance – GEN 2 multi-sports areas
- Facilities Guidance – HOCKEY5s Courts
- Facilities Guidance – Sports Lighting for Non-Televised Outdoor Hockey
- Facilities Guidance – Sports Lighting for Televised Outdoor Hockey
- Facilities Guidance – Hockey Field Irrigation
- Facilities Guidance – Indoor Hockey

- Hockey Turf and Field Standards – Part 1 FIH Approved Hockey Turfs
- Hockey Turf and Field Standards – Part 2 - 11 a-side hockey fields
- Hockey Turf and Field Standards – Part 3 – HOCKEY5s courts
- Hockey Turf and Field Standards – Part 4 – Temporary Overlay Pitches (TOPS)

- FIH Approved Field Equipment – Hockey Goals
- FIH Approved Field Equipment – HOCKEY5s Rebound Boards
- FIH Approved Field Equipment – Team Shelters
- FIH Approved Field Equipment – Technical Officials Booths
- FIH Approved Field Equipment – Indoor Hockey goals
- FIH Approved Field Equipment – Indoor Hockey side-board

Rue du Valentin 61
1004 Lausanne
Switzerland

www.fih.ch