



Guide to Artificial Grass Pitches for Community Use

Part 1

Performance Standards for Surfaces and Pitches used Outdoors

Summary

This document defines the performance and durability characteristics the FA consider artificial grass pitches (for community use) should have to ensure they are suitable for their intended use. It describes the procedures for the laboratory assessment of artificial grass surfaces and the assessment of installed pitches. It also includes details on the construction tolerances, dimensions, lighting levels, etc that a pitch should achieve.

It is envisaged that manufacturers and contractors supplying and building artificial grass pitches and architects and consultants designing artificial grass pitches will use the document.

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1 Introduction

1.1 Background

Football has been played on artificial grass for many years; primarily on sand filled carpets laid over rubber shockpads and engineered bases. Whilst providing pitches that could sustain much higher levels of use than natural grass, the playing qualities of these types of surface are not considered particularly good for football, as they do not replicate the playing qualities of good quality natural grass.

The increasing market demand for surfaces that simulate the playing qualities of natural grass and can accommodate the use of studded football boots has led manufacturers to develop new forms of artificial grass. These surfaces have a much longer pile (anywhere between 35mm and 65mm) that is normally partly filled with rubber or rubber and sand mixes, although a small number have no fill.

The enhanced playing qualities of these surfaces has led to their rapid acceptance within the football world and stimulated much interest from the game's governing bodies. In particular UEFA is part funding the installation of five pilot pitches for competitive professional matches (including one at Dunfermline Athletic Football Club). These pitches will be monitored over a two-year period (2003/2004 & 2004/2005) before UEFA decides whether to allow the use of artificial grass in UEFA competitions. The FA supports UEFA's initiative and shares the principle of sanctioning the use of artificial grass pitches if the pilots are deemed successful. The FA's National Facilities Manager Steve Williams is a member of the UEFA Artificial Turf Experts Panel.

UEFA⁽¹⁾ have also defined the characteristics they consider artificial grass pitches require to be considered as a potential alternative to high quality natural grass for use in UEFA competitions. These requirements are exacting and it is envisaged that pitches meeting them will be located at professional and senior non-league clubs.

The FA recognises that the rigours demands and higher cost of pitches meeting the UEFA requirements may preclude the use of such surfaces at community based facilities. Wishing to ensure that all aspects of the game are able to benefit from good quality artificial grass surfaces the FA has developed this *Performance Standards for Outdoor Surfaces and Pitches*. It forms Part 1 (of 3) of the *FA Guide to Artificial Grass Pitches for Community Use*. The other parts are:

- *Guide to Artificial Grass Pitches for Community Use: Part 2 - Their design, specification & construction* - this document describes the many factors



that need to be considered during the design, specification and construction of an artificial grass pitch and describes some of the many surfacing and construction options being offered by contractors. It also includes advice on maintenance, life cycle costs, sinking funds and post installation monitoring and testing.

- *Guide to Artificial Grass Pitches for Community Use: Part 3 – Outline Design Brief* – this document has been prepared as an aid to those drafting design and build specifications for artificial grass pitches. It includes clauses for many of the elements of the construction and gives advice on the project specific items that need to be considered and described in such a specification.

1.2 Performance standards for outdoor surfaces for community use

The FA's *Guide to Artificial Grass Pitches for Community Use - Performance Standards for Outdoor Surfaces and Pitches* is based on the work undertaken by FIFA in developing the *FIFA Quality Concept*⁽²⁾ and UEFA, together with research and testing carried out on natural grass and artificial grass pitches laid in the United Kingdom. The Standard comprise two principal sets of requirements; those designed to ensure a surface performs in a way that allows football to be played in a manner associated with good quality grass and those designed to ensure the surface will continue, **subject to the correct maintenance**, to provide acceptable playing conditions. The playing or footballistic qualities are:

Football rebound

To provide acceptable playing conditions the surface must ensure a football does bounce too high or too low. The test is a measure of the height a ball bounces when it is dropped vertically from a height of 2m onto the surface. The higher the result the greater the rebound.



Ball rebound test

Ball Roll & Velocity Change

The resistance a surface offers to a rolling football has a major bearing on how players perceive a surface to play. Too little resistance and the surface will be considered fast, too much resistance and the surface will be viewed as being too slow. The resistance a surface offers can be measured in one of two ways:

Ball roll - a measure of how far a football rolls. The greater the distance rolled the faster the speed of the surface.

Velocity change - a measure of a ball's loss of speed as it rolls across the surface. This is inversely related to the measure of ball roll. The larger the result the quicker the ball decelerates and the slower the surface



Velocity change test

Football Pace

One of the most important playing aspects of a surface's performance is how a ball rebounds when it strikes the surface at a shallow angle. If the ball rebounds too quickly or too slowly a player will not be able to intercept the ball in their normal manner.

The Football Pace test is a measure of the change in the velocity of a football when it strikes a surface at a shallow angle. The lower the result the greater the loss in speed and the slower the ball as it rebounds from the surface.



Football Pace test

Rotational Resistance

Players need to be confident that a surface will allow them to change direction with ease. Insufficient grip and a player may lose footing, too much and muscles, ligaments and joints may be placed under excess stress and injury might occur. The Rotational Resistance test is a measure of the resistance provided by the surface to a twisting foot. The higher the result the greater the resistance to twisting.



Traction test

Sliding Distance

A player needs to be able to stop quickly but safely when running on a surface. This characteristic requires an interaction between the sole of the football boot and the playing surface. If there is insufficient grip the player will slip in an uncontrolled manner, whilst conversely too much grip can result in injuries to muscles, ligaments and joints.

The Sliding Distance test is designed to simulate a player running and stopping and measures the resistance to a sliding foot provided by the surface. The greater the result the lower the resistance or the longer the slide.



Sliding Distance

Force Reduction

In order that artificial surfaces do not increase the risk of players injuring themselves it is important they provide a level of shock absorbency that is similar to natural grass pitches.

Force Reduction is a measure of the impact forces experienced when the surface is subjected to a load simulating a player running across the surface. The result is expressed as a reduction in the peak load compared to a similar impact on concrete. The higher the result the greater the reduction in the impact force.



Measurement of Force Reduction using an Artificial Athlete

Vertical Deformation

The stability of a surface as a player runs across it has a significant effect on their running pattern. A surface that compresses excessively may feel unstable and players will tend to shorten their stride and their speed will reduce. Conversely a surface that does not deform enough is considered to be too hard and unforgiving and might cause discomfort.

The Vertical Deformation test is a measure of the degree to which a surface will deform or compress when subjected to a loading pattern designed to simulate a player running across the surface. The higher the result the greater the deformation of the surface.



Measurement of Deformation using an Artificial Athlete



The standard contains requirements for product and pitch assessments. A Product Assessment is where an artificial grass surface is tested in the laboratory to assess its performance and durability in advance of it being marketed or installed. A Pitch Assessment is where an installed pitch is tested to allow its performance to be assessed and compared to anticipated levels of performance, ensuring the installed surface has not been adversely affected by faulty workmanship, defective materials, inadequate maintenance, etc.

1.3 Test laboratories

The testing of products and pitches require specialist test equipment. The FA recommends that all testing be undertaken by independent test houses that have been accredited by one of the following organisations for the relevant tests:

- FIFA
- UEFA
- United Kingdom Accreditation Service (UKAS)

1.4 How should the FA Performance Standard be used?

When selecting an artificial grass surface project developers should ask potential suppliers / contractors to provide independent third party proof that the system of artificial grass surfacing they are proposing for the pitch satisfies the Product Assessment requirements of this Standard. This is normally included as a condition of the tender specification and is also often a condition of external funding agencies.

Most artificial grass pitches are bought using design and build types of contract. In this form of procurement the developer specifies what they require and the contractor prepares a design to satisfy this brief. To ensure pitches are designed to perform in accordance with FA recommendations the Design Brief prepared by the developer should state that the system of artificial grass surfacing and the construction of the pitch should be in accordance with this Standard.

Once constructed a pitch should be tested to confirm it has achieved the required levels of performance as defined in this Standard. As the player / surface and ball / surface interactions will change over the life of the pitch it is important that the pitch is periodically retested to ensure it is still providing a facility that is fit for use and in accordance with FA recommendations.

It is recommend that testing be undertaken at the following times:



- on commissioning to demonstrate compliance with the contract specification and this standard
- prior to the end of the defects liability period (after 12 months) to ensure adequate performance is still being provided prior to release of the contract retention
- after three years to allow an assessment of the effects of play and maintenance to be made, ensuring appropriate remedial actions can be taken as required.
- after five years, typically just prior to the end of the contractor's warranty.
- after seven years to determine how the pitch is continuing to perform and much longer the surface is likely to last before it requires replacing

2 Normative references

This Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications will apply to this Standard only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

Artificial Grass in UEFA Competitions Requirements and Recommendations Section 2, Part 2, Method 2.1 Force Reduction: 2003

Artificial Grass in UEFA Competitions Requirements and Recommendations Section 2, Part 2, Method 2.2 Vertical Deformation: 2003

Artificial Grass in UEFA Competitions Requirements and Recommendations Section 2, Part 2, Method 2.3 Rotational Resistance: 2003

Artificial Grass in UEFA Competitions Requirements and Recommendations Section 2, Part 2, Method 2.4 Ball Rebound: 2003

Artificial Grass in UEFA Competitions Requirements and Recommendations Section 2, Part 2, Method 2.5 Football Pace: 2003



Artificial Grass in UEFA Competitions Requirements and Recommendations
Section 2, Part 2, Method 2.6 Ball Roll: 2003

BS 5229 Method for determination of Tuft Withdrawal Force of Carpets: 1975

BS 7044 Artificial Sports Surfaces, Section 2.2: Method 2 Determination of Sliding
Distance: 1990

BS 7044 Artificial Sports Surfaces, Section 2.4 Method 3 Determination of
Resistance to Water: 1989

BS EN 430 Resilient Floor Coverings – Determination of Mass per Unit Area:
1994

BS EN Tests for Geometrical Properties of Aggregates; Part 1. Determination of
Particle Size Distribution – Sieving Method: 1997

BS EN 1969 Surfaces for Sports Areas, Determination of thickness of Synthetic
Sports Surfaces: 2000

BS EN Surfaces For Sports Areas – Determination of Thickness Synthetic Sports
Surfaces: 2000

BS EN 12228 Surfaces for Sports Areas, Determination of Joint Strength of
Synthetic Surfaces: 12002

BS EN 12616 Surfaces for Sports Areas, Determination of Water Infiltration Rate:
2003

ISO 1763 Determination of Number Of Tufts and / or Loops Per Unit Length and
Per Unit Area: 1986

3 Definitions

Artificial grass surface

Artificial grass carpet, infill, shockpad and all underlying layers that influence the
sports performance or biomechanical response of the surface.

4 Laboratory test temperature & sample conditioning

Laboratory tests shall be undertaken at a temperature of $23 \pm 5^{\circ}\text{C}$. Test



specimens shall be conditioned at the test temperature for at least 3 hours prior to test.

5 Laboratory test specimens

5.1 Unbound bases

If the artificial grass surface incorporates an unbound base construction that is designed to contribute to the dynamic properties of the surface, laboratory measurements of Football Rebound, Football Pace, Shock Absorption and Vertical Deformation shall be made on the artificial grass, shockpad (if applicable) and a depth of unbound base of at least 50mm or the depth stated by the manufacturer to influence the performance, whichever is greater. If the unbound base is not designed to contribute to the dynamic properties of the surface, laboratory measurements may be made with the artificial grass surface laid on a concrete base. Tests for Rotational Resistance, Sliding Distance and Velocity Change may be made with the artificial grass surface laid on macadam, concrete or unbound base, subject to the manufacturer's approval.

5.2 Engineered bases

If the artificial grass surface is intended for installation on an engineered base, laboratory measurements may be made on a macadam or concrete base, subject to the manufacturer's approval.

5.3 Preparation of laboratory test specimens

Test specimens shall be prepared strictly in accordance with the manufacturer's instructions. These should be detailed in the test report. Following preparation the specimens for sport and player / surface interaction tests should be conditioned using the procedure detailed in Section 2, Part 2 of the UEFA Recommendations for Artificial Grass.

5.4 Wet laboratory tests specimens

For all tests other than ball roll wet test specimens should be produced by evenly applying to the test piece a volume of water that is equal to the volume of the test specimen. The sample shall be allowed to drain for 15 minutes and the test carried out within a further 5 minutes. For ball roll test specimens the sample shall be saturated using a hose supply or watering can, taking care to ensure any infill is not disturbed and be allowed to drain for 15 minutes, with the test being carried out within a further 5 minutes.



6 Product assessment

The artificial grass surface shall satisfy the requirements of clauses, 6.1, 6.2, 6.3 and 6.4.

6.1 Sport and player / surface interaction

Property	Method of test		Requirement
Football Rebound (dry and wet)	UEFA Method 2.4		Between 60cm and 100cm
Football Pace (dry and wet)	UEFA Method 2.5	Dry	Between 45% and 60%
		Wet	Between 45% and 80%
Ball Roll or Velocity Change (dry and wet)	Ball roll - UEFA Method 2.6.2		Between 4m and 10m
In cases of dispute the measurement of ball roll is designated the definitive method	Velocity Change - UEFA Method 2.6.3		$\geq 0.45\text{ms}^{-1}$
Rotational Resistance (dry and wet)	UEFA Method 2.3		Between 30Nm and 50Nm
Sliding Distance (dry and wet)	BS 7044 Section 2.2 Method 2. The test foot shall be as specified in clause A.1 of this Standard.		Between 0.25m and 0.75m
Force Reduction (1 st impact, studded foot) (dry and wet)	UEFA Method 2.1 mean of five tests in different positions		$\geq 55\%$
Vertical Deformation (1 st impact, studded foot) (dry and wet)	UEFA Method 2.2 mean of five tests in different positions		Between 4mm and 12mm



6.2 Effects of simulated play

Following conditioning of the artificial grass surface using a Lisport wear machine as described in clause A.2 of this standard the artificial grass surface shall be tested for the properties stated below using the specified methods of test. All tests shall be made under dry conditions, as appropriate.

Property	Method of test	Requirement
Football Rebound	UEFA Method 2.4	Between 60cm and 100cm
Football Rolling Resistance	Clause A.3 of this Standard	$\leq 1:1.50$
Force Reduction (1 st impact, studded foot)	UEFA Method 2.1 mean of three tests in different positions	$\geq 55\%$
Rotational Resistance	UEFA Method 2.3 mean of three tests in different positions	Between 30Nm and 50Nm
Pile Wear	Clause A.4 of this Standard	$\leq 15\%$
Water Infiltration Rate	BS EN 12616 (using a single ring sealed to the surface)	$>100\text{mm/h}$



6.3 Effects of low temperatures on performance

Surfaces designed for use in frozen conditions shall satisfy the following requirements.

Property	Method of test	Requirement
Sub-ambient Football Rebound	UEFA Method 2.4	Between 60cm and 100cm
Sub-ambient Force Reduction (Studded foot)	UEFA Method 2.1	≥45%
Rotational Resistance	UEFA Method 2.3	Between 30Nm and 50Nm

6.4 Properties of artificial grass surfacing

Property	Method of test	Requirement	
Seam Strength before and after water ageing	Water ageing BS 7044 Section 2.4 Method 3		
	Joint strength BS EN 12228 Method 1	Stitched	≥ 1,000 N/100m
	Joint strength BS EN 12228 Method 2	Bonded	≥ 25 N/100mm
Tuft Withdrawal before and after water ageing	BS 5229		
	Water ageing BS 7044 Section 2.4 Method 3		≥ 25N



6.5 Ultra Violet stability

The artificial grass surface shall be manufactured from polymers that have levels of resistance to ultra violet (UV) light degradation that will ensure the surface does not prematurely breakdown, fail, significantly fade or change colour during its normal service life (8 years).

6.6 Toxicity

The manufacturer shall supply an assurance that the artificial grass surface together with its supporting layers, does not contain in its finished state any substance which is known to be toxic or carcinogenic when in contact with the skin and that no toxic or carcinogenic substances will be released as a vapour, leachant or dust during normal use.

6.7 Characterisation tests

To enable the artificial grass surface to be identified it should be characterised as follows for the appropriate properties.

6.7.1 Artificial grass carpet

Property	Identification method
Manufacturer	Manufacturer's declaration
Pile height	Manufacturer's declaration
Pile weight	Manufacturer's declaration
Mass per unit area	BS EN 430
Pile denier / detex	Manufacturer's declaration
Pile width	Manufacturer's declaration
Pile yarn manufacturer	Manufacturer's declaration
Tufts per unit area	ISO 1763
Stitch gauge	Manufacturer's declaration

6.7.2 Infill

Property	Identification method
Composition and ratios of blends	Manufacturer's declaration
Particle grading(s)	Manufacturer's declaration based on EN 933
Particle shape	Manufacturer's declaration based on EN 933
Application rate (kg/m ²)	Manufacturer's declaration



6.7.3 Shockpad

Property	Identification method
Construction	Visual description
Manufacturer	Manufacturer's declaration
Thickness	Manufacturer's declaration based on BS EN 1969
Mass per unit area	Manufacturer's declaration based on BS EN 430

6.8 Test report

The test report shall contain the following information:

1. The name of this Standard
2. The name and product identification code(s) of the surface tested
3. The names of each of individual components forming the surface
4. The manufacturer(s) of each components forming the surface
5. The specification for sample preparation supplied by the manufacturer
6. The base on which the tests were carried out
7. The name of the organisation commissioning the tests
8. The temperature at the time of test
9. The mean results for each of the tests (see appendix B)
10. The individual test results if required
11. Characterisation data (see appendix C)

7 Pitch assessments

New pitches shall satisfy the requirements of clauses 6.1 and 8.3.

7.1 Test and surface conditions

Tests on site should be made at the prevailing ambient temperature, but within the range of +5°C to +30°C.

Tests on site should be made under the prevailing surface conditions (dry or wet), unless performance under a certain condition is of concern, in which case that condition should prevail.

Pitches that have been used for less than 120 hours should be conditioned in accordance with the procedure detailed in the UEFA manual (Section 2, Part 2).

7.2 Test locations

Tests should be carried out in the positions shown in Figure 1 unless performance at a certain location is of concern, in which case that location should be assessed.

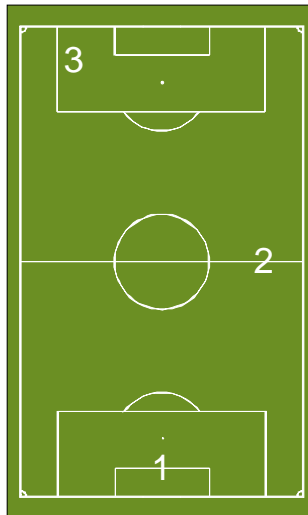


Figure 1 – field test locations

7.3 Test report

The test report should contain the following information:

1. The name of this Standard
2. The site of the pitch
3. The name and product identification code(s) of the surface tested
4. The date of installation
5. The name of the organisation commissioning the tests
6. The temperature at the time of test
7. The test positions
8. The condition of the surface (dry or wet) at the time of test
9. The mean results for each of the tests (see appendix D)
10. The individual test results if required



8 Pitch design & construction requirements

8.1 Dimensions and run-offs

The total playing area of a pitch comprises the playing area (the area within the boundary markings of the pitch) and run-offs (the areas beyond the boundary markings), which are provided to ensure players do not injure themselves by running into surround fencing, hoardings and other obstacles. The run-offs should be surfaced with the same artificial grass surface as the playing area.

The rules of football, mini-football, Futsal, etc specify the size of pitch required for each. For the eleven-a-side game (senior pitch) the FA has established a recommended pitch size to ensure a facility is suitable for all potential levels of use, categories of competition, etc.

For smaller sized pitches the FA has adopted the ranges detailed by each game, but recommends that any pitch should be as large as possible (to provide maximum potential flexibility). Table 1 summarises the various pitch sizes for the main categories of football and age groups together with the recommended run-offs.

8.2 Goal posts

Goal post safety should always be of paramount importance to designers, builders, operators and users of pitches.

All goals should be purchased, installed and maintained in accordance with the FA's Goals for Football - Guidance Notes ⁽³⁾.

Permanent goals with sockets or goals with fence / wall or ground anchors should be used wherever possible.

The FA has established suggested goal sizes for the main categories of football and age groups. These are detailed in Table 1.



8.3 Construction tolerance

Pitches should be designed and built to the following criteria:

Property	Test method	Requirement
Surface regularity (see note below)	3m straight - edge	$\leq 10\text{mm}$
	Maximum number of deviations: 20 with no deviation greater than 15mm. Deviations greater than 1m in length shall be considered multiple deviations	
Gradients	Surveyor's level	No more than 1.0% in any direction. (0.5% recommended)
Deviation from design level	N/A	$\pm 25\text{mm}$
Water Infiltration Rate	BS EN 12616	$> 100\text{mm/h}$

Note: Variations in the distribution of particulate fill within the pile of a carpet can have an adverse effect on the regularity of the playing surface. Whilst this can be corrected through maintenance the regularity will also be influenced by the base on which the artificial grass carpet is laid. The base should therefore also meet the requirement for regularity and it should be checked before the artificial grass is laid.

9 Floodlighting

Many league and cup competitions specify the minimum level of lighting they require and it is necessary to identify the requirements of competitions that teams using a pitch will compete in when designing the floodlighting system.

Where no league or cup competitions requirements apply the minimum levels of performance should be in accordance with FIFA's Class II for Non - Televised events⁽⁴⁾, which are:

Property	Requirement
Maintained average illuminance	$> 200\text{ Lux}$
Uniformity (Min/Ave)	> 0.6
Glare rating	≤ 50
Lamp colour temperature	$T_k > 4000\text{ K}$
Lamp colour rendering	≥ 65



For coaching, training and cross pitch play pitches should be lit to the following minimum standards:

Use	Property	Requirement
Cross pitch play	Maintained average illuminance	120 lux
	Uniformity (Min/Ave)	>0.6
Training	Maintained average illuminance	75 lux
	Uniformity (Min/Ave)	No requirement

Note: Following installation or re-lamping a lighting system will normally suffer an initial deterioration in lighting performance; this is typically in the order of 15% to 25%. The lighting levels should then be consistent (subject to routine maintenance, including cleaning of lamp glass, realignment, etc.) until the lamps reach the end of their service life. The value of maintained average illuminance is the level of illumination provided after the initial deterioration.



Table 1 recommended pitch dimensions, run-offs and goal sizes

Game	Age group	Playing area		Recommended run-off beyond playing area		Total pitch size	Recommended goal size
		Length	Width	Minimum at either end of pitch	Minimum at either side of pitch		
Eleven-a-side	Senior & Youth (U17 – U18)	100m (110yds)	65m (70yds)	3.0m	3.0m	106m x 71m	7.32m x 2.44m
	Youth (U15 -U16)	82m (90yds)	55m (60yds)	3.0m	3.0m	88m x 61m	7.32m x 2.44m
	Youth (U13 -U14)	73m (80yds)	55m (60yds)	3.0m	3.0m	79m x 61m	6.40m x 2.13m
	Youth (U11 -U12)	64m (70yds)	46m (50yds)	3.0m	3.0m	70m x 52m	6.40m x 2.13m
Mini-soccer	U9 – U10	54.90m (60yds)	36.60m (40yds)	3.0m	3.0m	60.90m x 42.60m	3.66m x 1.83m
	U7 – U8	45.75m (50yds)	27.45m (30yds)	3.0m	3.0m	51.75m x 33.45m	3.66m x 1.83m
Small sided football (five-a-side)	Senior	Between 25.0m & 50.0m	Between 16.5 & 35.0m	No run-offs required when rebound boards / fences form boundaries. 3.0m on each boundary when playing to goal and touchlines			4.88m x 1.22m
	Junior						3.66m x 1.22m
	Mini	The ratio of the length to width should, where possible, be 2:1.					2.44m x 1.22m
Futsal		Between 25.0m & 42.0m	Between 15.0m & 25.0m	3.0m	3.0m		3.00m x 2.00m



APPENDIX A

TEST METHODS

A.1 Sliding distance test foot

The test foot used to measure Sliding Distance should comprise four plastic studs (Shore hardness 96 ± 2) mounted in accordance with Figure 1. The stud profile should be in accordance with Figure 2

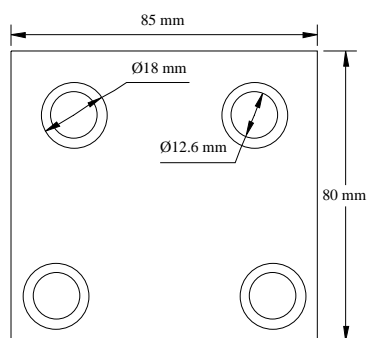


Figure 1 – Sliding distance test foot stud positions

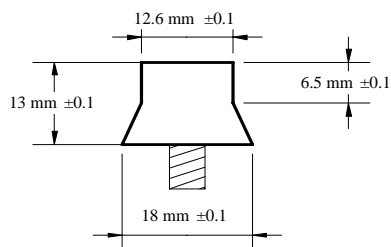


Figure 2 – Sliding distance stud profile



A.2 Conditioning of surfaces to simulate the effects of play

Apparatus

Lisport Wear Machine

Number of studs for each cylinder: 145 ± 5

One cycle of movement (to and from) linear speed: (0.25 ± 0.05) m/s

One cycle of transversal movement: $20 \text{ mm} \pm 1 \text{ mm}$, at a speed of $(0,015 \pm 0,005)$ m/s

Procedure

Place the prepared test specimen in the Lisport and adjust the roller height to ensure contact with fill layer. Undertake 200 cycles. Stop the test and replace any fill material that has been dislodged from the sample and is lying in the sample tray, do not add new material. Lightly brush the pile to lift.

After a further 2000 and 4000 cycles stop the machine and replace any fill material that has been dislodged from the sample and is lying in the sample tray, do not add new material. Lightly brush the pile to lift.

Carry out a final 800 cycles before removing the test specimen from the Lisport. Do not reapply any fill material that has been dislodged.

Test the conditioned specimen for the relevant properties taking care to ensure any particular area is only tested once (this will normally require two or more test specimens for a full series of tests).

A.3 Determination of Football Rolling Resistance

Apparatus

Timing gates of length 200 ± 10 mm being capable of measuring to an accuracy of at least ± 0.1 ms.

Ball roll ramp as detailed in UEFA manual clause 2.6.3 with a cross bar set at a vertical height of 300mm from the surface.

Steel tape capable of measuring to an accuracy of ± 0.001 m.

Procedure

Position the ramp on the test piece so the ball only rolls across the conditioned area of surface.

Position the timing gates so the distance from the point at which the ball first comes into the contact with the surface when leaving the ramp to the first timing sensor is $300\text{mm} \pm 1\text{mm}$.

Place the ball on the ramp against the cross bar. Release the ball and allow it to roll down the ramp and across the test specimen.

Record the time taken for the ball to roll between the first and second timing sensors.

Repeat the procedure 10 times and calculate the mean time for the ball to roll between the first and second timing sensors.

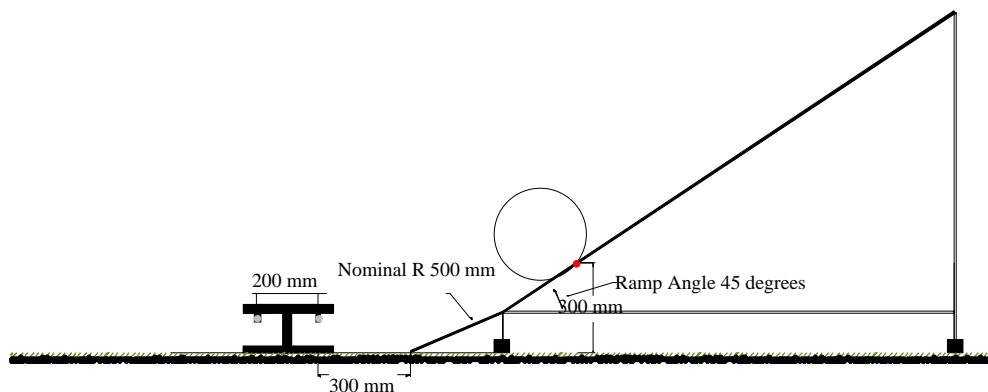


Figure 3 – Football rolling resistance

Carry out the procedure on test specimens of new artificial grass (after conditioning in accordance with Section 2, Part 2 of the UEFA Recommendations for Artificial Grass) and a test specimen conditioned for simulated wear in accordance with clause A.3.

Calculate the ratio of rolling resistance of the conditioned test specimen to the rolling resistance on the test specimen of new artificial grass.



A.4 Determination of pile wear

Randomly extract one hundred tufts from a sample of unconditioned artificial grass and determine their mean mass to an accuracy of 0.01g.

Repeat the procedure on a sample of artificial grass surface that has been conditioned using the Lisport in accordance with clause A.3.

Calculate the percentage pile wear as follows:

$$\% \text{ pile wear} = \frac{\text{pile weight before conditioning} - \text{pile weight after conditioning}}{\text{pile weight before after conditioning}} \times 100$$



APPENDIX B

PRODUCT ASSESSMENT RESULTS SHEET



Product name, code & description		Manufacturer		
		Date of test report		
Test substrate		Test house		
Project ref.		Signature		
Property	Condition	Requirement	Test result	Pass/ fail
Ball Rebound	Dry	60cm - 100cm		
	Wet			
	After simulated use			
	Frozen			
Football Pace	Dry	45% - 60%		
	Wet	45% - 80%		
Ball Roll or Velocity Change	Dry	4m - 10m		
	Wet			
	Dry	$\geq 0.45\text{ms}^{-1}$		
	Wet			
Rolling resistance	After simulated use	$\leq 1:1.50$		
Rotational Resistance	Dry	30Nm - 50Nm		
	Wet			
	After simulated use			
	Frozen			
Sliding Distance	Dry	0.25m - 0.75m		
	Wet			
Force Reduction	Dry	$\geq 55\%$		
	Wet			
	After simulated use	$\geq 45\%$		
	Frozen			
Vertical Deformation	Dry	4mm - 12mm		
	Wet			
Pile Wear	After simulated use	$\leq 15\%$		
Water infiltration	Unaged	$> 100\text{ mm/h}$		
	After simulated use			
Seam strength - bonded joints	Unaged	$\geq 25\text{ N/100mm}$		
	After water ageing			
Seam strength - stitched joints	Unaged	$\geq 1000\text{ N/100mm}$		
	After water ageing			
Tuft withdrawal	Unaged	$\geq 25\text{N}$		
	After water ageing			



APPENDIX C

PRODUCT IDENTIFICATION – MANUFACTURER’S DECLARATION



PRODUCT DECLARATION / IDENTIFICATION		
Artificial grass		
Property	Identification method	Result / declaration
Carpet manufacturer		
Pile type (fibrillated / monofilament, etc)		
Pile yarn manufacturer (s)		
Pile height (s)		
Tufts per unit area	ISO 1763	
Pile weight		
Pile detex (s)		
Pile width (s)		
Stitch gauge		
Primary backing (type & manufacturer)		
Secondary backing (type & manufacturer)		
Carpet mass per unit area	EN 430	



Particulate infill		
Composition / type	Rubber	Sand
Rubber (SBR, EPDM, other)		
Sand (trade name/ code)		
Supplier	Rubber	Sand
Particle grading (EN 933)	Rubber	Sand
Particle shape	Rubber	Sand
Application rates and process		
Application rate (kg/m ²)	Rubber	Sand
Joints		
Type		
Adhesive manufacturer		
Adhesive ref.		
Backing tape manufacturer		
Backing tape ref.		



Shockpad		
Property	Identification method	Result / declaration
Type (in-situ, prefabricated rubber, felt, etc)		
Manufacturer		
Composition / mix blends		
Thickness	EN 1969	
Mass per unit area	EN 430	



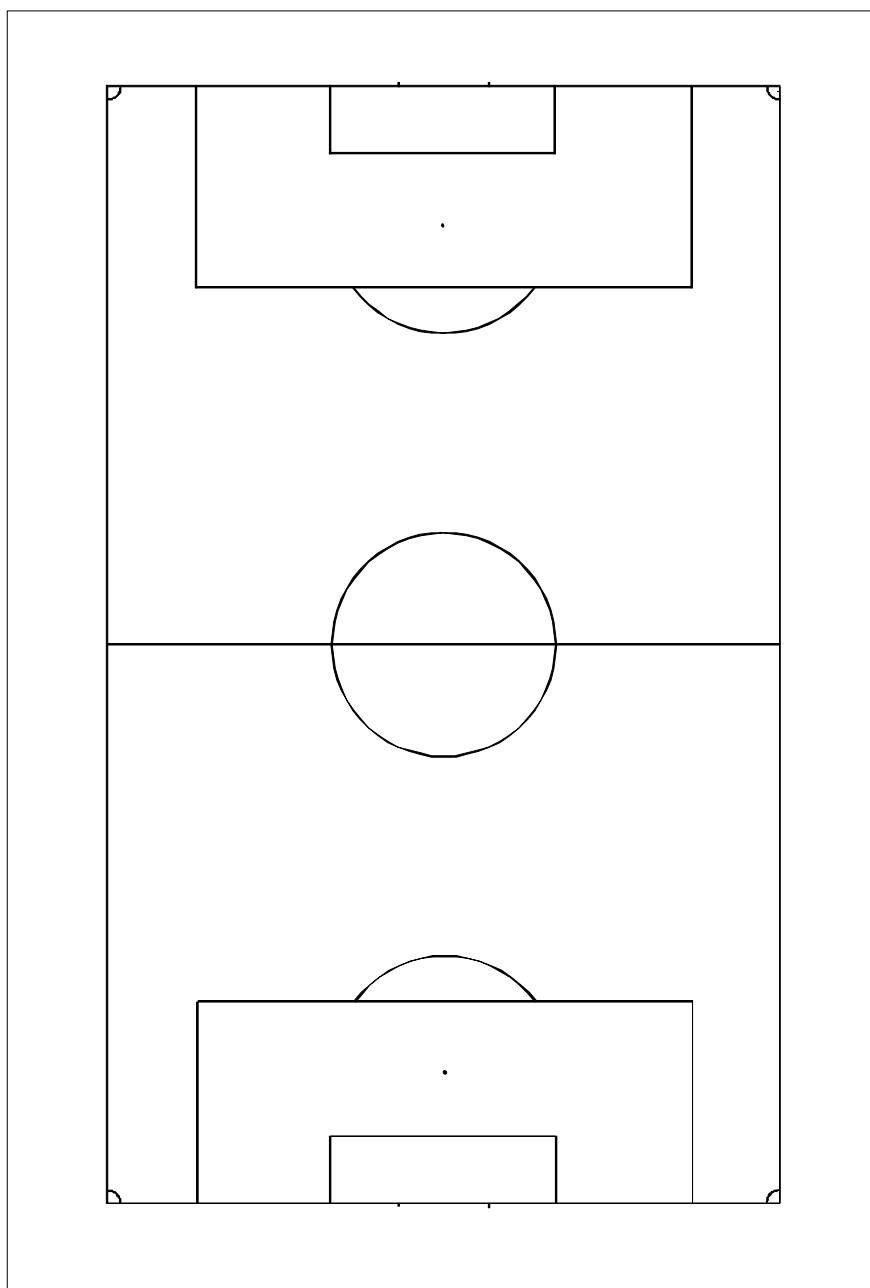
APPENDIX D

PITCH ASSESSMENT RESULTS SHEET



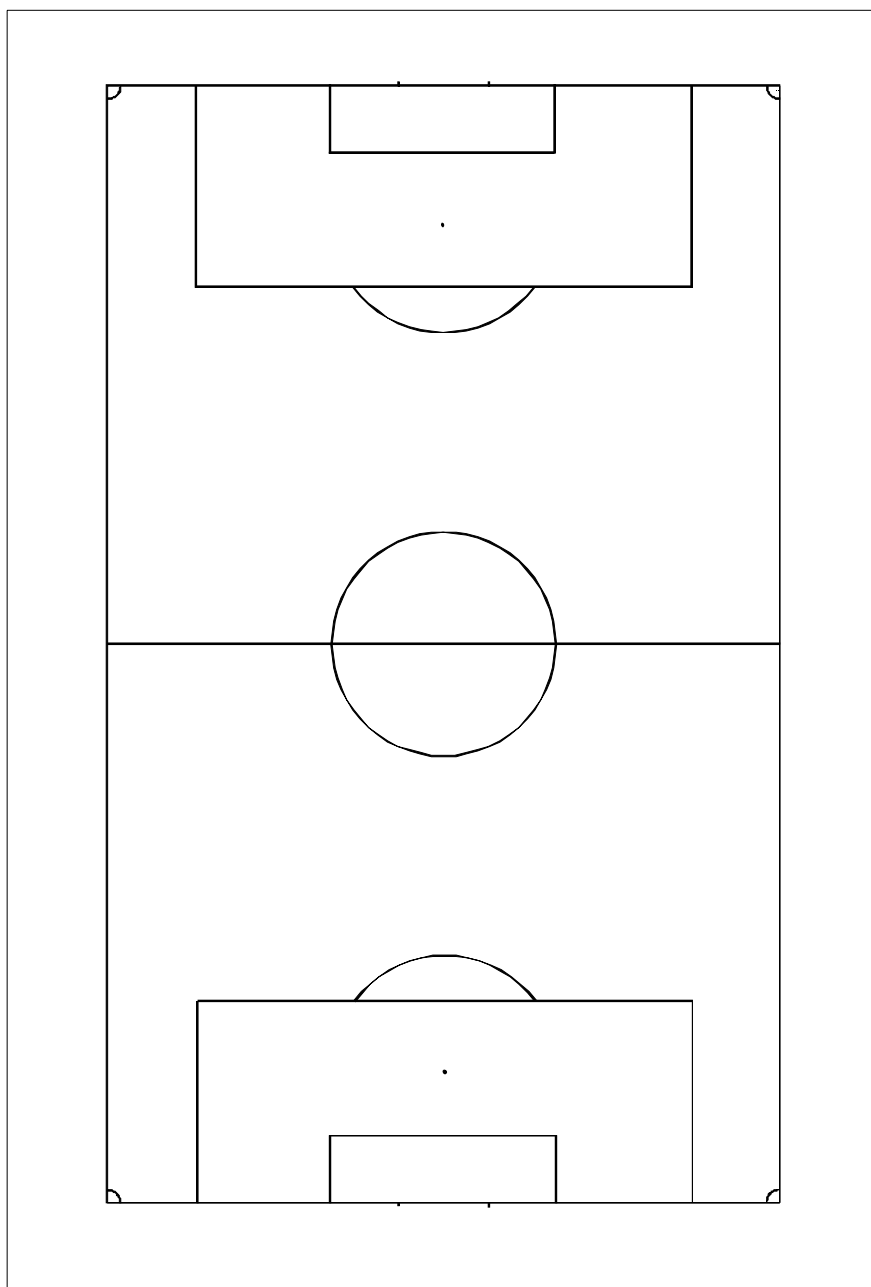
PITCH ASSESSMENT RESULTS					
Site		Surface / shockpad			
Sub-base		Contractor			
Date of construction		Date of test			
Surface condition at time of test		Test temperature at time of test		Min.	°C
				Max.	°C
Humidity at time of test	Min. Max.	%Rh %Rh	Wind speed during ball roll tests		ms ⁻¹
Property	Requirement	Test results / test positions			Pass/ fail
		1	2	3	
Ball Rebound	60cm – 100cm				
Football Pace	Dry: 45% - 60% or Wet: 45% - 80%				
Ball Roll or Velocity change	4m - 10m ≥0.45ms ⁻¹				
Rotational Resistance	30Nm - 50Nm				
Sliding Distance	0.25m - 0.75m				
Force Reduction	≥ 55%				
Vertical Deformation	4mm - 12mm				
Water infiltration	> 100 mm/h				

Surface regularity record of undulations exceeding 10mm





Principal pitch gradients





APPENDIX D
PITCH ASSESSMENT RESULTS SHEET

FLOODLIGHTING



LIGHTING TEST RESULTS				
Illuminate area	Switching Intensity	Horizontal luminance	Result	Pass / Fail
Full Pitch	Maximum	Average Illuminance		
		Minimum Illuminance		
		Illumination Uniformity (E_{min}/E_{av})		
Full Pitch	Minimum (if applicable)	Average Illuminance		
		Minimum Illuminance		



References

- 1 Artificial Grass in UEFA Competitions, Requirements and Recommendations, UEFA, 2003
- 2 FIFA Quality Concept for Artificial Turf Surfaces, FIFA, 2001
- 3 Goals for Football - FA Guidance Notes, FA, 2003
- 4 FIFA Guide to Artificial Lighting of Football Pitches, FIFA, 2002