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Message from the President

If any sport can boast a long and rich tradition, it is football. Its simple rules have remained intact for more than a century, in spite of the numerous technical changes that have taken place and the attempts that have been made to alter the rules of the game. We are well aware that this highly conservative and traditional attitude to football is considered as outdated in many quarters, which is why attempts are constantly made to change its rules. However, the present policy will remain in force during our lifetime and should not be subject to debate. Football has nevertheless shown that it can accommodate changes, provided such changes make the game more attractive without losing its simplicity.

The introduction of floodlighting and the decision to allow substitutions during a match have certainly been two of the most important amendments to the rules to date. Rules that limit back passing and the time that a goalkeeper can keep the ball have also had the effect of speeding up the game. The obligatory wearing of shin-pads and rules on tackling help prevent player injuries. Extra time and the "golden goal" rule ensure that a match is finished within a certain time limit, without having to resort to replay.

All these changes apply to the game itself, to its organisation, or are intended to protect players from injury.

No attempt has yet been made to change the most essential item of the game - which is the field itself - that stage on which the players act out their various parts. Pitch dimensions and markings, which were originally standardised more than a hundred years ago for the sake of uniformity, have remained virtually unchanged ever since.

Surprisingly, the rulebook has never until now specified the kind of material the playing surface should be made of.

It is thus perfectly legal to play a major competition match on concrete - provided that both teams and the referee agree. It is likewise possible to play on a sand-covered pitch without breaking the rules in any way. In fact, matches at the highest levels are often played on pitches that have become either soggy or rock-hard.

A playing surface in bad condition can ruin the game of technically good teams, which means that an important match can be lost and the team knocked out of a competition. We leave it to the reader to imagine what it cost a team to be eliminated from one of today's lucrative competitions.

The popularity of football has led to a massive increase of interest from young people of both sexes. Consequently, football associations have seen their membership increase and their teams multiply. These all want to play matches and the football season has become longer, to the point that football is now played practically all year round. The natural grass of the pitches can hardly regenerate, making the task of the stadium maintenance staff increasingly difficult and driving the cost of maintenance dramatically high.

At the same time, the spectators are showing a clear preference for a "genuine" football stadium, rather than a multisports centre or similar arenas with an athletics track or other facilities that can create a distance with what is happening on the pitch. Furthermore, today's (and no doubt tomorrow's) spectators expect a particular set of facilities that is worth the money. This includes seats with covers, modern safety and security facilities, proper catering,

decent toilets etc. The planning of such modern stadiums designed for football only - which are rightly referred to as “event venues” - depends heavily on the quality of the playing area. It has unfortunately been demonstrated that a grass pitch located in such an “enclosed” space and subjected to so much use can no longer regenerate and deteriorates rapidly. The maintenance of such pitches becomes increasingly difficult, resulting in the excessive costs already mentioned. Finally, a grass pitch doesn’t allow the owner of the stadium to hold non-football events in it to earn additional income.

We can see then that all the efforts to make football and the events surrounding it more attractive, and thus encourage interest in the sport inevitably bring back to that green rectangle in the middle of the stadium.

Several measures have been taken over the years to reduce this strong dependence. Systems of lightweight covers, sliding playing surfaces and removable sections of turf have all been tried at one time or another in an attempt to allow other events in a football stadium without damaging the pitch. Most of these systems have been found to be excessively expensive, time-consuming or even, occasionally, completely useless.

We can currently see only one viable solution to these problems: the laying of artificial turf - and when we refer to this material, we mean football turf. The previous generations of artificial turf were unable to prove themselves “football-friendly” and were largely rejected by those who run the sport. However, we are now fully convinced that these new types of artificial turf are an excellent alternative to natural turf, and that the football authorities can now seriously consider the possibility of approving the use of artificial-turf playing surfaces for all competition matches - even at the highest level.

The latest generation of artificial turf has only been known in Europe for about five years, but it is already widely used. These new systems offer outstanding football-specific features, very similar to those of well-maintained natural turf. In contrast to those of the first two generations, these products are far more suitable for football, for they have the following qualities:

- Soft, even and regular playing surface
- Excellent shock absorption
- Outstanding rebound performance
- Hard-wearing
- In late Autumn and early Spring, they are far better than most natural grass surfaces

Above all, this new generation of artificial turf allows the player to perform one of the fundamental actions of the game - the sliding tackle - without any fear of injuries caused by abrasion. Tackling was always associated with painful experiences with the previous two generations of artificial turf, and is still the main reason why players refuse to play on this type of surface.

We are very happy to see that the artificial turf industry is finally taking a strong interest in the well being of players by developing a long-awaited product that actually meets the needs of football.

Message from the President

UEFA is in no way attempting to promote artificial turf to the detriment of natural grass. On the contrary, football should be played on a natural pitch, provided the playing surface meets players' expectations and does not increase their risk of being injured. However, as demonstrated above, it has in recent years become more and more difficult to keep a natural pitch in an acceptable condition. The football authorities should find alternatives and solutions to this problem. Some signs and tendencies seem to indicate that the latest generation of artificial turf can be a suitable substitute for natural grass.

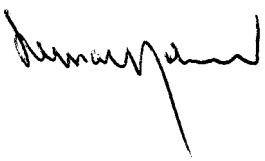
Coming from a country that loves natural products, I realise just how important this step is. On a personal level however, I am totally convinced of the viability of these new artificial turf systems, and will do everything in my power to ensure that artificial football turf can play a major role in European and in world football.

For that purpose, a working group consisting of experts in artificial turf and UEFA officials has compiled this manual. The guidelines it contained herein should ensure, on one hand, that the artificial turf used at all levels of football conforms to the same specific requirements. They also provide national associations with a means to promote the use of football turf at national level and to secure its approval for competition matches. The manual is furthermore designed to help the manufacturers of the various elements that make up an artificial turf playing surface - and the testing organisations responsible for inspecting it, to apply clear, uniform European wide standards. Finally, this manual is intended to provide the layman with useful facts and information on football turf.

I regard the items detailed herein as being of considerable value to the European football community. UEFA will meet the costs of setting up, implementing and continuing this project in the future. The group of experts has been clearly instructed to ensure that the formulation and implementing of this policy will not have a negative effect on the price of artificial turf products. We are sure that this objective has been kept in mind while writing this manual.

My colleagues on the Executive Committee have discussed the contents of this manual thoroughly and agree unanimously with the approval procedures it lays down. In this respect, we are happy to announce that - from the 2004 / 05 season onwards - any UEFA competition matches can be played on artificial turf.

We are confident that this manual on "Artificial Turf in UEFA Competitions" will fulfil its purpose of helping European football to benefit from the latest generations of artificial football-pitch technology.



Lennart Johansson
President of UEFA

Introduction

From the 2004-05 season, artificial-turf pitches will be acceptable for all UEFA competition matches, provided that the playing surface fulfils the quality standards set by UEFA.

The UEFA Executive Committee took this decision on December 12/13, 2001. The decision also implies a groundbreaking step towards solving a large group of problems related to the subject of natural-turf playing surfaces. In taking this step, UEFA has recognised the important progress made by the artificial-turf industry and its efforts to supply a range of innovative products.

It had hitherto only been possible to play on a surface of this type if the away team was in full agreement with doing so. This approval procedure is now to be eliminated from the start of the 2004/05 season.

From the 2004/05 season, it will however still be necessary to ensure that only the best available products are used for international competition matches, in order to fulfil the expectations of the visiting team. Another important consideration in this respect consists of the need to prevent competition-approved playing surfaces being used if they imply a clear advantage for the home team. Finally, it is necessary to convince referees that the intended playing surface fulfils the rules of the game, while at the same time providing reliable evidence that it conforms to all applicable European standards and criteria.

The above principles constituted an important part of the task of creating this manual. The members of the group of experts furthermore agreed that the manual should provide a comprehensive source of reference material that can be used both by specialists in the subject of artificial turf and by non-experts in the field.

Note: the high quality standard set by UEFA and described in this manual only applies to football turf installed on playing surfaces used for UEFA competition matches. An artificial turf installed on a pitch that does not meet the UEFA requirements cannot be used for UEFA competition matches, but it does not mean that theses surfaces are unsuitable for football at national level.

This manual is divided into three sections.

Section 1
is the main booklet for the general use. It is destined mainly for the football authorities, but also contain a general description of the footballistic and technical requirements.

Section 2
describes the specification criteria important for the turf manufacturer and test laboratories.

Section 3
deals with design and construction recommendations, as well as maintenance.

Introduction

The UEFA Administration has drawn on the experience and specialist knowledge of numerous experts in the subject of artificial turf, without whose help and co-operation it would have been impossible to create this manual. We would like to take this opportunity to extend our warmest thanks to all the people who have helped bring this manual to publication.

The authors hope that this manual will prove to be a useful source of facts and information, both for anyone with an interest in the subject of artificial turf and for the football community as a whole.

The UEFA Football Turf Commission

UEFA Turf Consultant

- Jacob Erel
- René Eberle
- Claudio Negroni
- Ernest Walker
- Thierry Favre
- Rolf Hediger (Sportfloor Technologies)

With the collaboration

Football Associations

- The Nordic group

The International Association for Sports Surface Sciences (ISSS)

- Alstair L. Cox (CST)
- Hans-Jörg Kolitzus (IST)
- Dominique Boisnard (Labosport)
- Juan.V. Durà (IBV)

Environment

- Hans-Theodor Grunder

The Manufacturer

- Artificial turf and rubber granulate industry

Content

- Claudio Negroni
- René Eberle
- Rolf Hediger

Illustrations

- Eusebio Arias (Graphics)
- ISSS (Test equipment: graphics and photos)
- Rolf Hediger (Photos)

WE CARE ABOUT FOOTBALL

Section 1
Part 1: Administrative Requirements

Introduction

The Past

The 1960s saw the construction of Houston's astrodome baseball arena and thus the origin of a new problem for stadium builders everywhere: how to get over the fact that natural grass cannot grow or survive in a roofed-in area. A chemical company, significantly as it turned out, was charged with the task of finding a solution to this problem. This resulted in the Astrodome being equipped with the first-ever artificial pitch, which was made of 100% nylon fibres.

In the 1970s, a German company imitated the American original by producing an artificial turf made of polypropylene - a material that is less resistant than nylon, but which considerably reduces the risk of graze injuries.

Both products were initially produced without elastic pad; later on the elastic pad was always included. These two types of artificial turf are now both referred to as "first-generation", i.e. turf made of artificial fibres and without filling material of any kind.

The second generation came into being towards the end of the same decade, when a Canadian firm produced a different type of artificial turf, which was likewise made of polypropylene. The innovation, where this new product was concerned, lay in the fact that the fibres were twice as long as before and were tufted into strands that were far more widely spaced than previous products.

This “carpet is filled-in with round silica sand. Indeed, the product basically consisted of a large sandpit filled with artificial fibres, the role of which was to keep the sand in place and prevent it moving around excessively. This new product revolutionised the artificial turf industry, as the use of fewer fibres allowed price reductions of more than 50%

In order to lower the price still further, artificial turf has been laid at many places onto unstabilised infrastructures and without any elastic layer. After some years, many of these fields had very irregular surfaces and a completely hardened turf. This type of surface has been not only rejected by the footballers but also by all other users. Luckily these errors have mostly not been repeated when the field has been renovated.

1

1. Asphalt-wearing course
2 + 3. Elastic layers

2

3

Since their initial market launch, both these generations of artificial turf have proven themselves, above all on tennis courts and for hockey, American football and baseball fields. For several reasons, neither type of artificial turf has proved suitable for soccer nor they have never really gained a foothold in this market - being used only on training pitches or for matches played at the lowest levels of the various national competitions.

The Present

The artificial-turf industry has now taken advantage of the experience gained from the negative aspects of these first two generations to develop a third-generation product that is more football-friendly. Therefore from now on in the manual we will call this third-generation artificial turf “FOOTBALL TURF”. Footballers are now being offered a playing surface that is highly similar to natural turf. With this football turf, the following characteristics are the most important where the players themselves are concerned:

- Sport-specific criteria, such as ball-roll and rebound, have been drastically improved with respect to first- and second-generation artificial turf, and are now virtually identical to those achieved on a natural playing surface.
- The risk of incurring graze injuries has been reduced.
- Improved stability and safer stopping are guaranteed.
- The playing surface is soft enough to absorb impacts and shocks.
- The player’s boots sink into the turf-filling material, just as they would with the earth under natural turf and,
- Football boots with studs can rotate in the turf without any effort.

The state of the art this season (2001/02) consists in the fact that football turf has a longer fibre (over 40 mm) than the first and second generation of artificial turf (10 mm to max. 35 mm) and is much more open (wider spread).

Most of the products still use silica sand, but only for the purpose of weight stability and in the bottom layer of the playing surface - where it does not come into contact with players. Most of the products have a layer of rubber granules on top of the silica sand and the remaining (approximately) 20 mm of fibre are left loose. These loose lengths of artificial-turf fibre correspond somewhat to the blades of grass of natural turf growing out of the ground.

The Future

Not only UEFA, but also many clubs and national associations, have discovered the football turf alternative to natural turf, have purchased the corresponding products and have had a pitch laid accordingly.

National and international football authorities are now classifying artificial-turf playing surfaces as viable replacements for natural turf, and the day can now be foreseen when a qualifying match - or even the final - of a major international competition will be played on football turf.

The entire football community must be suitably prepared for this moment and become accustomed to matches being held on artificial playing surfaces in a not too distant future. Steps must be taken to ensure that products of the same quality are used throughout Europe, to guarantee that playing on a pitch with special conditions with which the members of the away team may not be familiar does not advantage the home team. Most importantly, players must be protected from the risk of injury to the greatest possible extent.

It soon became clear to the UEFA “artificial turf”-working working group that playing surfaces of this type can only be approved if their design clearly fulfils the corresponding footballistic requirements in a standardised and comprehensible way. Furthermore, an inspection of the field in question is of course a vital requirement in order to ensure that any football turf installed compares favourably to will cared-for natural turf.

UEFA’s purpose in publishing this manual is to meet this challenge and attempt to explain - in a clear and easy-to-understand way - the various subject-areas and factors that come into play in this matter.

The future prospects for artificial football turf are good. New developments in this area have definitely provoked a large amount of excitement throughout the football community - a fact clearly demonstrated by the published sales figures of the suppliers involved. UEFA is very happy to see this trend continue, hopefully with reduced acquisition costs and further developments designed to improve the product.

B.C.	In China, on clay and sand “The football” was made out of leather-filled goat stomach
1874	Founding of the first football association in England
1966	Installation of the first artificial, non-sand-filled turf (nylon-monofil fibre, including a shock absorption pad), installed in the Astrodome in Houston (USA) named “Astroturf”
1975	Non sand-filled turf (polypropylene / fibrillated fibre)
1980	Sand-filled turf (fibrillated fibre)
1987	Sand-filled turf (fibrillated textured fibre)
1992	Sand-filled turf (monofil fibre)
1998	Rubber-filled turf (fibrillated fibre)
1999	Rubber-filled turf (monofil fibre)
2001	Rubber-filled or non-filled turf systems, with monofil and fibrillated fibbers and with and without elastic pads
2002	and later: time will show further developments

Acceptance by the Players

In 2001, the Swedish and Norwegian football associations set up a programme to evaluate the qualities of artificial football turf as compared to natural turf. Teams had to train on both surfaces and then answer nine questions about ball roll, playing impressions, hardness, change of direction, etc. The marks given to the artificial turf were: 1 = poor, 5 = equivalent to natural turf, 8 = good, 9 = very good. The teams involved were from the first, second, third and fourth divisions, plus two women's teams from the first division.

The overall appreciation was 6 among the men players and above 8 for the women, which means that the artificial turf in October with an outside temperature of 15∞C was judged to be better than natural turf.

UEFA has tested the football-specific qualities of several natural turf fields, some of them known to be excellent by professional players (Nantes in France and the Parma in Italy). All these test results have been used to establish the footballistic criteria for this manual.

Injuries

Tests undertaken in the late seventies in Germany and in the USA concerning the first and second generations artificial turf have shown that there are fewer injuries on artificial turf than on poorly maintained natural grass fields and clay grounds. As far as we know, no other comparative studies of injuries on artificial turf compared to natural grass have been carried out. It should also be noted that the above-mentioned studies concern artificial turf of the first generation, which has nothing in common with the artificial football turf of today.

The Nordic football associations, which have long experience with artificial turf, have not received any complaints about significant injuries during the last three years, since the installation of football turf.

We can therefore be assured that football turf is at least nearly equivalent to natural turf in the best conditions, and certainly much better and safer than any dry and hardened natural turf in the summertime, or frozen or muddy turf in the wintertime!

To ascertain this on a scientific basis, UEFA has decided to initiate a medical and biomechanical study between 2002 and 2004.

Authority

This manual is published under the authority of the UEFA as a detailed and comprehensive statement of its requirements and recommendations for artificial turf pitches to be used for competition matches organised under the authority of UEFA.

The manual established both a technical bases for product approval of football turf and acts as a guide to those organisations contemplating the installation of artificial turf.

For reasons of simplicity and in order to avoid any misunderstanding caused by translations, the manual is being published in English. However, any artificial turf expert is well familiar with any technical descriptions contained in this manual.

Administrative Requirements

Objectives

The primary objective of UEFA in establishing the various technical requirements with regard to artificial turf is to ensure that football competitions are conducted in such a way as to:

- Provide artificial surfaces with sporting characteristics of similar values all over Europe and more importantly which are comparable to natural turf.
- Provide an opportunity to players to display and develop their football skills.
- Increase comfort and limit danger to players.
- Extend playability in adverse weather conditions.
- Ensure that players can choose their playing equipment as they wish.

The system of product approvals should help to ensure uniformity and improve performance standards for the benefit of the game.

It is up to the national associations to introduce this concept for all of their competitions or up to a certain level and/or to impose further criteria or requirements.

The scheme of product approvals will have an influence wherever and whenever such products are considered for installation, particularly if the purchaser contemplates the possibility of bidding to host international competition matches organised by UEFA at any time during the life of a pitch. Before giving its approval for any international fixture, UEFA will obviously consider the standard of the “host” pitch.

Principles

All artificial turf fields, which are intended for UEFA competition matches, must obtain a UEFA approval before that such a field can be used. For this purpose the following tests must be carried out according to the requirements described in Section 2 of this manual.

Lisport: abrasion test

Laboratory Testing

Product Identification (type testing):

- The material used for the composition of a artificial turf field must be tested and identified;
- Once the material testing has been carried out, six footballistic criteria (e.g. ball rebound, ball roll, shock absorption, football pace, foot stability and rotational resistance) will have to be tested.

Field Testing

- Once the type tests have been carried out, the turf may be delivered to the site and installed.
- On completion of the installation a field test will take place to ensure that the values of the aforementioned footballistic criteria requested by this concept are met.

Test Handling

The product identification test can be carried out either by the manufacturer or by a test institute. However, only a UEFA-accredited test laboratory is entitled to confirm the validity of the test results.

A test laboratory approved by UEFA must carry out the laboratory and the field tests.

UEFA approval will only be granted to products or combinations of products (compounds) and football pitches that have been tested in accordance with the provisions described in Section 2 of this manual.

The UEFA football turf test certificate is valid for two years and is renewable (refer to Section 2).

Both the standards and the concept mentioned reflect, either explicitly or implicitly, established technology (state of the art summer 2002). Obviously, the technology in the industry will continue to change and this will require the adaptation and modification of the set requirements and recommendations at regular intervals.

Administrative Requirements

UEFA will closely observe the development in the artificial turf industry in order to adapt criteria, requirements and recommendations contained in this concept whenever deemed necessary. However, substantive changes to this concept will not be made without reasonable prior notice to manufacturers and the football family.

Furthermore, such changes will not, of themselves, render a pitch unacceptable for specific competitions, if approved under and still meeting earlier standards.

Responsibility

By launching the Approval Concept, UEFA decline any responsibility and liability with regard to injuries or any physical harm to players, referees, medical and support staff caused by any approved artificial football turf or damage caused to the artificial turf by playing national or international competition matches on such a field.
The owners of approved fields are responsible to observe the provisions related to the:

- Maintenance work and on-going improvement measures
- Safety and environment measures in accordance with national regulations (recommendations in section 3 of this manual)

Guarantees related to the material and the installation must be obtained from and only from the manufacturer combined with the installer.

Approval Procedure

Only pitches that conform to the criteria and specifications described in this manual, and which have been granted the corresponding UEFA test certificate will be approved for UEFA competition matches.

WE CARE ABOUT FOOTBALL

Section 1

Part 2: Football-Related Technical Requirements

Football-Related Technical Requirements

Introduction

The aim of the manual describes the requirements for the infrastructure, technical and footballistic characteristics of an installed artificial turf product, - as well as the inspection and testing procedures, - when contemplating approval for UEFA competition matches.

All products first have to be tested – in the laboratory and then on site. The purpose of this section is to give information on the most important elements and aspects concerning the subject of artificial turf products (hereafter called football turf).

An explanation on product identification is also included in this part, as this aspect is very important to the purchaser. Clear product identification is absolutely necessary to ensure that the material installed is indeed the one, which has been tested, as this can affect the footballistic characteristics and the life expectancy of the product.

Finally, information on the choice of UEFA-approved testing laboratories forms part of this manual.

It should be noted that most of the manufacturers do not install the turf themselves, but rather rely on partner companies specialised in the construction of sports surfaces. In many countries, these construction companies often represent the manufacturers and have the advantage of knowing the local construction conditions. They are quite often also able to construct the necessary infrastructure. In general, however, it is advisable to call upon an independent, local expert to assist the future owner of an artificial turf pitch in all matters related to the choice and purchase of a football turf system.

We have deliberately avoided mentioning the names of specific companies, as we do not wish this manual to be seen as part of an advertising campaign. However, the approved products and the name of the manufacturers will be published on our website www.uefa.com.

This manual is not an aid to design and construction, but rather an explanation of facts and criteria that are of importance for the choice and the installation of artificial football turf.

Football Turf Information

Artificial football turf consists of the following elements:

- Infrastructure (similar to road construction).
- Elastic pad (shock absorption element, if required by the artificial turf system).
- Woven fabric (backing for the attachment of the synthetic fibres).
- Synthetic fibres (artificial grass element).
- Quartz sand (turf stabilisation element, if required by the artificial turf system).
- Rubber granules (infill element, if required by the artificial turf system).

Some manufacturers produce their own turf fibres; others buy fibres from a third party and manufacture the turf (a process known as “tufting”). The football turf is then delivered in rolls of various lengths and widths. The sand and rubber granules are generally bought from separate suppliers. The elastic pad is either prefabricated or constructed on site.

In order to give the reader an idea of the quantities of the main elements required for an football turf of the latest generation (state of the art – summer 2002), the following list is based on a football field with the standard dimensions of 105m X 68m, including a 3m security buffer zone all around the field.

Elastic pad (if constructed on site)

- Rubber granules = Up to 120 metric tons
- Polyurethane binder = Up to 15 metric tons

Football-Related Technical Requirements

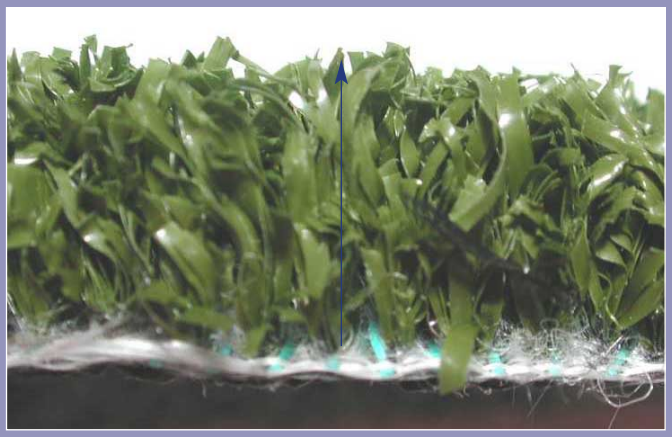
Artificial football turf

- Woven fabric with latex backing = up to 14 metric tons
- Synthetic fibres = up to 14 metric tons

Infill (if applicable)

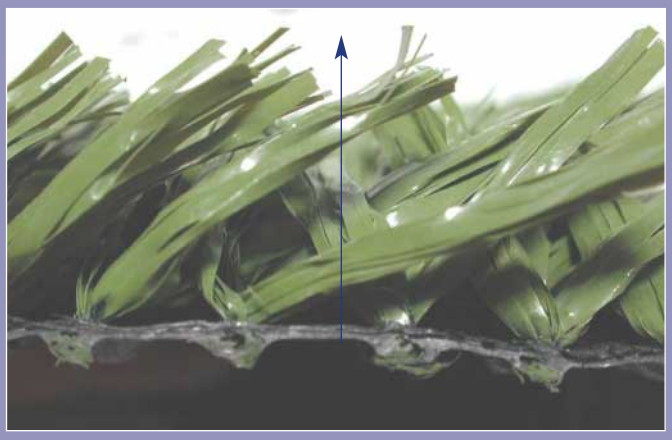
- Quartz sand = up to 120 metric tons
- Rubber granules = up to 140 metric tons

Football-Related Technical Requirements



1st generation of artificial turf

- tuft distance, gauge 3/16
- pile height, 10-12mm



2nd generation of artificial turf

- tuft distance, gauge 3/8
- pile height, 20-35mm

Football turf

- tuft distance, gauge 3/4 ect…
- pile height, 50-70mm

Infrastructure Recommendations

Base construction

The sub-base and earthwork vary from continent to continent, country to country and even region to region. It would not be inappropriate to establish requirements that could not be met all over Europe.

But it is nevertheless necessary to establish certain constructional recommendations:

- Evenness of the turf.

  The surface should have a degree of evenness that allows the ball to roll over the surface without affecting its trajectory or causing the ball to bobble.

- Stable infrastructure.

  An asphalt base (or a similar stable construction) does not need to be reconstructed every time the turf is replaced; it can last some decades (experience has shown that such bases are very durable - at least three turf lifetimes).

- Water permeability.

  The infrastructure should be permeable to water, although in hot climates it can be impermeable (generally in southern European countries).

- Heating system.

  In regions where cold climatic conditions prevail over a long period of the year, it is recommended that a heating system be built into the sub-base.

Technical Turf Recommendations

UEFA does not require the use of any specific turf material, but does require the installed football turf product to fulfil all the football-related specifications mentioned on the UEFA test certificate.
(see Section 2).

Elastic pad

An elastic pad is recommended but is not a UEFA requirement. It is up to the manufacturer to propose a turf system with or without an elastic pad, as long as the values of the tests both at the time the turf is installed and afterwards, during the lifetime of the playing surface, fulfil UEFA requirements.

- If an elastic layer is to be installed, the manufacturer has to specify and test its type and elasticity factor, as it will affect the overall footballistic performance of the turf.
- An elastic pad can provide additional comfort to players.
- A high-quality elastic layer is beneficial to the overall turf system and helps to increase the turf life-time
- A high-quality elastic layer can usually be re-used several turf lifetimes, particularly if installed in situ, which makes it comparable to an asphalt infrastructure in this respect.

In any case, if an elastic layer is used, the turf manufacturer has to test the entire system “turf-elastic-layer-combination” to ensure that it complies with UEFA requirements once installed.

The test certificate will always reflect the behaviour of the entire turf system.

Fabric Properties

Does the manufacturer observe his own specifications regarding the amounts and quality of material used in his turf system?

UEFA requires only footballistic qualities of the turf. It is the responsibility of the owner to ensure that the amounts and quality of each component correspond to the certified sample mentioned in the test certificate.
(Section 3 gives turf material quality recommendations)

Important

UEFA does not intervene in any way whatsoever in the manufacture of artificial turf. UEFA only requires that the Footballistic characteristics of the installed turf meet its recommendations at any given time.

Turf System Identification

For the purpose of information and to illustrate the many different manufacturing possibilities mentioned in the above paragraph, the following table indicates the existing product range and product characteristics (state of the art summer 2002).

This table contains information on the fibre length / weight / thickness / tufting space etc., as well as the type and quantities of infill. The type of elastic pad and infrastructure vary from product to product and from one installed field to another.

Turf products	
Fibre (pile length)	35 – 70 mm
Infill of quartz sand	0 – 25 mm
Infill of rubber or mix of sand and rubber	0 - 30 mm
Height of fibres on top of infill	5 - 25 mm
Fibres	
Fibre components	Polyethylene (PE) Polypropylene (PP) Polyamid / Nylon (PM) Copolymer (blend and reactor made)
Fibre type	Mono- or fibrillated fibre
Weight of fibre	6.000 – 12.000 dtex
Thickness of fibre	60 - 130 mu (mircron)
Length of stretched fibre	105 – 150 mm
Number of tufts	8.000 – 14.000 tuft / m2
Tufting	3/4”, 3/8”, 5/8” etc.
Pile weight	800 – 1.500 g / m2
Roll width	4 – 5 m
Backing	
Type of fabric	Polypropylene or Polyester
Weight of primary backing	80 - 230 gr. / m2
Type of induction	latex
Weight of induction	500 – 900 gr. / m2
Joints and Bonding	
Assembly of turf rolls	Glued with bonding tapes or sewn
Infill	
Quartz sand, weight	90% round river sand, 0 – 20 kg / m2
Rubber	Green EPDM (manufactured for sport inst.) Black and grey EPDM (industrial waste) Black SBR (car and truck tyres) Green tinted SBR Green vulcanised rubber
Weight	0 – 25 kg / m2
Elastic Layer	
Elastic layer	Prefabricated polyurethane (PUR) recycled material Prefabricated polyvinylchloride (PVC) Recycled tyres and technical rubber
Force reduction	20 - 70 %
Weight	1 – 25 kg / m2

Football-Related

Introduction

UEFA recognises that the strategy adopted for approving artificial football turf for international UEFA competition matches at any level must be based primarily on Football-Related characteristics.

UEFA has conducted several test series under the same weather conditions in order to gain values from both natural and artificial turf. The results of these tests provided the working group with a valuable basis for determining the:

- Number of criteria
- Parameters
- Exact test methods

A natural grass field in good condition is considered to be a field which is not completely dry, which is flat, covered with healthy grass, and that has recently been mown.

While compiling this document, UEFA has consistently aimed to produce a solution, which would not unnecessarily increase the testing procedures and, consequently, the costs. Therefore, it was agreed to include only those criteria which are meaningful to the users and which represent the real action of a football match.

Moreover, consideration has been given to the three main reasons that have made players and coaches generally adverse to artificial football turf in the past. Requirements based on results obtained from tests on natural turf in good condition have been established and will be strictly applied.

Football-Related characteristics which must be met for UEFA approval:

Ball-turf interaction

- Ball roll (distance of the ball roll)
- Ball rebound (height of the ball bounce)
- Football pace (loss of speed of the ball after a long pass)

Player-turf interaction

- Shock absorbency (protection of the players body)
- Vertical rotation (ease of rotation of the of the player's boots)
- Vertical deformation (stability and sure-footedness of the players)

Ball Roll

The ball roll depends on the height and density of the grass, the evenness of the playing field, the humidity and, naturally, the force of the stroke carried out by the player. Although a footballer will adapt very quickly to the prevailing conditions, the football authority wishing to promote new football equipment must make sure that new products do not differ excessively from familiar ones.

Consequently, it is important that an artificial turf field provides similar ball roll distances as experienced on a natural turf field in good condition.

Ball Rebound

There is nothing worse for a footballer than when a ball rebounds too high or does not rebound at all. Again, even if a player adapts very quickly to such a situation, it is important that the rebound be similar to a rebound on a natural turf in good condition. While the ball rebound may vary significantly on natural fields (hard surface, wet or waterlogged field, etc.), this should not be the case on artificial turf produced and installed according to this manual.

The values reflect the loss of height after bouncing on the surface.

Football Pace

UEFA has initiated a test simulating a long pass whereby the horizontal speed and the rebound angle of the ball before and after hitting the surface are measured and compared.

It is essential in football that this action, which occurs very frequently during a match, should not be adversely affected by the use of artificial turf. The technicians who carried out this test were rather surprised by the results obtained with the football turf, which were very similar to those with natural grass.

This test is in its initial stage and will be further developed in the years to come. However, in order to create awareness of this parameter, some recommendations have already been drawn up.

The value indicates the speed reduction after the impact of the ball on the surface.

Shock Absorption

Football is certainly not an injury-free sport. Numerous dangers and risks are inherent to a football match at any level and under any conditions. It has been recognised that many former players, both professional and amateur, suffer from joint and back problems. Scientists as well as medical staff are currently looking into the causes of these afflictions, which are obviously caused by playing football.

A key part of the blame must certainly be attributed to the field of play. Playing regularly on a hard field probably causes more injuries than a “soft” surface. It is the duty of football governing bodies to ensure that the short and long-term consequences of playing football be reduced to a minimum. An artificial football turf should therefore provide a degree of softness similar to a natural grass field in good condition.

Although the football community today recognises and appreciates the fact that football turf provides very good football-friendly characteristics, it must ensure that a field approved for international competition matches offers both comfort and safety to the players.

In an attempt to better replicate what the player feels tests are also made with a studded test foot instead of the ‘standard’ test foot used by a number of sports. At the moment, the use of the studded foot is a new development and insufficient data has been obtained to allow a decision on its suitability or requirements to be established. To aid this process UEFA has decided to make the use of the studded foot mandatory for laboratory tests. This will allow knowledge to be gained for future consideration.

The value reflects the amount of shock absorption of the turf.

Rotational Resistance

Another very important and frequent movement that a player makes is rotation. The field must allow a player to carry out such actions without running the risk of blockage, which could result in serious injuries.

Consequently, the surface should allow free rotation while still giving the player sufficient stability.

Vertical Deformation

A player should not feel unsteady when moving on the field.
As with shock absorbency, the merits of using a studded test foot are being investigated for future consideration.

He should feel stable all the time, without the sensation that he is “wobbling”.

Sliding tackle and other typical football actions

Several test apparatus exist at present that provide different test interpretations. As far as UEFA is concerned, none of them gives significant and satisfactory footballistic results. Therefore UEFA has decided to set up a working group with experts in the fields of sports medicine, sports biomechanics studies, coaches etc. in order to investigate additional footballistic characteristics and their impact on artificial football turf. UEFA hopes to find ways of measuring the impact of sliding tackles, in order to protect the player from injury.

Biomecanic studies

Security Compatibility

This concerns in particular the security situation (fire / fumes / toxics) in a closed Stadium.

Flame test with a football turf

Artificial football turf must be produced and installed in conformity with national laws and rules.

This concerns the following elements of the football turf system:

Elastic layer
- Elastic material.
- Bonding agent.

Artificial football turf
- Turf fibres.
- Turf backing.

Infill material
- Miscellaneous infill.

Environmental Compatibility

This concerns in particular ground water, which could be affected by the breakdown of the chemical components present in the artificial turf system.

Section 3 gives additional information about security and environmental compatibilities.

The manufacturer and purchaser must abide by all relevant local security and environmental legislation during the construction, use, operation and disposal of the surface and its supporting layers. The purchaser must request the relevant certifications and declarations.

Regulations with regard to the security and environmental compatibility of products currently vary from country to country. The buyer should therefore insist that the manufacturer/supplier of all the products and materials used in the fabrication and laying of the artificial turf provide the corresponding certification.

Life Expectancy/Quality Insurance/Guarantee

The life expectancy of a football turf system depends on the following factors:

- Quality of the infrastructure
- Quality of manufacturing
- Quality of the fibre
- Quality of the laying (elastic pad, artificial turf and infill)
- Local climatic conditions
- Frequency of use
- Maintenance

The elements that adversely affect the original footballistic characteristics of the turf are, above all:

- Insufficient and/or inadequate maintenance
- and, of course, the frequency of use of the playing surface

A turf product may no longer fulfil the UEFA criteria, but still be an excellent product for any other type of football activity, depending on the norms applied on national level.

Quality control

It is highly recommended that quality control (material and footballistic characteristics) be carried out by the turf manufacturer and his appointed installer in order to insure that the product which is ordered corresponds to the product which has been manufactured and installed.

Please refer to section 3 for additional information on Life Expectancy, Guarantees and Quality Control.

Accreditation of Test Laboratories

Test institutes entitled to carry out laboratory and field tests according to UEFA requirements are those accredited by an internationally recognised accreditation authority such as ISO 17025. They are also advised to register with the International Sport Surfaces Science Organisation (ISSS).

Section 2, Part II gives additional information about the accreditation of test laboratories.

Details of UEFA-accredited test institutes (name, address and accredited personel) are published on the UEFA website www.uefa.com.

Choice of Artificial Turf Expert

Deciding whether to choose natural turf or to opt for an artificial alternative has never been a simple affair, and probably never will be. However, thanks to the good performance of football turf, there is now an increasingly marked tendency in favour of this solution. If merely reaching an initial decision seems difficult, implementing the project can sometimes be a nightmare! Countless questions need to be answered concerning the various elements of the system. It is therefore advisable to seek advice from a turf expert (see Section 3).

At first, it may seem that the overall costs will be higher as a result of calling in a turf expert for this purpose, but the investment is well worth it in the long run.

WE CARE ABOUT FOOTBALL

Section 2
Part 1: Inspection Procedures

Test methods for the use of the test laboratories and manufacturers

Introduction

Important: The following procedures apply only to artificial football turf surfaces that are to be used for UEFA competition matches. Training pitches, or playing surfaces that are to be used for national competition matches are subject to national rules.

With reference to footballistic tests, as already mentioned in section 1, the aim was to draw up requirements and criteria that are of significance for football. For this reason, the working group limited itself to the most important and frequent play actions and player reactions (interaction: ball and turf / player and turf).

There are currently still no pan-European standards with regard to test methods on “football turf” (e.g. artificial-turf playing surfaces) – despite long discussions and attempts over many years to impose a single set of principles on this subject.
It should be mentioned, with respect to inspection procedures, that the European Standards Committee (CEN TC 217) have for many years been trying, in collaboration with manufacturers and testing organisations, to achieve a standard set of practices in this area – so far without success.

The UEFA organisation, which exists independently of any state or territory, counts 52 European football associations as members. A large proportion of these member associations have their own particular rules, regulations and standards as regards the methods and procedures for inspecting football turf. Attempting to harmonise these procedures and produce a set of pan-European standards is not part of UEFA’s role. UEFA must however ensure that football turfs are installed in accordance with the expectations of users throughout the continent. For this reason, there is a need for a unified set of standards designed to ensure a Europe-wide quality benchmark.

In order to carry out this task, the working group based its procedures on existing national and European test methods, incorporating both present and future processes into its own modus operandi.

To ensure as good reproducibility as possible, UEFA has decided it will not accept correlation between different test apparatus. That means that only the type of apparatus described in this manual is accepted.

Before the corresponding requirements and criteria with respect to the footballistic characteristics of artificial football turf could be drawn up, it was necessary to establish the corresponding inspection procedures and describe them in detail.

The objective of these tests is to use the technical means at our disposal to certify the characteristics of a given football turf, in order to assure the user that the playing surface measures up to the quality standard required. As mentioned earlier, precise details of the corresponding test methods are described in section II, part 2. These methods, which are already being used in several countries, have been elaborated in collaboration with recognised European testing organisations such as the International Association for Sports Surface Sciences, along with the working group of the Nordic countries, manufacturers of artificial turf, infill products and elastic layers.

UEFA proposes to regularly review the footballistic criteria as more data and information is gained. It is envisaged that these reviews could lead to requirements being revised or additional requirements being introduced. Such revisions would not be retrospective.

The test institutes which are entitled to carry out laboratory and field tests according to this concept are those accredited by an internationally recognised accreditation authority (refer to section 2, part II). Only these laboratories can be accredited by UEFA and they may then test football turf for UEFA competitions.

The inspections are carried out according to the following sequence:

Phase 1: Laboratory tests
- product identification / declaration.
- footballistic tests.

Phase 2: Field tests
- footballistic tests before holding any UEFA competition matches.

Phase 3: Approval procedures
- UEFA grants approval for two years.
- At the end of this two-year period, the playing surface is again inspected (or earlier if the surface is changed during this two-year period) with respect to its compliance with the footballistic criteria described hereafter. UEFA approval is renewed when all these requirements are fulfilled.

Phase 1: Laboratory Tests

Product identification

The purpose of product identification is to determine precisely which product has been manufactured, lab-tested and installed.

The procedures used during these tests follow these principles:
- The manufacturer of the football turf, or a laboratory, tests the artificial turf product system (elastic layer, artificial turf and infill) according to specific material and technical criteria (see: Test Specifications for Manufacturers and Test Laboratories; Section 2, Part 2).
- The manufacturer of artificial turf supplies a system specification (product identification) for each individual, specified and tested artificial turf product system.
- If there is any change to the composition of the product or components of the product of the turf system in question, the test must be repeated and the turf system assigned a new product specification.
- The technical product specification details are given on the test certificate.

Football-Related characteristics

- Once the material of the turf system has been identified (see “Specimen of Test Certificate – Product Identification” at the end of this volume), the turf system can be tested according to the footballistic characteristics.

Laboratory test certificate

- If all the requirements are fulfilled, a laboratory test certificate with a football turf product number is issued by UEFA and the approved football turf system including all its components can now be manufactured and the football-turf-system installed in stadium used for UEFA competitions.

Note: The UEFA accredited test laboratory will retain 1m2 samples of materials forming the turf product system so that in the event of dispute or guarantee claims, samples of the turf that has been installed can be compared with the original sample retained by the testing organisation. For more detailed information:refer to Section 3.

Phase 2: Field Tests

Before any official UEFA approval for the use of the football turf for a UEFA competition, a field test by an authorised laboratory must be carried out.

- The company responsible for installing the turf must ensure that all the values and characteristics given in the system specification are observed throughout the installation process.
- Once the turf is installed, the football turf is tested for its footballistic characteristics.

Field test certificate

- If the requirements are fulfilled, a field test certificate will be issued by UEFA.

Note: The UEFA will retain 1m2 samples of any registered football turf product system.

Phase 3: Approval Procedures

- UEFA then issues the owner of the football turf with a permit to hold UEFA competition matches.
- This decision is communicated to both the football association involved and the manufacturer of the football turf.
- The test certificate for the field must be no more than two years old, after which the playing surface in question must be re-inspected.

UEFA also publishes the registrations on its website – UEFA.com

- the name of the manufacturer
- the identified turf product system with details of the tests
- the location of the installed surface with details of the tests and permit awarded.

Test Certificate

Product declaration

The test certificate has to define every product accurately and certify the origins of the products and material installed:

- type of shock-pad, if required
- type of turf backing
- type of turf fibres
- types of infill, if required

To ensure that the tested turf cannot be mixed with or assimilated to a similar tested product (turf system), the manufacturer is required to add to his product (brand name) a product code which clearly defines this product. The brand name and the product code have to appear on all test certificates, similar to other industrial products:

As an example, the product code should include:

- type of fibre
- tufts per m2
- pile weight
- pile height
- backing
- type and quantities of infill, if required for the the turf system
- type of shock-pad, if required for the the turf system
- etc., etc

With all these data included in the product code, the turf product system will be clearly defined. It will have exactly the same construction/composition wherever it is installed and is part of the product/system declaration of the turf manufacturer.

UEFA Test Certificate

For all tests hereafter, refer to the UEFA - Football - Turf Manual; Season 2002/03

Turf Manufacturer	
Turf product (brand name)	
Turf product (code)	
Test applicant Address	

Turf Composition

Product/System declaration of the turf manufacturer (refer to pages 3-5)

Pile fibre length	.....mm		.....mm
Number of stitches	.....mm^2		.....m^2
Stabilisation infill	.....type	.....mm	.....kg/m^2
Shock absorbing infill	.....type	.....mm	.....kg/m^2
Total height of infill	.....mm		
Height of fibres above infill	.....mm		
Total height of the turf	.....mm		
Elastic pad/shock absorbing layer	.....type	.....mm	.....kg/m^2

Footballistic and Technical Turf Characteristics

Conclusion of the laboratory and field tests

Laboratory tests

UEFA test laboratory
Date
Number
Signature

UEFA product/system registration
Date
Number
Signature

The tested turf system complies with the UEFA Laboratory requirements.
This test certificate is only valid with all pages numbered from 1 to 5.

Football Caracteristics: Laboratory Tests

Footbalistic characteristics			Required values	Test Conditions	Test results	UEFA compliance
Ball rebound			60 - 85 cm	dry		
				wet		
Ball roll			4 - 8 m	dry		
				wet		
Force reduction	at +23°c	1st impact	>60 % recommendation	dry		N/A
				wet		
		mean 2nd & 3rd impact	>60 %	dry		
				wet		
	at 5°c		>50 %	frozen		
	with studded foot		no requirements	dry		N/A
				wet		
Football pace			45 - 60 % recommendation	dry		N/A
				wet		
Rational resistance			30 - 45 Nm	dry		
				wet		
Vertical deformation		1st impact	<10 mm	dry		N/A
				wet		
		mean value	<8 mm	dry		
				wet		
		with studded foot	no requirements	dry		N/A
				wet		

Field tests and registration; test validity

Country, city and name of the field						
Installation date				m x		m
Test laboratory				UEFA field registration		
Field test	Date	Number	Signatue	date	Number	Signature
Initial test						
1st renewal						
2nd renewal						
3rd renewal						

The tested field complies with the UEFA requirements.
Note: This certificate is only valid for the above-mentioned field for a maximum of 2 (two) years from the date of the last test.

Infrastructure characteristics

Base layer	Description	
Base permeability	Description	
Slope	Description	
Soil heating	Description	
Water sprinkler	Description	

Football-Related Characteristics: Field test

Footballistic characteristics		Required values	Test measurements: Test position 1	2	3	4	5	6	Pitch mean	UEFA compliance
Ball rebound		60 - 85 cm								
Ball roll		4 - 8 cm								
Force reduction (impacted)	1st impact	no requirement								N/A
	mean 2nd & 3rd	>60%								
Football pace		45 - 60% recommendation								N/A
Rotational resistance		30 -45 Nm								
Vertical deformation	1st impact	<10 mm recommendation								N/A
	mean value	<8mm								
Evenness		8mm / 4 meter								
		4mm / 1 meter								

The pitch mean results is the mean of the five locations.
The lowest mean value for each series of tests is shown in red.
The highest mean value for each series of tests is shown in blue.
Each of the lowest and the highest results at the 5 locations shall meet the UEFA requirements.

Conditioning of test areas	Yes ☐		No ☐	
	(cross to show if conditioning is used or not)			
Air temperature during test programme	min	^{0}C	max	^{0}C
Surface temperature during test programme	min	^{0}C	max	^{0}C
Humidity during test programme	min	%RH	max	%RH
Wind speed	Football pace	m/h	Ball roll	m/h

Product System Declaration by the Manufacturer

Turf fibre (main fibre)	Test Method	Test Results
Fibre manufacturer		
Material identification (brand name)		
Material identification (code or description)		
Colour		green (compulsory)
Total length of stretched fibre		……mm
Fibre weight per unit area		……dtex
Pile weight per unit area		……gr. / m^2
Turf per unit area		……m^2
Turf pattern		
Turfing construction		
Size of pile fibres		……micron
Complementary turf fibre (if applicable)		
Fibre manufacturer		
Material identification (brand name)		
Material identification (code or description)		
Colour		green (compulsory)
Total length of stretched fibre		……mm
Fibre weight per unit area		……dtex
Pile weight per unit area		……gr. / m^2
Turf per unit area		……m^2
Turf pattern		
Turfing construction		
Size of pile fibres		……micron
Turf backing		
Manufacturer		
Material identification (brand name)		
Material identification (code or description)		
Primary backing		
Secondary backing		
Type of induction		
Total weight of backing and induction		……gr. / m^2

Sewn turf joints (if applicable)	Test Method	Test Results
Manufacturer		
Brand name		
Glued turf joints (if applicable)		
Backing manufacturer		
Brand name		
Width of joint backing tape		……cm
Glue manufacturer		
Brand name		
Glue		……gr. / per m
Stabilisation infill (if applicable)		
Manufacturer		
Brand name		
Material identification (code or description)		
Particle shape		
Weight per unit area		……kg / m^2
Infill thickness		……mm
Particle size w/range		……mm
Particulate infill (if applicable)		
Manufacturer		
Brand name		
Material identification (code or description)		
Colour		
Weight per unit area		……kg / m^2
Infill thickness		……mm
Particle size w/range		……mm
Particle shape		

Shock pad (if applicable)	Test Method	Test Results
Manufacturer		
Brand name		
Material identification (code or description)		
Force reduction		……%
Cross-tensile strength		……MPa
Weight per unit area		……kg / m^2
Thickness		……mm

This product identification declaration can, when required, be cross-checked with the registered turf sample.

Additional comments from the test laboratory / manufacturer

Product-System-Declaration	Date and Signature
Turf manufacturer	
UEFA registered test laboratory	

Key to Abbreviations

The following list includes some of the most important abbreviations that may be of interest to a non-expert:

PP	Polypropylene
PE	Polyethylene
Dtex	Weight of the fibres for a length of 10,000m
Nm	Newton Meter
EPDM	Ethylene-Propylene-Dien-PolyMethylene; normally granulated virgin green rubber granules specially produced for sport installations
SBR	normally granulated recycled car and truck tyres

WE CARE ABOUT FOOTBALL

Section 2

Part 2: Football-Related Technical Requirements

1.Test Description

Introduction

This section of the UEFA football turf manual describes the tests methods for assessing the entire artificial turf system (product testing) and installed football turf (field testing).

The test procedure specifications are based on the expertise of laboratories and other experts. These tests are limited to those relevant for football (Footballistic characteristics) and the practical utilisation of playing fields (infrastructure characteristics). In addition, tests are mentionned in Volume 3 to identify the products involved (product identification characteristics).

All tests that need to be performed for product approval and installed football turf are specified below. As no standards exist which provide consistent and satisfactory test procedures, it has been decided that none of the existing norms, such as CEN, DIN, ASTM, BS etc., will be used for the footballistic criteria.

To assure correlated and comparable test results between the UEFA accredited test laboratories, only one type of test apparatus is specified and no correlation between different types of apparatus is allowed.

This part of the manual is designed primarily for the use of technicians (testing organisations and manufacturers). The simplified illustrations contained herein should nevertheless be of use to any purchaser or end-user who wishes to get an insight into this important part of the concept.

The test methods to be applied are illustrated in the following three manners:

- written description
- photo and sketches of the testing apparatus
- diagram of the field test areas

The detailed description of testing methods ensures that all artificial football turf are inspected according to the same test procedures.

Laboratory test

- A football turf is defined as a system where the top surface, elastic pad and underlying layers influence the sports performance or biomechanical response. Tests for ball rebound, football pace, force reduction, vertical deformation and rotational friction shall be made on all elements of the construction that influence the sports performance or biomechanical response. If an elastic pad is part of the turf system, all tests must include the specified elastic pad.

- Laboratory tests for ball roll shall be made on all elements that influence the ball roll response – this does not normally include the elastic pad.

- Test specimens shall be prepared strictly in accordance with the manufacturer's instructions. Whenever possible it is recommended that the manufacturer should prepare the test specimens at the laboratory and that they be verified by the test laboratory.
- The test samples shall have a minimum size of 1.0 m by 1.0 m except for ball roll, where the test sample should have minimum dimensions of 10.0 m by 1.0m, and sub-ambient force reduction and ball rebound, where the test sample should have minimum dimensions of 0.3 m by 0.3 m.
- Following infilling, all test samples (other than sub-ambient tests) shall be conditioned by passing a hand-pulled roller over the sample for 50 cycles (one cycle comprises one outward and one return path). The barrel of the roller shall weigh 30 ±0.5 kg, be 118 ±5 mm in diameter and have plastic studs (Shore A hardness: 96 ±2) shown and mounted as per Figures 1 and 2 (see field test).
- Laboratory tests shall be made on dry and wet test specimens. Wet specimens shall be prepared 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 5 minutes.
- Laboratory tests shall be made at an ambient temperature of 23 ±2° C.
- Test pieces shall be conditioned for a minimum of 8 hours at the test temperature.

Field test

- For pitches that have been used for less than 120 hours of play, the area of the test shall be conditioned by passing a hand-pulled roller over the area of test for 50 cycles (one cycle comprises one outward and one return path). The barrel of the roller shall weigh 30 +0.5kg, be 118 +5mm in diameter and have plastic studs (Shore A hardness: 96 +2) shown and as mounted as per Figures 1 and 2.

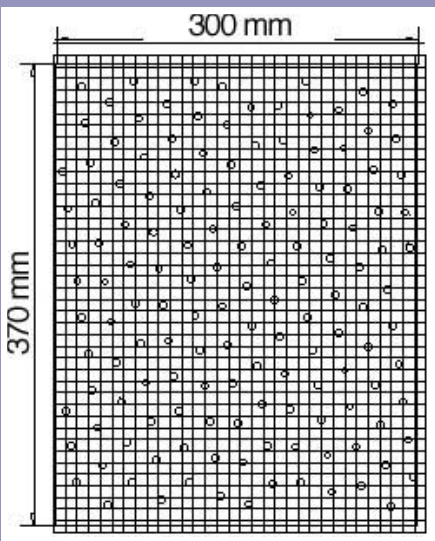


Figure 1

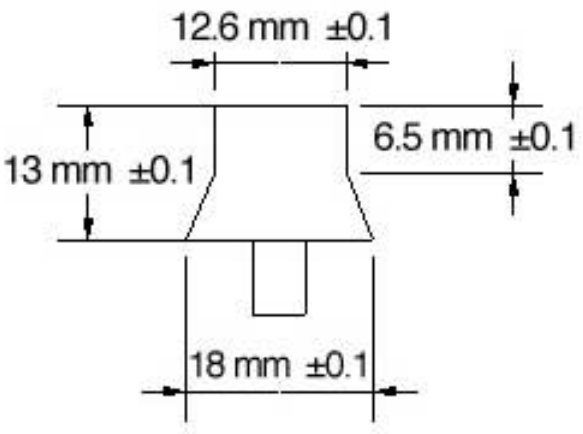


Figure 2

Stud layout on roller (grid at 10mm centres)

- Tests on site shall be made under the prevailing conditions, but within a range of +5°C to +35°C.
- Temperature (min. and max.) and ambient humidity conditions shall be recorded and reported (surface and air).
- Each test shall be made on the 5 locations (within 1m2), except for ball roll.

Field Test Areas

Test ball

- To minimise the effect on testing of the inherent variations found in footballs, UEFA will supply FIFA-approved balls to the accredited test laboratories for the purposes of testing. Prior to any test, the pressure of the ball shall be adjusted to give a rebound on concrete, at the temperature the test will be made, of 1.35 ±0.02 m, from a drop height of 2.0 metres.

2. Football-Related Technical Requirements

Force Reduction

2.1.1.1 Laboratory requirements

Test foot A:

- At + 23°C minimum mean of second and third impacts: 60 %
- At – 5°C minimum mean of second and third impacts: 50 %
- Initial impact, no requirement, test undertaken for data collection only

Test foot B:

- No requirement, test undertaken for data collection only

2.1.1.2 Field requirements

Test foot A:

- Minimum 60 %

2.1.2 Principle

A mass is allowed to fall onto a spring that rests, via a load cell and test foot on the test specimen, and the maximum force applied is recorded. The percentage reduction in this force relative to the maximum force measured on a concrete surface is reported as the 'force reduction' (also called 'shock absorption').

2.1.3 Test apparatus

The principle of the apparatus is shown in Figures 3 and 4. It consists of the following essential components:

- Falling weight, 20 ± 0.1 kg with a hard striking surface, which is guided so as to fall smoothly and vertically with minimum friction.
- Spiral spring, whose characteristic, when mounted in the assembly described below, is linear with a spring rate of 2 000 ± 60 N/mm over the 0.1 kN to 7.5 kN range. The spring is fitted with a hard upper plate and has an outer diameter of 70.0 mm or less. It is recommended that the spring be manufactured by milling from the solid.
- Adjustable supporting feet, no less than 250 mm from the point of application of the load.
- Steel base plate, with the rounded lower side having a radius of 500 mm, radius of the edge 1 mm, diameter 70.0 ± 0.1 mm, thickness 10 mm minimum.
- Metal guide tube, interior diameter 71.0 ± 0.1 mm.

- Electrical force-sensing device, with a capacity of 10 kN, class 0.2.

- Test foot A

  Test foot, consisting of the steel base plate (see above), force sensing device, spring and upper plate, funnelled into the guide tube. The total weight of the testing foot (without guide tube) should be 3.0 ±0.3 kg.

- Test foot B

  Test foot consisting of the base plate (thickness 10 mm minimum) onto which are attached four plastic studs 13 ±1mm long by 12.6 ±1mm diameter as shown in Figure 2, force sensing device, spring and upper plate, funnelled into the guide tube. The total weight of the testing foot (without guide tube) should be 3.0 ±0.4 kg.

- Test foot C

  Test foot consisting of a steel base plate, with a flat lower side; radius of the edge 1 mm, diameter 70.0 ± 0,1 mm, thickness 10 mm min., force sensing device, spring and upper plate; funnelled into the guide tube. The total weight of the testing foot (without guide tube) should be 3.0 ± 0.3 kg.

- A means of supporting the weight, allowing it to be set to the fall height with an uncertainty no greater than ± 0.5mm.

- A mean of conditioning and recording the signal from the force sensing device and the sensors, and a means of displaying this signal. The ISO 6487 channel frequency class of the conditioning amplifier shall be ≥ 1 kHz.

  Care shall be taken to ensure anti-aliasing does not occur. This may be achieved by applying an analogue prefilter with a cut-off frequency of approximately 500 Hz, to prepare the signal for final filtering.

- The conditioning amplifier shall be followed by or shall incorporate a low-pass filter having a 9th order Butterworth characteristic with a -3 dB frequency of 120 Hz. Filtration may be implemented in hardware or software. The response of the system at any given frequency shall be within ± 0.5 dB of the expected response, calculated on the basis of the Butterworth function.

- Where digital recording means are employed, the word length shall be ≥ 12 bits, the amplitude of the signal shall be no less than 25% of the equipment full scale and the sampling frequency shall be ≥ 2 kHz or twice the upper frequency response limit of the amplifier/filter system preceding the digital system, whichever is greater.

- A rigid, non-vibrating, smooth, level and even concrete floor on which a peak force (Fmax) of between 6.60 ±0.25 kN is achieved.

Tests at –5°C

- Conditioning cabinet capable of maintaining a temperature of -8 to -12°C.
- Metal sample tray with internal dimensions of at least 300mm by 300mm. The depth of the tray shall be at least 10mm greater than the sample and the base of the tray shall be of rigid mesh, to allow the free draining of water from the samples. The tray shall include a clamping assembly around the perimeter of the tray base to prevent the movement of samples during test and conditioning.

  If the base of the tray is recessed, a rigid concrete or metal block shall be provided to ensure that the tray cannot deflect during the force reduction measurement.

2.1.4 Measurement of reference force Fmax (concrete) using tests foot C

- Set the apparatus on the concrete floor so that it is vertical.
- Set the height of the lower face of the impact weight (projection) so that it is 55 ± 0.25 mm above the force measurement assembly. Allow the weight to fall onto the force measurement assembly. Record the peak force applied to the surface in the course of the impact.
- Repeat the procedure ten times, giving a total of 11 impacts. Record the average value of peak force from the second to the eleventh impact and denote it Fmax (concrete).
- Carry out this procedure at intervals of at least three months or whenever components of the test apparatus change.

2.1.5 Measurement of force reduction using test foot A or B

- Set up the apparatus so that it is vertically positioned on the test sample.
- Set the height of the lower face of the impact so that it is 55 ± 0.25 mm above the force measurement assembly.
- Allow the weight to fall onto the force measurement assembly.
- Record the peak force applied to the surface in the course of the impact. After the impact and within 5s, lift and re-attach the impact weight to its support so that the surface can recover before the following impact.
- Repeat the procedure twice at intervals of 60 ±10s, giving a total of three impacts.

2.1.6 Expression of the results

- Calculate the force reduction FR from the expression.

$$FR = \left(1 - \frac{F_{max(testpiece)}}{F_{max\,(concrete)}}\right) \cdot 100\,\%$$

where

FR is the force reduction, as a percentage (%).

$F_{max\ (test\ piece)}$ is the measured maximum peak force of the test piece, in Newton (N).

$F_{max\ (concrete)}$ is the measured maximum peak force of the concrete, in Newton (N).

- Calculate the mean of the force reduction results from the second and third impact.

- Report the initial and mean results to the nearest whole percentage, e. g. 37%, as required.

2.1.7 Test conditions

Laboratory tests

Tests at 23 ±2°C shall be made using the test foot A (curved foot) and the test foot B (studded) foot.

Tests shall be made in three positions, each at least 100 mm apart and at least 100mm from the sides of the test specimen.

Tests shall also be made using test foot A on a frozen sample as follows:

- Place and clamp the sample in the metal container and immerse in water to a depth of 10 ±2 mm above the top of the synthetic turf pile.
- After eight hours, remove the sample from the water and allow it to drain by gravity for 30 ±2 minutes before placing the sample and metal tray in a conditioning cabinet at –8°C to –12°C.
- After 20 hours, remove the sample and metal tray from the conditioning cabinet. Allow the temperature of the sample to rise monitoring its temperature using a temperature gauge inserted into the sample to approximately half the thickness of the sample.
- When the temperature gauge reads –5°C, measure the force reduction using test foot A, ensuring the temperature of the sample does not rise above –3°C.

Field-tests

Tests shall be made using the test foot A (curved foot) only.

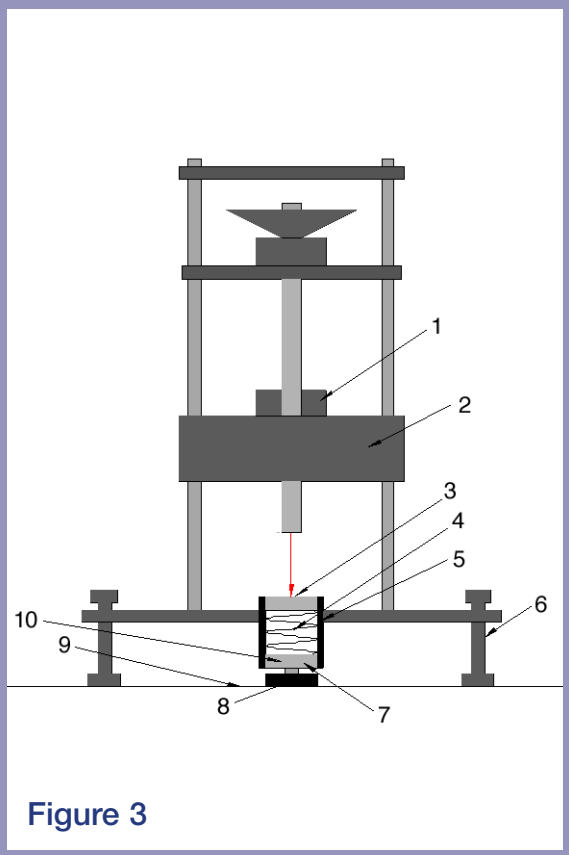


Figure 3

Figure 3
Shock Absorbtion Artificial Athlete
1 Lifting/release facility
2 Falling Weight
3 Upper Plate
4 Spring
5 Metal Guide Tube
6 Adjustable Foot
7 Force Sensing Device (load cell)
8 Test Foot
9 Test Surface
10 Steel Base Plate

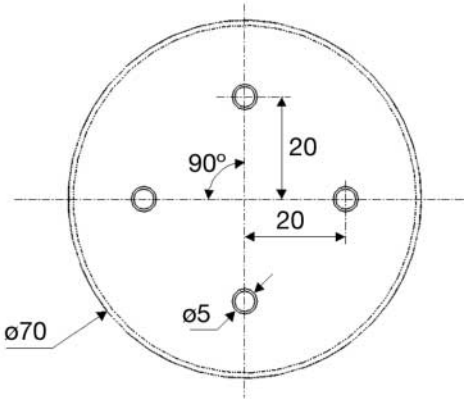


Figure 4
Stud Postioning

2.2 Vertical Deformation

2.2.1 Requirements:

Test foot A:

- Initial impact: max. 10 mm
- Mean of second and third impacts: max. 8 mm

Test foot B:

- No requirement, test undertaken for data collection only

2.2.2 Principle

A mass is allowed to fall onto a spring that rests, via a load cell and test foot, on the test specimen, and the deformation of the surface under a standard force is determined.

2.2.3 Test apparatus

The principle of the apparatus is shown in Figure 5.
It consists of the following essential components:

- Falling weight of 20 ±0.1)kg with a hard striking surface guided in such a way as to fall smoothly and vertically with minimum friction.
- Single coil spring which, when mounted in the assembly described below, is linear with a spring rate of 40 ±2.5 N/mm over the 0.1 kN to 1.6 kN.
- Adjustable supporting feet, no less than 250 mm from the point of application of the load.
- Steel base plate, with a flat lower side; radius of the edge 1 mm, diameter 70.0 ±0.1 mm; thickness 10 mm min.
- Test foot A

  Test foot consisting of the base plate, two horizontal projections attached to the testing foot for the sensors, force sensing device, spring, and upper plate. The total weight of the testing foot (without guide tube) shall be 3.5 ±0.35 kg.
- Test foot B

  Test foot consisting of the base plate, two horizontal projections attached to the testing foot for the sensors, force sensing device, spring, and upper plate. The total weight of the testing foot (without guide tube) shall be 3.5 ±0.45 kg. Four plastic studs 13 ±1mm long by 12.6 ±1mm in diameter shall be mounted on the base of test foot as shown in Figure 2.
- Metal guide tube, interior diameter 71.0 ±0.1 mm.

- Two sensors e. g. electronic pick-ups with a measuring range of no less than 20 mm and an uncertainty no greater than 0.05 mm. The distance between the sensors shall be less than or equal to 300 mm. The sensors shall be mounted on a separate stand from the falling weight, etc.

- A means of supporting the weight, allowing the drop height to be adjusted and set repeatedly.

- A means of conditioning and recording the signals from the force sensing device and the sensors, and a means of displaying these signals.

- The ISO 6487 channel frequency class of the conditioning amplifier for the force signal shall be ≥ 500Hz. It shall be followed by or shall incorporate a low-pass filter having a 9th order Butterworth characteristic with a -3 dB frequency of 120 Hz. Filtration may be implemented in hardware or software. The response of the system at any given frequency shall be within ± 0.5 dB of the expected response, calculated on the basis of the Butterworth function.

- The signal conditioner for the deformation signal shall have a –1 dB measuring range of min. 100 Hz (-1 dB upper frequency response). The individual signals of the two deformation sensors shall be superposed before calculating the vertical deformation.

- Where digital recording means are employed, the word length shall be ≥ 12 bits, the amplitude of the signal shall be no less than 25% of the equipment full scale and the sampling frequency shall be ≥ 0.5 kHz.

2.2.4 Test procedure

- Set the apparatus so that it is vertically positioned on the test sample.

- Adjust the sensors (deformation pick-ups) so they are equi-spaced either side of the falling weight axis. Under this condition the force measurement assembly shall give a surface pre-loading of 0.01 ±0.005 N/mm2 and a corresponding deformation of the surface which equates to the zero position.

- Adjust the deformation pick-ups so they contact the horizontal projections on the test foot.

- Set the height of the lower face of the impact mass so that it is 120±0.25 mm above the top plate of the spring.

- Allow the mass to fall onto the testing foot.

- Record the force applied to the surface and the resulting deformation of the initial impact.

- Repeat the procedure twice at intervals of 1 min., giving a total of three impacts.
- Move the test apparatus and repeat the procedure to obtain five sets of readings of initial and mean (second and third) vertical deformation.

2.2.5 Expression of test results

Calculate the vertical deformation VD from the expression.

$$VD = \left(\frac{1500}{F_{max}}\right) \cdot d_{max}$$

where

d_{max} is the maximum deformation of the synthetic turf in the axis of impact, in millimetres (mm), calculated from the mean of the two sensors (electronic pick-ups).

F_{max} is the maximum force (peak value), in Newton (N).

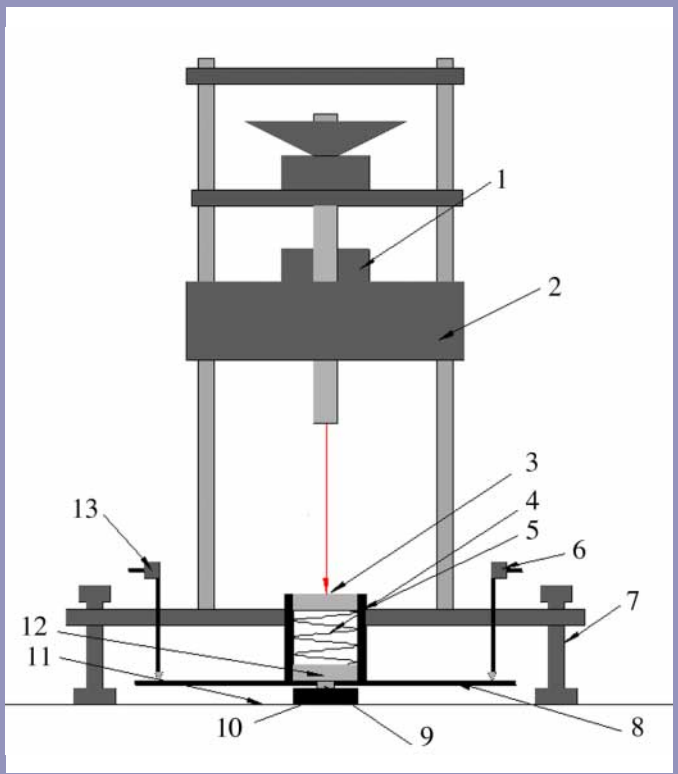


Figure 5
Artificial Athelete
Vertical Deformation

1 Lifting/release facility
2 Falling Weight
3 Upper Plate
4 Spring
5 Metal Guide Tube
6 Sensor (Electronic Pick Up) mounted on seperate frame
7 Adjustable Foot
8 Horizontal Deflection Bar
9 Force Sensing Device (Load Cell)
10 Test Foot
11 Test Surface
12 Steel Base Plate
13 Sensor (Electronic pick up) mounted on seperate frame

2.3 Rotational Resistance

2.3.1 Requirements: 30 – 45 Nm

2.3.2 Principle

The torque required to rotate a loaded studded disk in contact with the surface is measured and the rotational resistance calculated.

2.3.3 Test apparatus

The apparatus to be used is shown in Figures 6 and 7.

It consists of the following elements:

- A steel disc 145 ±1 mm in diameter with six football studs (see figure 2) equi-spaced on the bottom surface 46 +1 mm from the centre of the disc.
- A shaft with attached lifting handles which is attached centrally to the centre of the studded disc.
- A set of annular weights which rest centrally on the upper surface of the studded disc allowing free movement of the disc beneath the weights. The total mass of the studded disc, weights, shaft and torque wrench (below), shall be 46 ±1Kg.
- A two-handled torque wrench with a scale up to 80N, which attaches to the top of the shaft.

2.3.4 Test procedure

- Assemble the apparatus and ensure the free movement of the disc below the weights.
- Drop the apparatus from an approximate height of 60mm onto the surface.
- Zero the torque wrench indicator needle.
- Without placing any vertical pressure on the torque wrench, turn the apparatus until movement of the studded disc occurs and it has rotated through at least 45°.
- Record the value displayed on the torque wrench to the nearest Nm.
- Move the test apparatus and repeat the procedure to obtain five readings of rotational friction. Before conducting each test ensure that disc and studs are cleared of any in-fill/detritus.

2.3.5 Expression of results

From the five test results, calculate the mean value of rotational traction.

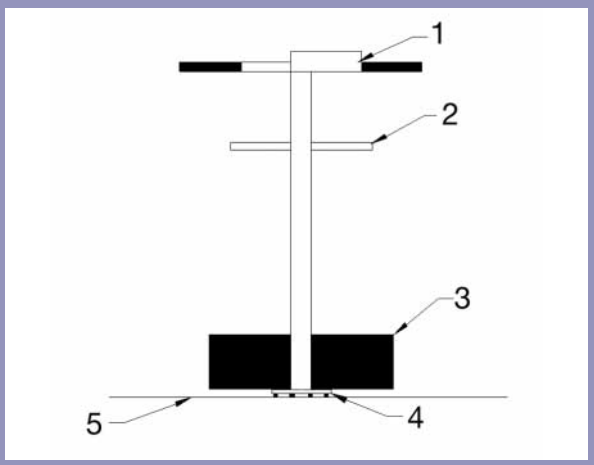


Figure 6

1 Dial Indicating Torque Wrench
2 Lifting Handles
3 Weight
4 Stubbed Foot
5 Test Surface

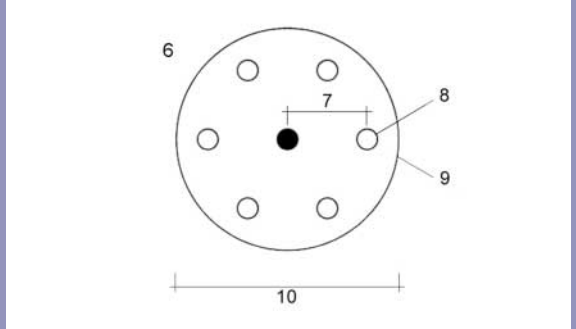


Figure 7

6 Stubbed Disk
7 46mm ± 1mm
8 Football Stud
9 Steel disc 12mm ± 2mm thickness
10 145mm ± 1mm

2.4 Ball Rebound

2.4.1 Requirements: 60 – 85 cm

At –5°C (recommendation): 60 – 85 cm

2.4.2 Principle

- A ball is released from 2m and the height of its rebound from the surface calculated.

2.4.3 Test apparatus

- A means of releasing the ball and allowing it to fall vertically from 2.00+0.01m (measured from the bottom of ball) without imparting any impulse or spin.
- Vertical scale to allow the drop height from the bottom of the ball to the top of the surface to be established.
- Acoustic recording apparatus (microphone and timing device, activated acoustically) or infrared timing gates. The recording apparatus shall be capable of determining the maximum height to which the ball rebounds (bottom of ball) to an accuracy of not less than ±2 cm of the drop height. If infrared timing gates are used they shall be activated by the impact of the ball on the surface and not by the ball falling or rebounding.
- Test football provided by UEFA.

Tests at –5°C

- Conditioning cabinet
  capable of maintaining a temperature of –8 to –12°C.
- Metal sample tray with internal dimensions of at least 300 mm by 300mm. The depth of the tray shall be at least 10 mm greater than the sample and the base of the tray shall be of rigid mesh, to allow the free draining of water from the samples. The tray shall include a clamping assembly around the perimeter of the tray base to prevent the movement of samples during testing and conditioning.

  If the base of the tray is recessed, a rigid concrete or metal block shall be provided to ensure the tray cannot deflect during the ball rebound measurement.

2.4.4 Test procedure

- Release the ball from the 2.00 ±0.01m and record the time between the first and second impact in seconds.
- Move the apparatus and repeat the procedure to obtain five results.

Laboratory tests shall be made on samples at ambient laboratory temperature and on frozen samples. Frozen shall be prepared as follows:

- Place and clamp the sample in the metal container and immerse in water to a depth of 10 ±2mm above the top of the synthetic turf pile.
- After eight hours, remove the sample from the water and allow it to drain by gravity for 30 ±2 minutes before placing the sample and metal tray in a conditioning cabinet at –8°C to –12°C.
- After 20 hours remove the sample and metal tray from the conditioning cabinet. Allow the temperature of the sample to rise monitoring its temperature using a temperature gauge inserted into the sample to approximately half the depth of the sample.
- When the temperature gauge reads –5°C measure the ball rebound, ensuring that the temperature of the sample does not rise above -3°C.

2.4.6 Expression of results

- For each test calculate the rebound height using the formula:

  $H=1.23\ (T- t)^2$

  where

  H = rebound height in m

  T = the time between the first and second impact in seconds

  t = 0.025s

- Calculate the mean value of rebound of the 5 tests
- Report the mean value rebound as an absolute value in centimetres.

2.5 Football pace

2.5.1 Recommendation: 45% – 60 %

2.5.2 Principle

A soccer ball is projected, without spin, from a cannon at a specified speed and angle, onto the surface and the football pace is calculated from the ratio of the final speed after impact to initial speed.

2.5.3 Test apparatus

- Means of projecting the ball onto the surface without spin at an impact velocity of 50 ±3 km/h and an angle of 15 ±2° to the horizontal. (See Figure 8).
- Radar gun or infrared light barrier gated timing device to determine speed before and after bounce with accuracy of ±1 km/h.
- Field tests: means of measuring wind speed to an accuracy of 0.1m/s.

2.5.4 Test procedure

- If wind speeds exceed 5 m/s during field tests, shield the test area from the prevailing wind.
- Adjust the ball projection device so that the ball impacts the surface at the specified velocity and angle.
- Record the speed of the ball immediately before and immediately after impact with the surface.
- Move the apparatus and repeat the procedure to obtain five results.
- If the test results are influenced by factors such as pitch slope or turf pile pattern, carry out the tests in such a way that a set of readings is obtained in directions giving maximum and minimum values.

2.5.6 Expression of test results

- Calculate the football pace using the formula:
  Football pace = (S2/ S1). 100 [%[
  where
  S2 = speed after rebound in m/s or km/h
  S1 = speed before rebound in m/s or km/h

- Calculate the football pace mean value from the five tests.

- Report the rebound mean value as a percentage.

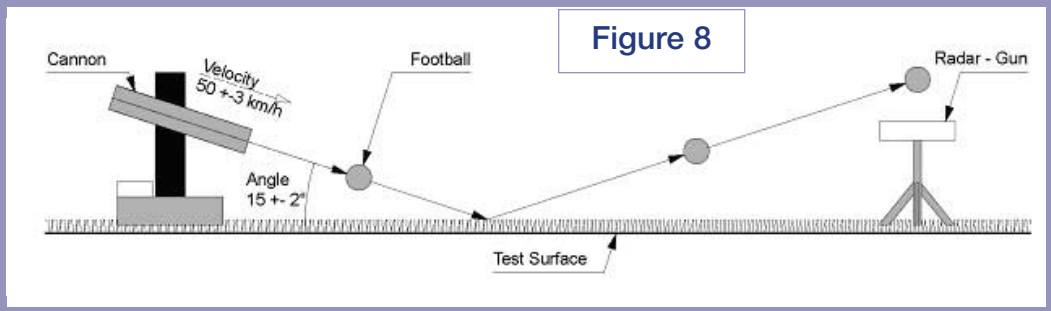


Figure 8

2.6 Ball roll

2.6.1 Requirement: 4 – 8 m

2.6.2 Principle

A ball is rolled down a ramp and the distance it rolls determined. The ball is allowed to roll until it comes to rest and the distance travelled is recorded.

2.6.3 Test apparatus

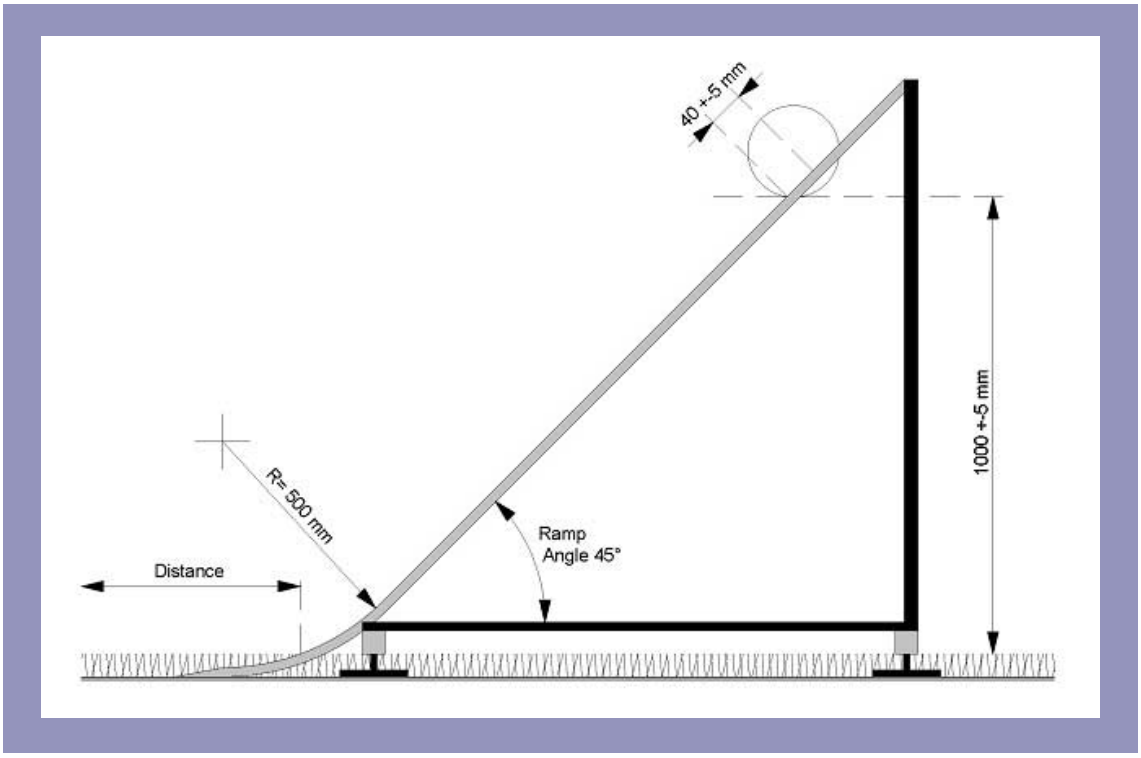
- A 45° inclined ball roll ramp consisting of two smooth parallel rounded bars (diam. 10 mm) whose inside edges are 100 ±10 mm apart. The ball shall transfer from the ramp to the surface without jumping or bouncing. (See Figure 9).
- Water level
- Laboratory tests: a flat, smooth floor
- Field tests: means of measuring wind speed to an accuracy of 0.1m/s.
- Steel tape capable of measuring the distance the ball rolls to an accuracy of ±0.01 m.

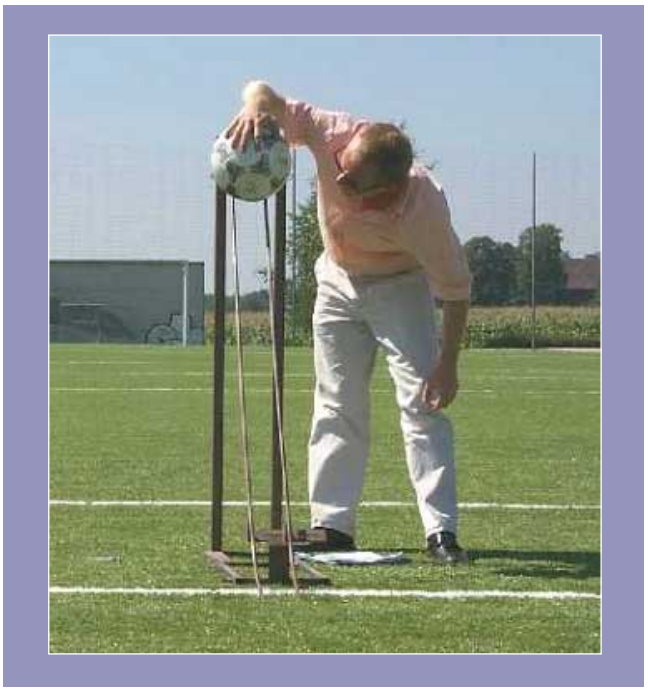
2.6.6 Test procedure

- Adjust the ramp so that it is perpendicular to the pitch.
- The ball is placed on the ramp at a height of 1000 ±5 mm vertically above the test specimen or pitch. For repeatibility the contact point between the ball and the bars should be marked on the bars at a height of 40 ±5 mm above the 1.0 m mark.
- Release the ball and allow it to roll until it comes to rest.
- Measure the distance from the point the ball first comes into contact with the surface to the point below the centre of the ball at which it is resting on the surface.
- Move the apparatus and repeat the procedure to obtain five results.
- If the test results are influenced by factors such as pitch slope or turf pile pattern, carry out the tests in such a way that a set of readings is obtained in directions giving maximum and minimum values.
- If the wind speed during field tests exceeds 1 m/s, the test shall be stopped and repeated.

2.6.7 Expression of results

- For each test position/direction report the mean value of ball roll to an accuracy of 0.1 m.





2.8. Turf Product System Characteristics

Turf fibre (main fibre)

Fibre manufacturer
Brand name
Material identification (code or description)
Colour: green (compulsory)
Total length of stretched fibre, mm
Fibre weight per unit area, dtex
Pile weight per unit area, gr. / m2 Tuft per unit area, m2
Tuft pattern
Tufting construction
Size of pile fibres, micron

Complementary turf fibre (if applicable)

Fibre manufacturer
Brand name
Material identification (code or description)
Colour: green (compulsory)
Total length of stretched fibre, mm
Fibre weight per unit area, dtex
Pile weight per unit area, gr. / m2
Tuft per unit area, m2
Tuft pattern
Tufting construction
Size of pile fibres, micron

Turf backing

Manufacturer
Brand name
Material identification (code or description)
Primary backing
Secondary backing
Type of induction
Total weight of backing and induction, gr / m2

Sewn turf joints (if applicable)

Thread manufacturer
Brand name

Glued turf joints (if applicable)

Tape manufacturer
Brand name
Width of joint backing tape, cm
Glue manufacturer Brand name
Glue, gr / per m

Stabilisation infill (if applicable)

Manufacturer
Brand name
Material identification (code or description)
Particle shape
Weight per unit area, kg / m2
Infill thickness, mm
Particle size w/range, mm

Particulate infill (if applicable)

Manufacturer
Brand name
Material identification (code or description)
Colour Weight per unit area, kg/m2
Infill thickness, mm
Particle size w/range, mm
Particle shape

Shock pad (if applicable)

Manufacturer
Material identification (brand name)
Material identification (code or description)
Force reduction %
Cross tensile strength, MPa
Weight per unit area, kg/m2
Thickness, mm

The manufacturer shall indicate the test method used and the test results.

3. Accredition of test laboratories

The test procedure specifications are based on the expertise of laboratories and other experts. If the test results are to be used for UEFA approval and registration purposes, the test institutes have to be accredited by UEFA. Whilst accredited laboratories can test products and pitches to the UEFA standard, only UEFA can issue UEFA product and pitch certificates.

3.1 Only accredited test institutes are entitled to carry out laboratory and field tests according to this concept.

3.2 They shall have a calibration, tracability and staff training system accredited by an internationally recognised accreditation authority to ISO 17025. If accreditation to ISO 17025 is not possible due to national policies UEFA will assess the application from the laboratory on a case by case basis.

3.2.1 It is also recommended that the test institutes be registered with the International Sport Surfaces Science Organisation (ISSS) as scientific members.

3.2.2 The test laboratory should be devoted to the research and development of sports surface science and shall have achieved a position of influence and responsibility in the field of sports surfaces. Their work may include the testing and evaluation of sports surfaces and related materials, in the laboratory and in the field, with well-documented records.

3.2.3 They shall be independent of any company manufacturing, supplying or installing sports surfaces, or manufacturing or supplying sports equipment.

3.2.4 They must show that they are in possession of the necessary test equipment.

3.2.5 Their work must be recognised as being of consistent high quality maintained by operating a comprehensive policy of calibration of all relevant test equipment.

3.2.6 They must participate regularly in ‘round-robin’ testing, field testing, presentation of papers and publications, and other scientific and technical matters which may be requested by UEFA.

3.2.7 Where appropriate the calibration of test equipment shall be carried out with the ISSS reference norm methods and with UEFA footbal turf samples.

3.2.8 The laboratory shall nominate a senior member of staff to act as its official contact with UEFA. The named person shall be responsible for issuing all UEFA test reports, organising round-robin testing and other duties as required by UEFA. The laboratory may only change the designated member of staff with UEFA’s approval.

3.3 Laboratories applying for UEFA accreditation must provide the following information in full:

a) A list of test equipment (with photos) relevant to the testing of football turf.

b) A diagram of its organisational structure, together with the curriculum vitae of its nominated representative(s) and brief details of the qualifications and experience of other relevant staff in the organisational structure.

c) The personnel and their assistants in charge of testing football turf must be named individually.

d) Independent verification of the results, which shall include a set of test results generated in round-robin testing of samples which demonstrate the accuracy and validity of their test equipment and procedures. The accreditation tests shall be done in the presence of a representative of UEFA and a UEFA accredited laboratory (appointed by UEFA), ensuring peer assessment of the applicant laboratory. The applicant laboratory must meet all expenses (including fees and travel costs etc.) involved in this procedure.

3.4 Approval as an accredited laboratory shall be given in writing by UEFA, and initially shall be valid for a period not exceeding two years (probationary period). At the end of this period, UEFA shall review the performance of the laboratory and, if satisfied that it has fulfilled its obligations as an accredited laboratory, shall confirm its accreditation on a normal basis.

3.5 UEFA reserves the right to cancel the accredited status of any laboratory, at any time, by a written statement to the laboratory. No reasons need be given for the cancellation.

The current list of UEFA accredited test institutes (name, address and accredited contact personnel) is published on **uefa.com.**

WE CARE ABOUT FOOTBALL

Section 3

Part 1: Design and Construction Recommendations

Design and Construction Recommendations

Introduction

The authors believe that, apart from being a source of technical data for specialists in the area of artificial turf for football (hereafter called “football turf”), this manual should also serve as a useful reference for football clubs and owners of football fields. It should provide easy-to-understand instructions and recommendations on this complex subject.

Section 3 contains some of the most important information acquired in this respect and covers the current state of the technology (2001/02 season).

In July 2000 UEFA purchased a football turf (which has been laid on a site opposite its headquarters). The UEFA Administration made the decision (which later proved to be very wise) to call in a specialist in the area of football turf to advise on the choice and supervise the construction of this complex operation. Through this construction, UEFA has been able to gain valuable experience regarding the design and laying of this new type of artificial playing surface.

One decision that has proved extremely wise was to entrust the project compilation and supervision to an expert in artificial turf with many years of experience in planning and tendering procedures, analysis of tenders, award procedures and the supervision of projects that involve artificial turf. The Involvement of an expert has ensured, among other things, that local and other specific conditions have been considered and that the football turf has been laid totally in line with predetermined criteria.

Construction recommendations

Planning

The construction/laying of football turf must be planned with great care. Among other things, errors in the construction/installation stage can seriously shorten the working life of a playing surface – with negative consequences in both financial and sporting terms.

Planning procedures must take account of the fact that football turf is an overall system that consists of the following elements:

“infrastucture - elastic layer - artificial turf - infill”

All the components of the football turf system are of equal importance!

To be approved for the playing of football, an artificial turf playing surface must match the quality of a well-cared-for natural pitch.

The approval criteria are described in Section 1, Part 2, under the heading “Footballistic Requirements”, and in Section 2, Part 1, under the heading “Field Tests”.

Choice of an expert in Football turf

Deciding whether to choose natural turf or opt for an artificial alternative has never been a simple affair, and probably never will be.

If merely reaching an initial decision seems difficult in itself, implementing the project can become a nightmare. Countless questions need to be answered concerning the following elements of the turf system:

- site
- dimensions
- substructure
- bearing layer
- elastic pad
- turf
- infill,
- etc…

Rare is the layman who would dare to try and select – from the wide range of available options – a product or system that is just right for specific local conditions - or to try and tell the difference between genuine EPDM rubber granules and green-coloured granules made from old vehicle tyres and offered as EPDM granules - or to try and check that the specified quantity of infill sand per square metre has actually been laid. We do not of course wish to imply with these examples that the artificial turf industry could in any way be untrustworthy, nor do we wish to cause discouragement. We would just like to point out that to purchase and supervise the laying of artificial turf systems requires a certain level of expertise.

One could argue that the involvement of an expert will increase the overall cost of a project, but that investment is well worthwhile in the long run. It is an investment in quality, functionality, economy and the life of the football turf. Entrusting the planning, selection and construction supervision to a specialist in artificial turf is not only recommended but essential.

It is therefore advisable to involve a football turf expert – either alone or together with a civil engineer familiar with the local conditions - to determine the soil characteristics and its bearing capacity.

The turf expert should be present on site to ensure that all the tasks are carried out correctly and according to specifications:

- Planning (choosing the appropriate infrastructure).
- Tender description (technical and footballistic requirements).
- Tender analysis :
  - infrastructure quality
  - material quality
  - footballistic UEFA requirements
  - turf product composition

- Construction supervision :
  - infrastructure designed to conform to local conditions and UEFA requirements
  - laying of the turf and its quality control in order to assure a long life
- Testing the installed turf according to UEFA requirements
  - only necessary for fields to be used for UEFA competition matches.

Choice of the site

The choice of the site is obviously limited. However, wherever possible, it is advisable to consider the following aspects:

- Leaves from trees, meadows and busy roads will render the pitch dirty, thus requiring more maintenance work.
- Heavy pollution can quickly cause the turf to lose its qualities.
- Animals can damage and soil the turf.

Infrastructure

The sub-base and earthworks vary from continent to continent, country to country and even region to region. Consequently, it would be inappropriate to set up requirements which could not be met everywhere in Europe.

Soil investigation

Excavation

The advantage of a well-planned base that has been designed without regard to cost is that it does not have to be rebuilt each time the turf itself is replaced. This involves an investment that pays for itself over a period of two to three turf live cycles, provided the corresponding precautions have been taken with respect to planning and installation.

- This can result in sagging of the infrastructure and cause big differences in evenness of the playing surface
- When it comes to renovation, the entire infrastructure has to be rebuilt!

Artificial turf installed on unstabilised infrastructure

A cost-restricted (i.e. cheap-quality) base construction – for example, one involving an infrastructure without a layer of asphalt or similar stable structural elements – will in any case reduce the live cycle.

A good, stable and suitable base is extremely important for the overall quality of the pitch and its lifetime.

Sub-base and wearing course

A well-constructed base consists of:

- A drainage system beneath the sub-structure, below the frost zone.
- Drainage pipes with a diameter adapted to local geographical weather conditions.
- Access to the drains for maintenance.

Drainage

Curb stones as edging for artificial turf

- A porous, drained sub-structure, sheltered from frost (exception: non-porous in countries with hot climates).
- A sub-base with sufficient load-bearing capacity to support the playing surface and any machinery used to maintain the surface without any deformation.

Construction of the sub base with crushed stone aggregates

- The installation of an underground heating system is recommended in countries where winters are long and harsh. For this special construction parameter, it is recommended that the advice of heating specialists be sought.

- A water-permeable, stabilised wearing course (such as a single layer water permeable bituminous mortar). In countries with a hot climate, however, this wearing course can be built non-porous.

Laying of the asphalt binder course with electronic control levelling device

- Any stabilised wearing course should be build, wherever possible, using an electronically-controlled levelling device to obtain the required accuracy and achieve eveness to the required tolerance.

Fine levelling of a non-stabilised sub base and a bitumen stabilised finish

- The surface should present evenness such as to allow the ball to roll over the surface without affecting its trajectory or causing the ball to bobble on the surface.
- There are two requirements on evenness:
  - one which covers a large area (e.g. 4 metres)
  - the other, over a smaller area (e.g. 1 metre)

Evenness check of asphalt mortar and level corrections

The infrastructure described corresponds to the standard construction used in Western Europe, i.e. one designed to withstand temperatures of -15°C to +35°C, at 400m above sea level.
These are the approximate climatic conditions at UEFA headquarters in Nyon, Switzerland.

Special construction parameters

The criteria described above apply to normal continental European conditions. Additional structural factors need to be taken into account in other areas of Europe, for example:

Countries with a hot climate

Pitches in southern Europe can or should be laid on a waterproof base or semi-permeable base. This ensures that water is stored in the elastic layer, thus regulating the temperature of the playing surface and making the artificial turf fibres smoother.

A football furf system does not need any water-sprinkling system, unlike sand-filled turf or full synthetic turf for hockey. But in countries with a hot climate, the heat of the sun can make the use of synthetic turf very uncomfortable, especially when filled with black rubber granules. The heat can be reduced by sprinkling water.

If a water sprinkler is used, it is recommended that the wearing course (bituminous asphalt) be constructed impervious. With an impervious infrastructure, the water will remain much longer in the elastic pad, thus reducing the quantity of water needed. Note that this layout requires the installation of a lengthwise surface drainage system.

Countries with a cold climate

In countries with a cold climate, the installation of an underground heating system is recommended to ensure that the pitch remains suitable for play throughout the cold months of the year and to prevent any accident and injuries to the players on frozen turf.

A ground heating system can keep the sub base and the elastic pad supple, unfrozen and permeable; thus rain and snow water can drain into the ground.

Ground heating system installed near the Arctic Circle

The main purpose of a heating system is to ensure a playable field, but not to melt the snow. The snow should always be removed mechanically in order to save energy and costs.

- The heating system has to be planned/calculated individually for each region and stadium to achieve a surface temperature of ±0 to +2°C.

- The ground heating has to be planned so as to melt snow falling shortly before and during a game.

The wearing course, the elastic pad and the football turf all act as insulation. Therefore it is of the highest importance that each one of them be tested beforehand for their insulation factor.

Elastic Layer

Even though footbal turf with no elastic pads performs well at the outset, from a sporting and technical point of view, with respect to shock absorbency, its performance can deteriorate quite quickly as a result – above all in terms – of general wear and tear. This can mean that not long after installation, the footballistic requirements are no longer fulfilled.

Experience with the first and second generations of artificial turf shows that turf without an elastic pad could not retain their initial qualities over a long period of time, while those with an elastic pad performed much better. In the last decade most of the high quality turf of the first two turf generations has been installed with an elastic pad.
Today (year/season 2001/02) many artificial turf systems are designed and installed without any elastic pad. It seems that history is repeating itself again with football turf.

Construction

A prefabricated elastic layer, or one constructed on site (in-situ installation), is installed on top of the base layer and offers the following advantages:

- Provides more protection and a more comfortable surface for the player.
- Delays the wear process of the fibres.
- Extends the performing life of the pitch surface.
- An elastic pad can outlive several artificial turf playing surfaces (as is the case with an asphalt-bearing layer). This applies especially to elastic layers produced in situ.

Elastic layer constructed in situ

Prefabricated elastic pad

Remarks:

When UEFA bought and installed its own football turf in Nyon, a decision was taken to keep the existing elastic layer, which – despite being 14 years old – was still in excellent condition. Tests to determine the ball rebound and shock absorbency characteristics of this new artificial pitch (with its old elastic layer) produced results similar to those carried out on natural turf.

As already observed in connection with the substructure (asphalt-bearing layer), a high-quality (i.e. high-strength) elastic layer can outlive several replacements of the artificial turf itself. In the case of this UEFA pilot project, only five square metres of the elastic pad had to be replaced as a result of damage suffered when the old turf was removed.

Minor level corrections on a 14-year-old elastic layer prior of the laying of a new turf.

The installation of an elastic layer is highly recommended in order to maintain the long-term functions of football turf, but it is the responsibility of the manufacturers to assure the footballistic characteristics of the turf over the years, irrespective of the presence of an elastic pad. The corresponding test certificate always refers to the footbal turf system as a whole.

Artificial Turf

Artificial turf of the second generation, infill with quartz sand only. Replaced with football turf, infill with quartz sand and green EPDM rubber granules

Laying of a football turf on a non-stabilised infrastructure (without elastic pad) with a textile fabric in between.

Quality of football turf

UEFA requires only footballistic characteristics anddoes not ask for any technical turf qualities. Therefore there are no specific recommendations regarding the quality, thickness or height of artificial turf fibres. Each artificial turf manufacturer should deliver a product designed to provide footballistic performance in accordance with UEFA requirements.

UEFA recommends that the following factors be taken into account in the design of a football turf system:

Turf backing

The backings of the football turf can be made of different material. The two most important characteristics of backings are:

- Strong attachment for the fibres
- Dimensional stability

Dimensional stability of the turf backing prevents undulations in the playing surface. This is at present achieved with a quartz sand infill and with the use of extra-dimensionally stable, weather-resistant turf backings.

Different types of turf backings

The joints can be sewed or glued. A minimum joint strength is recommended.

If they are glued, the use of large fabric bands is recommended:

- Width of 30 cm minimum and
- up to 50 cm under the line markings.

Gluing the joints and line markings

Turf joint: strong adhesion

Example of poor execution – no adhesion!

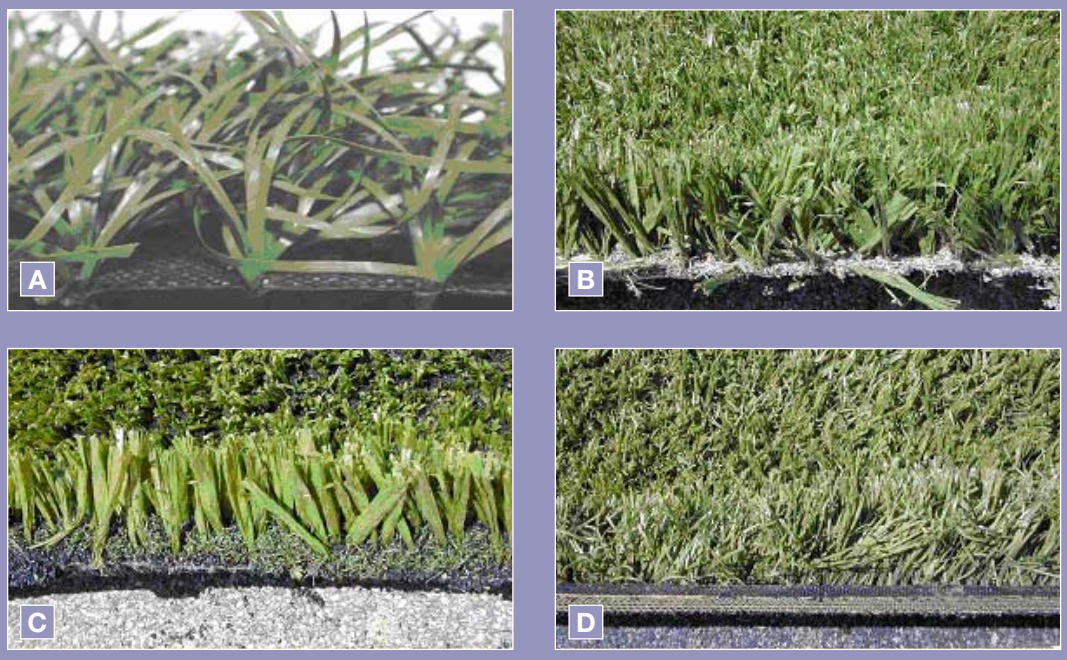
Synthetic fibres

- Fibres are made of polypropylene, polyethylene, nylon and combinations of fibres.
- Fibres are fibrillated or mono-filaments.
- They can be straight or curled (Note: straight type of fibre is now generally used).
- Fibres are much longer (up to 70 mm) than the fibres of synthetic turfs without infill which are 10 mm to 12 mm long and those of sand-filled turf which are between 20 mm and 35 mm long.
- The space between the tufting lines is much larger than for previous turf systems.

Non-filled turf (or first generation) is used mainly for hockey these days. The fibres are generally curled monofil nylon or straight fibrillated polyethylene.

Sand-filled turf (or second generation) is used mainly for multi-purpose fields nowadays. The product consists mainly of curled mono-filament fibres, as experience has shown that they have a longer life-span than fibrillated fibres.

Football turf: Most of the different types of fibres used in turf manufacturing during the last 20 years are now used in various combinations for football. Which of the types mentioned above, in what thickness, length, width etc., will finally succeed as the best product for football cannot be predicted, so for the moment all the manufacturers still offer turf in varyious combinations of fibres (composition, thickness, length, etc.).



Clock-wise: “A”Monofil, “B”fibrillated, “C”fibrillated with small monofil and “D”monofil mixed with fibrilated fibres

Infill (if any)

- A layer of river quartz sand is first spread onto the bottom of the turf.
- Another layer of rubber granules is infilled over the sand filling.
- About 10 to 20 mm of the fibre at the top of the turf is left free of any infill, or
- no infill is used at all.

Quartz sand

Round silica quartz sand, generally round river sand larger than 0.5 mm, spread over the bottom of the turf in a layer not thicker than 15 mm.

Filling the turf with sand and rubber granules

Stabilisation infill with quartz sand

Rubber granules

Filled on top of the quartz sand, generally to a minimum depth of 20 mm. This minimum thickness is to prevent player impact and/or stud contact with the silica sand or turf backing. The rubber granules should moreover be sufficiently deep inside the turf so that it does not move too easily and stick to the ball (electrostatic effect).

Stabilisation infill with quartz sand

Infill with Green EPDM rubber

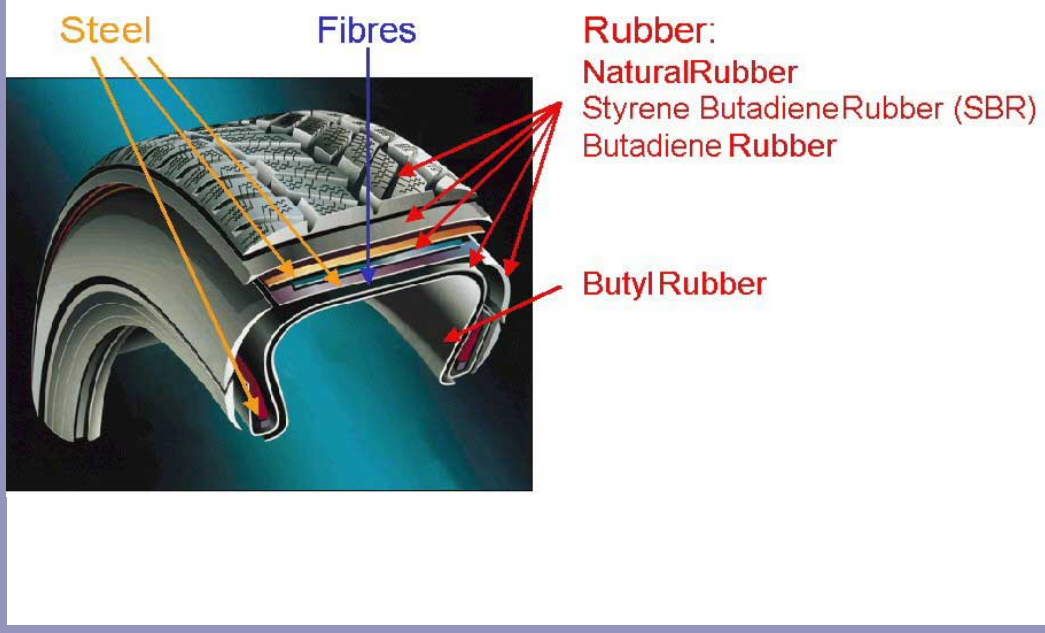
Infill with Black SBR rubber

Several different types of rubber granules designed for infill purpose are currently available on the market. The most frequently used products are those derived from vehicle tyres (one quality from cars, another quality from trucks and tractors), or from other types of waste industrial rubber. Another highly favoured alternative are coloured rubber granules made especially for sport surfaces.

SBR rubber granules

Rubber granules made of shredded black tyres from vehicles and industrial waste rubber.

- The use of these granules does not provide the optimum solution. The quality of these products is very difficult to control and they do not always comply with the national environmental legislation (see chapter Technical and Environmental Compatibility).
- There is no guarantee as to the constant quality of the raw material.
- The granules can become brittle when subjected to UV radiation, which can lead to a gradual hardening (compaction) of the entire playing surface.
- There is only a limited supply of quality controlled waste rubber, although the resulting granules can be acceptable from an environmental point of view.



Feed stock for “SBR” granules rubber infill of end-of-life-tyres

EPDM rubber

Green-coloured EPDM rubber, specially manufactured for sport.

- Good stability under UV radiation.
- Less absorption of heat from sunlight.
- Improved appearance.
- At least three quarters of the infill can be re-used when the artificial turf is replaced. Despite the high initial investment, a large proportion of high quality EPDM rubber granules will survive two turf life cycles (thus cutting overall costs).
- It is more in compliance with the national environmental legislation (see also chapter Environmental Compatibility), but
- More expensive than SBR granules.

Other miscellaneous infills

Coloured latex granules, thermoplastic rubber granules and other infill materials.

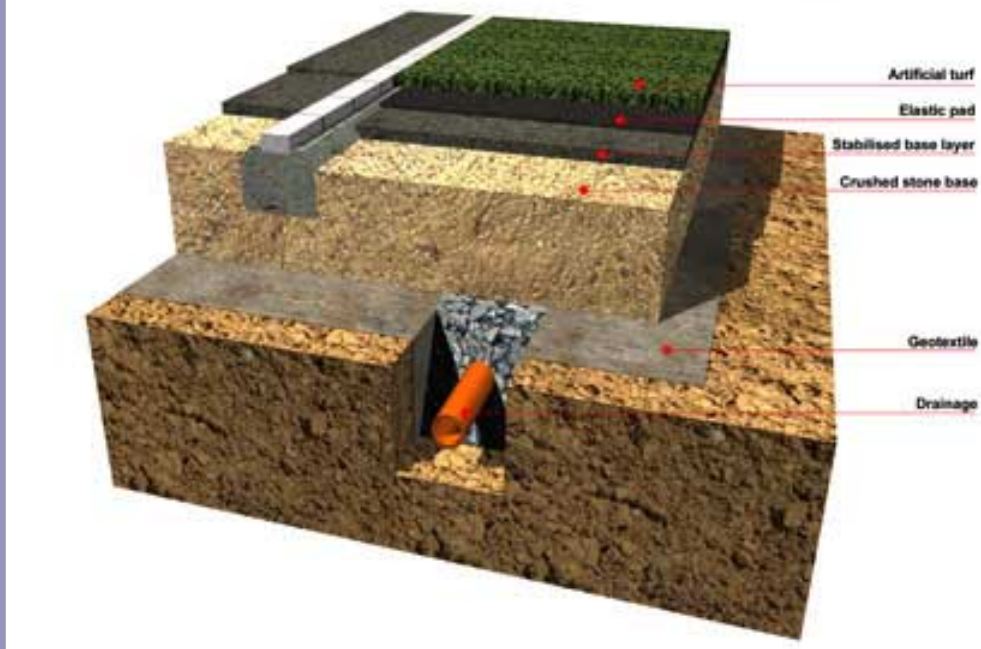
- At the time of printing this manual, discussions concerning other infills are ongoing.
- Industrially, these products are not yet ready or else the industry has not released the appropriate technical information about them.
- The future will show if they can provide a more favourable alternative to the existing systems.

Note: Depending on the type, quality and climate, black rubber fillings may release a rather unpleasant odour and may bother even residents in the immediate vicinity of a football turf.

Construction possibilities

Property	Ideal composition, construction recommendations
Drainage, according to local weather conditions	• Diameter 60 mm to 120 mm. • Laid parallel below the level of frost penetration. • Space between pipes: 4 to 12 metres. • Recommendations for countries with a hot climate: - Impervious and semi impervious infrastructure. - Surface perimeter drains lengthways to the field.
Sub base	• Base: crushed rock aggregates. • Water-permeable and resistant to frost penetration. • Top levelling: fine crushed rock aggregates. • Depending on the bearing capacity and the level of the frost penetration, average thickness: 30 cm to 100 cm.
Ground heating	• Only necessary for the north of Europe and at high altitude.
Bearing layer	• Single layer of water-permeable bituminous mortar (or e.g. bituminous asphalt penetration layer, or an elastic-bearing layer). • Laser graded, using electronically-controlled levelling system. • Sieve gauge: 02 / 11 – 02 / 16 mm (or e.g. 02 / 06 mm). • Thickness: 40 to 50 mm (or e.g. 20 / 25 mm). • Water permeability: Pore proportion min. 15% • Recommendation for countries with a hot climate: - Water - impermeable or semi permeable bituminous mortar.
Load-bearing capacity	• Bearing without any deformation: - asphalt wearing course: min. 60 / 70 N/mm2. - crushed stone base: min. 40 / 45 N / mm2.
Tolerance of bearing layer	• Max. 8 mm under 4 metre straight edge. • Max. 4 mm under 1 metre straight edge. The carpet has to lay flat; no undulations are permitted.
Slope	• To retain acceptable ball roll properties it is recommended that pitches are built without any slope!
Water sprinkler	• Recommended for countries with a hot climate

Design and Construction Recommendations



Football Turf

	Geo-textile	Mineral bound (stabilised) base layer	Mineral bound elastic base layer	Prefabricated elastic pad	Elastic layer constructed in situ
				Mineral-bound (stabilised) base layer	
crushed stone base					
drainage					

Constructions with unbound infrastructures are not recommended	Possible construction depending on the elastic quality of the turf	Infrastructures with stabilised elastic base are the recommended solutions

Many more variations exist.
The above-mentioned solutions may help you to choose the most suitable construction, according to the existing technical and financial possibilities.

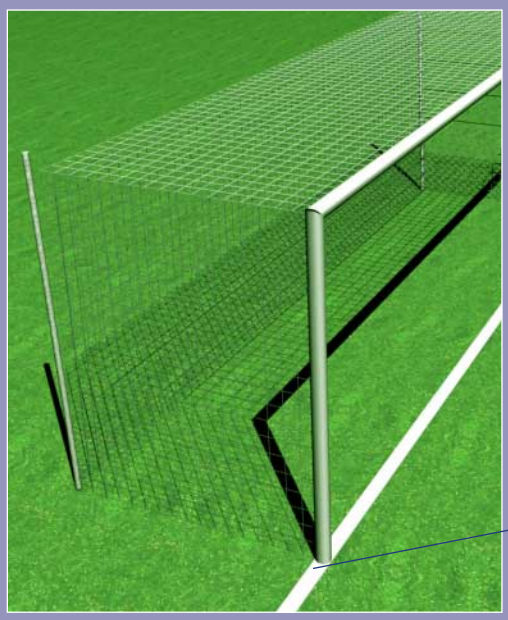
Line markings

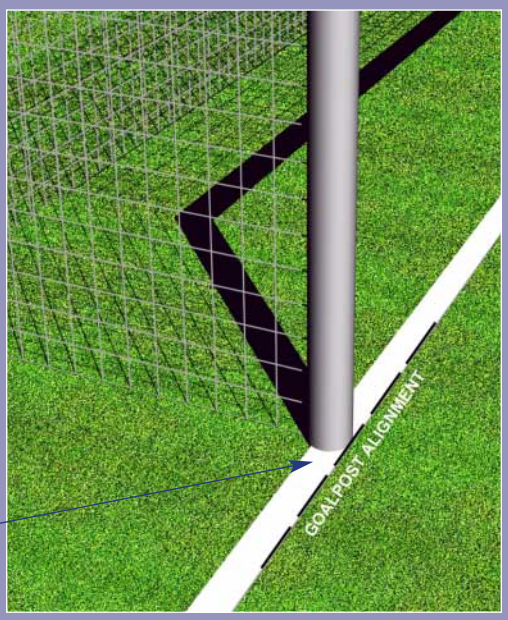
The field of play

Dimension required for UEFA competion matches: 105 metres by 68 metres.

Note: The technical zone is positioned according to the stadium.

Line marking details





WE CARE ABOUT FOOTBALL

Section 3

Part 2: Turf Use, Maintenance and Turf Exhibition

Environmental and Security Compatibility

The manufacturer and purchaser must abide by all relevant local security and environmental legislation during the construction, use, operation and disposal of the football turf and its supporting layers. The purchaser must request the relevant certifications and declarations.

Regulations with regard to the technical, security and environmental compatibility of products currently vary from country to country. The buyer should therefore insist that the manufacturer/supplier of all the products and materials used in the fabrication and laying of the artificial turf provide the corresponding certification.

Security compatibility

Security compatibility concerns in particular the hazard of fire and fumes, especially in closed stadiums.

Environmental friendliness

Environmental compatibility concerns in particular ground water, which could be affected by the breakdown of the chemical components present in the artificial turf system.

The ecological recommendations of football turf systems and their components, i.e. the artificial turf piles, the turf backing, the elastic layer and the infill material, have to be designed and installed in copliance with local legislations. The following recommendations concern risks to soil and ground water.

Measuring parameters (leachate / extract)	Recommendations
DOC	≤ 20 mg/l or ≤ 40 mg/l
EOX	≤ 100 mg/kg
Lead (Pb)	≤ 0.04 mg/l
Cadmium (Cd)	≤ 0.005 mg/l
Chromium (Cr) total	≤ 0.05 mg/l
Chromium VI (Cr VI)	≤ 0.008 mg/l
Mercury (Hg)	≤ 0.001 mg/l
Zinc (Zn)	≤ 3 mg/l or 0.5 mg/l
Tin(Sn)	≤ 0.05 mg/l
Toxicity (as nitrification inhibition)	Inhibition ≤ 50% or no standard

The DOC and toxicity parameters are measured in a neutral aqueous 48-hour leachate, the heavy metals in an acid CO2 leachate after 48 hours, and the EOX in a hexane extract. The raised DOC of 40 mg/l is only allowed if the EOX condition is met.

The requirement that a zinc content of 3 mg/l in acid leachate may not be exceeded applies to the artificial turf pile and the elastifying layers. In the case of the infill materials, the recommendations are increased. The infill must meet either the condition ≤ 3 mg/l in acid leachate or the condition ≤ 0.5 mg/l in neutral leachate. In both cases, the KO criteria of zinc content of 20 mg/l in acid leachate and of 1 mg/l in neutral leachate should not be exceeded.

Artificial turf pile and elastic layers which are manufactured according to the latest technical advances can generally meet the recommendations.

Regarding the infill materials, a distinction has to be made between:

- EPDM granules manufactured freshly for infill purposes,
- recycled rubber granulates, and
- miscellaneous infills.

The critical point is always the mobilised quantity of zinc. All other requirements can generally be met.

EPDM granulates can be manufactured either in sulphur-cured variants or in peroxide-cured variants. Nowadays, using the latest technical advances, it is possible to manufacture sulphur-cured EPDM granulates with relatively low zinc content and low-zinc and zinc-free peroxide-cured EPDM granulates which satisfy the recommendations. On account of the defined formulations, a continuously constant quality has to be maintained.

Due to their different original uses, recycled rubber granulates vary enormously from a substance point of view. There are selected old tyre rubber granulates that can also meet these recommendations. Were one to measure the infill only in terms of the amount of mobilised zinc in acid leachate, the predominant part of the old tyre rubber granulates would not be able to meet the requirement because of the high zinc content of the non-volatile matter. This also applies inter alia to waste from technical rubber. Here, the situation is even more complicated because of the quite different rubber requirements, and no approximately constant quality can be guaranteed. However, since ecologically sound recycling possibilities should be encouraged, selected old tyre rubber granulates have a fair chance through the alternative claim that the zinc content in neutral aqueous leachate may not exceed 0.5 mg/l. However, this requires a strict choice and therefore a relatively close continuous supervision of the quality of these recycled materials.

Components of the football turf systems should be produced, installed and certified in conformity with national laws and rules. This concerns in particular:

Elastic layer
- Elastic material (rubber)
- Bonding agent (polyurethane)

Artificial turf
- Turf fibres
- Backing (fabric and latex)

Infill material
- Quartz sand
- Rubber granules
- Miscellaneous infills

Quality control

Product identification

Football turf can be manufactured in many ways. The manufacturer can choose between many different fibre qualities, manufacture the turf in various heights and densities (and many more subtleties), fill the turf with different products and in varying quantities or have no infills at all, and, finally, install it onto different infrastructures built according to local conditions.

The technical turf characteristics are mentionned in the UEFA test certificate under "turf identification declaration by the manufacturer". The product identification provides the necessary information on the quantity and quality of the offered material.

Turf product properties

Does the manufacturer/supplier observes his own specifications for the quantity and quality of the material used in his turf system?

As UEFA requires only footballistic qualities of the turf, it is the responsibility of the owner to ensure that the quantity and the quality of each component correspond to the certified sample mentioned in the test certificate. The test laboratory mentioned in the test certificate keeps a sample of the tested and registred football turf system and is thus able to test and compare the installed turf with the certified turf system.

If the quality of the turf does not seem satisfactory, or should any visible polymer change occur (fibres and rubber infill), some of the following recommended tests can be carried out:

- Wear and abrasion resistance

  As a general rule, the best way is to visually inspect actual turf installations and to compare the various fields in terms of year of installation and hours of play, if available.

  A more accurate way is to resort to the Lisport test (according to CEN specifications, but with traversing movements). The aim of this test is to characterize the interaction between studded shoes and the turf and to determine the changes in physical and sport properties.

  This test has been developed for sand-filled turf and is now also used for football turf. However, many further laboratory abrasion tests need to be carried out and their results compared with installed fields, in order to be able to predict the possible service life of a turf before it loses its technical and footballistic characteristics.

- Pile fibre quality

  The quality of the fibres depends on the quality and degree of the fibre stabilisation.

  The chemical composition of the fibre can be analysed with the DSC test and UV -light resistance test (example: OISS turf requirements, 03/2001).

- Tear strength

  In tufted fabrics, the fibres (“the blades of grass”) are inserted into a backing fabric and fixed with a latex or other adhesive.

  How strong are the backing and the fibres?

  Will they withstand the forces of competing athletes?

  Are they hard to pull out, or do they break?

- Environment, toxicology and infallibility

  The manufacturer should supply the purchaser with environment, toxicology and infallibility declarations for all products used. It is the responsibility of the installer to obtain approval according to national legislation.

- Flammability and fumes

  The surface should not burn as a result of sources of ignition such as fireworks, etc. Pitches often serve as an emergency escape route. It is essential that expert advice be sought from the competent public authorities before any form of synthetic surface is installed.

- Static charges

  The turf system has to be designed so that the infill will not stick to the ball.

- Surface colour

  The colour of the surface pile must be green and the markings must be white. It is not acceptable to incorporate material that can cause glare to the players from sunlight or artificial lighting.

- Installation of football turf

  In order to avoid any warranty litigation after the installation of the turf, it is advisable to have all the construction phases recorded in a specific report containing all decisions made during the construction process (minutes of meeting, photos, etc.). In this report, emphasis should be put on:

  - Infrastructure
  - Elastic layer
  - Turf backing
  - Turf fibers
  - Infill

- Climatic conditions

  The manufacturer and purchaser must take the prevailing climatic conditions into consideration when establishing the surface specifications.

  Note: To assure good installation - quality, the football turf system should be laid at certain temperatures and levels of air humidity (above 10°C and below 70%).

Life Expectancy/Quality Insurance/Guarantee

The life expectancy of football turf depends on the following factors:

- Quality of manufacturing
- Quality of the fibres
- Quality of the infrastructure
- Quality of the laying of the turf
- Local climatic conditions
- Frequency of use
- Maintenance

The elements that adversely affect the original footballistic characteristics of the turf are, above all: insufficient and/or inadequate maintenance and, of course, the frequency of use of the playing surface.

The following typical signs of wear appear after several years of use:

- Unravelling of the artificial turf fibres
- Hardening of the infill material (compaction of the rubber granules and silica sand)
- Reduction in the height and density of the fibres

and, generally as a result of incorrect installation:

- Deformation of the infrastructure
- Disintegration of the elastic layer
- Tearing at the line markings and seam joints
- Stagnation of water on the turf

Deformation of the infrastructure

Torn seam joint

At the time this manual went to press, no conclusive data had yet been published regarding the first appearance of signs of wear or the service - life expectancy of football turf. With this new football turf system, it is of course mainly the fibres that are subjected to the greatest use – and which therefore suffer the most wear. In this respect, it is in fact possible to rely on the data obtained from 100% sand-filled artificial turf surfaces that have been subjected to much heavier wear.

Test sample after passing the wear test

Wear test with the Lisport

The previous generations of artificial turf used the same or similar fibres as the current turf manufactured especially for football. With the sand-filled turf systems, monofil fibres have proved more resistant than fibrillated fibres. To date, fibrillated fibre has been used more often than monofil fibre, as the abrasion factor with rubber-filled turf is lower. Research by the manufacturers has not yet provided a clear answer as to which type of fibre is most suitable for a long service life, or even if a mixture of both fibres gives the best result. Time will tell which system is more resistant.

Note: Some turf products can present an especially good wear resistance even when their footballistic characteristics no longer fullfill the UEFA criteria.

Quality control by the turf manufacturer and the company entrusted with the installation

How to make sure that the quality of the ordered material corresponds to that of the installed turf:

- Test the playing surface according to UEFA's footballistic requirements.
- Quality control by taking three samples on the construction site, to be kept by the owner, the installer/manufacturer and the testing laboratory.

Implementation:

- The manufacturer and his installer are jointly liable.
- The manufacturer and his installer compile all the manufacturing and construction parameters / quantities of material used for each phase of application.
- This information is kept along with the samples for at least five years (or the warranty period) and remains accessible to turf experts or turf testing laboratories at any time.

Advantages for the turf manufacturer / installer:

- Permanent control of the quality of the products manufactured.
- Internal control on site through the taking of samples.
- Greater responsibility on the installer's personnel.

Advantage for the football turf owner
Product ordered = product manufactured and installed

Multi-Purpose use of football turf for other sports and non-sporting events

This new generation of artificial turf has been specifically developed for the use of football. It can, however, also be used for other sports or even for non-sporting events.

Use for other sports

- Rugby: possible
- Field hockey: impracticable
- Running training: possible
  (reaction of users = similar to that of a woodchip - surface track)
- Track and field athletics
  In stadiums with athletics facilities, the turf surface is normally used for throwing events. This can however damage its surface. In order to determine the consequences of such use, UEFA has carried out a number of trials on an artificial - turf surface with a stabilised base layer and an elastic layer capable of absorbing at least 50% of the force acting upon it.

  The results of these tests are briefly described below:
  - Shot-put: This throwing event does no serious damage to the turf.
    The accuracy of the length measurement is 2 cm.

  - Discus: This throwing event does no serious damage to the turf surface.
    The accuracy of the length measurement is 2 cm.
  - Hammer: The impact of the hammer can result in damage to or deformation of the base layer.
    This event should therefore not be held on football turf.

- Javelin: The tip of the javelin penetrates the artificial - turf surface and elastic layer, and remains stuck in the turf. This leaves a hole in the artificial - turf surface of 1-2 cm in diameter. This event should likewise not be held on football turf.

The various athletic throwing events present an important challenge to the artificial - turf industry. If it is nevertheless planned to hold throwing events on football turf, the use of protective mats – similar to those already used in indoor sports facilities – is recommended.

Multiple non-sporting uses

Football turf can be used for non-sporting events. However, it should be adequately protected with covers in order to avoid the time and expenses associated with dirt removal.

It might be advisable to consult the manufacturer before heavy duty equipement is put on the turf, in order to avoid load - related damages.

Maintenance

There is a general but erroneous belief that once an football turf has been installed, the groundsman can sit back.

It is true that the construction of football turf results in numerous cost savings, as it is no longer necessary to spread fertiliser or pesticides, the turf no longer requires regular watering or mowing, and there is not even the need to paint markings.

Another cost - saving factor is the possibility using tfootball turf intensively during bad weather conditions.

Daily, weekly and annual maintenance work on football turf

However, as with virtually everything else, artificial turf still requires care and maintenance and must not under any circumstances be allowed to fall into disrepair. A lack, or indeed a total absence, of proper maintenance will inevitably shorten the service life of the turf and cause its playing surface to deteriorate.

Future owners of artificial - turf playing surfaces should heed the following advice:

As with its natural counterpart, the areas of artificial turf that are most likely to show the first signs of wear are those located where the majority of the action takes place – around the goal mouth and the penalty area.

For this reason, these areas are liable to lose their original quality extremely fast and will fail to meet UEFA criteria after a certain time. As worn patches cannot be replaced with “fresh” turf as easily as on a natural pitch, ground staff are advised to take special care of these parts of the playing surface.

The partial replacement of used turf is in any case possible, especially with a stabilised infrastructure (Note: the problem with an unstabilised infrastructure is how to maintain the surface perfectly level after the replacement of an area of turf).

Maintenance Schedule

- The manufacturer/supplier should be asked to provide a “major clean-up, at the pitch owner’s expense once or twice a year over an eight to ten year period, contractually agreed upon at the time the turf is ordered, or at least during the guarantee period.

- Major clean-up: When the pitch is dry the infill material is extracted from the turf system using a suitable sweeping and suction machine. The main requirement for this important cleaning work is that the surface of the turf should be “open”, so that the brushes in the machine can draw up the infill material.

- After the infill material has been picked up, the machine separates out all the fine particles (fibres, rubber, shoe wear and sand) and the remaining infill materials are then brushed back into the turf system.

Daily and weekly maintenance recommendations

- The infill material must be kept (depending on the football turf system) to approx. 10mm to 20mm under the fibre tips and brushed regularly to keep it even.

- The goal mouth, penalty spot and corner areas must be checked to ensure that the rubber infill is even and to the correct level. The infill material in these areas suffers the most displacement in every game or training session. Only if they are permanently and correctly infilled do they offer optimum protection and therefore a long service life for the football pitch.

- Displaced infill material must therefore be replaced continuously, which means that the ground staff must have an adequate supply of infill material at all times.

- Only by regular dragging, drag-matting, brushing, aspiration etc. can the level of infill material be kept at the prescribed level and the football turf system in perfect condition. Note: The infill material also protects the fibres!

    - Please note that after every 25-30 hours of use, the pitch must be dragged or drag-matted, brushed and aspirated. If the pitch is used more frequently, the maintenance schedule has to be increased to maintain its performance characteristics in the long term.

    - The regular drag-matting of the so-called edge zones (for example the outside areas) is also important to ensure that natural grass, moss and weeds do not start to grow there. Plants will only start to grow if you fail to maintain certain areas. Any existing vegetation growth must be removed mechanically (tear the plants out, cut them or spray them with high water pressure).

- In extreme circumstances, weed killer (in the appropriate dilution) may be used for specific areas. To prevent the large - scale migration of vegetation into the edge areas, it is advisable to cut back the vegetation outside the edge zones periodically.

- Remove surface dirt on a regular basis. Remove leaves, twigs, etc. immediately (use a leaf blower if necessary).

- After the initial phase (three to four months after installation depending on the number of play hours), the infill will settle/compact. Check the infill level of the system and redress with new infill where necessary.

- Wear losses (fine particles) must be removed by thorough cleaning.

- Dirt such as sand, topsoil and grass cuttings from neighbouring natural grass pitches should be removed immediately using sweeping machines where necessary.

- Snow removal: In principle when clearing snow, a layer of approx. 2-3 cm of snow should be left, so as to protect the artificial turf from mechanical damage. Partially iced pitch surfaces can be thawed using conventional “winter salt” (please consult your local department of the environment).

- Sharp objects (stones, shards of glass, etc.) must be removed immediately.

- Chewing gum waste can be removed easily after it has been iced with refrigerant spray.

- Oil and fuel must be soaked up as quickly as possible using sand or sawdust and then removed in full.

- Other contaminants can be scraped off the surface by shovel. Residual animal faeces can be treated with vinegar and water.

Instructions for preventing damage

- Follow the aftercare and maintenance instructions of the turf supplier.
- When operating maintenance equipment on the surface, excessive braking, turning, etc. that could damage the synthetic turf fibres should be avoided.
- Do not drive on the pitch without the prior consent of the manufacturer.
- Do not apply any high static loads to the system.
- Proceed with care when clearing snow.
- Do not use any chemicals that may damage the surface.
- Do not light fires on the turf system.

Recommended maintenance equipment

- Drag brushes and drag mats and nets.
- Hand-held equipment such as a hard road-sweeping brush for brushing the infill material into the turf system.
- High-pressure cleaner (wet cleaning with a pressure of approx. 200 bar).
- Manually-operated sweeping machines with an hourly capacity of around 1,000 m? or a sweeping and suction machine, self-propelled, with an hourly capacity of up to 3,000 m?.

Brushing, aspiration, cleaning and levelling in one go.

Choice and construction of the Football turf at UEFA Headquarters in Nyon, Switzerland

Summer 2000

Removal of the existing sand-filled turf.

Maintaining the 14-year-old shock-absorption (58%) pad built in situ on top of a bituminous mortar.

Only a few square metres of the stock pad had to be replaced!

Turf Use, Maintenance and Turf Exhibition

Tender document specifications

Artificial turf of the third generation (now called football turf) with no special requirements, except that the product should have the optimum footballistic characteristics.

Testing on site

All the companies had the possibility to test their product on site on the existing shock-absorption pad.

Synthetic turf ordered and installed

Specific turf manufactured according to the best footballistic test results obtained and adjusted to the existing elastic layer (rebound, absorption, etc.).

Turf exhibition

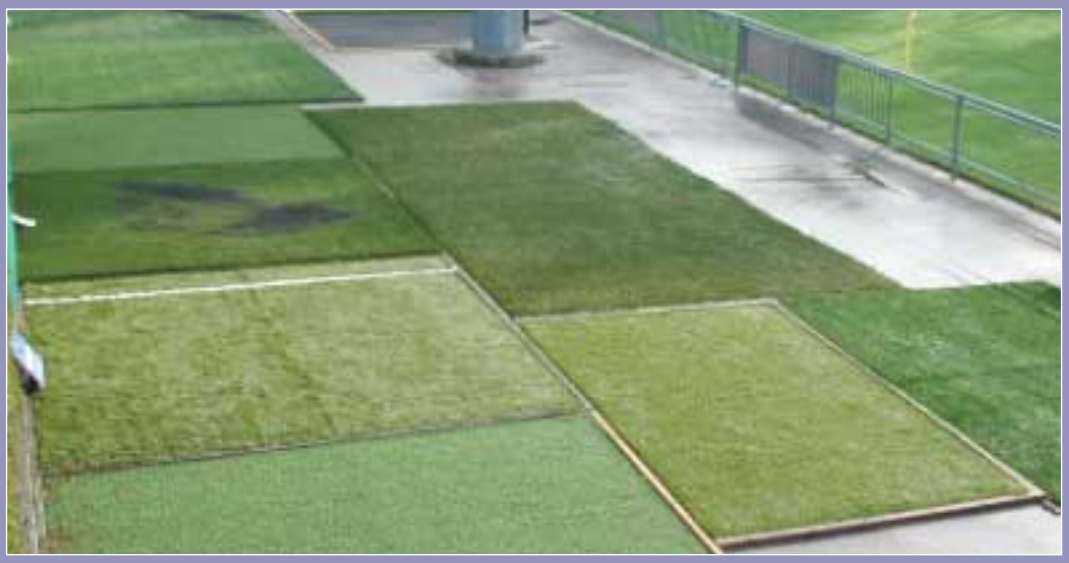
All manufacturers where asked to present their products on site.

Exhibition of turf samples in 2000

Meeting the manufacturers

All the products are still on site opposite the UEFA headquarters as a permanent turf exhibit.

Permanent Turf Exhibition



Football turf samples exposed in 2001

Football turf samples exposed in 2002

The manufacturers can use this permanent turf exhibit it as a showcase and permanently renew their exhibited products.