



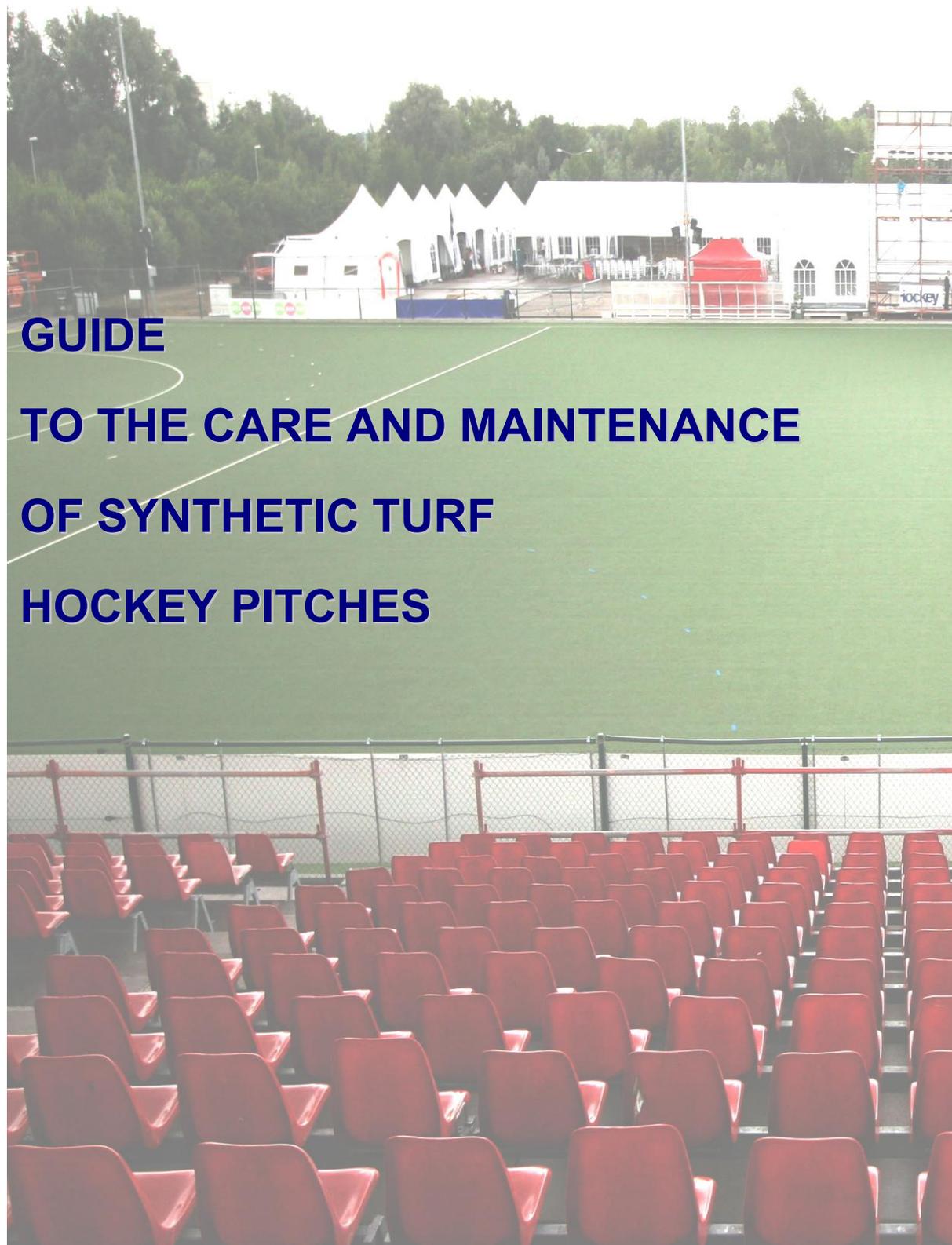
FairPlay Friendship Forever

GUIDE

TO THE CARE AND MAINTENANCE

OF SYNTHETIC TURF

HOCKEY PITCHES



Care and Maintenance of Synthetic Turf Hockey Pitches

Aim of this Guide

The FIH produces various publications and advisory materials for the development and support of hockey. In relation to synthetic turf hockey pitches, this includes:

- the FIH
- the FIH *Performance Requirements and Test Procedures for Synthetic Hockey Pitches – Outdoor*,
- a list of FIH Licensed Manufacturers/Suppliers of Synthetic Turf and their Products.

These documents and others are available on the FIH website, www.fih.ch, or from the FIH office in Lausanne.

Proper maintenance of synthetic pitches makes a significant contribution to player enjoyment and to the longevity of the facility. The Equipment Committee of the FIH has therefore produced this guide.

The detailed maintenance regimen for a particular synthetic turf pitch will depend on the precise turf installed. Reference should always therefore be made to the manufacturer or supplier of the turf. Their instructions should be followed closely not least because warranties will otherwise often be invalidated.

The aim of this guide is therefore to provide general guidance for the owners and users of synthetic turf hockey pitches.

Synthetic turf continues to develop quickly. This guide will therefore be updated whenever necessary.

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- **John McBryde**, who produced the first version in 2001;
- **Wolfgang Hillmann**, who updated the material for the current version.

Disclaimer: the information in this guide is provided in good faith and no responsibility or liability can be accepted by the FIH for any damage or loss as a result of any party relying on the information given.

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1 Preface

1.1 Introduction

- 1.1.1 Pitch maintenance is a very important factor in the short-term use and long-term viability of a synthetic playing field. In the short-term, enhanced playability of the pitch, minimisation of injury potential and added enjoyment are the major considerations. Over the longer term, a good maintenance regimen greatly increases the longevity of the pitch which is a major economic consideration.
- 1.1.2 This guide is intended as guidance for organisations including National Hockey Associations, clubs, local authorities, schools and other bodies undertaking the installation or responsible for the maintenance of a synthetic pitch. As well as expertise garnered from members of the FIH Equipment Committee and other knowledgeable members of the international hockey community, several manufacturers provided maintenance schedules, advisory notes and other very helpful technical information. However, this guide is not intended to be prescriptive, definitive or authoritative; it is intended merely as a reference guide for proprietors and users of synthetic turf pitches with the aim of achieving optimum playing and safety conditions and maintaining the value of the facility.
- 1.1.3 The guide is sub-divided into a number of self-contained sub-sections for easy reference. As a result, there is an element of duplication when the document is read in full.
- 1.1.4 It is generally recognised that a major advantage of synthetic turf over natural grass is the greatly reduced maintenance required. However, **a reduction in maintenance does not mean no maintenance**. It is extremely important to realise that sufficient maintenance must be performed to ensure the pitch is kept in top condition. This applies both to filled and unfilled pitches which are both covered by this guide.

1.2 Objectives

- 1.2.1 It is generally recognised that a well-maintained pitch enjoys the following advantages:
- optimising playing conditions;
 - minimising potential for injury;
 - maximising longevity of the pitch.
- 1.2.2 Thus, the objective of this guide is to:
- identify major preventive measures in design and implementation;
 - stress the importance of following specified maintenance routines;

- outline maintenance protocols and procedures;
- emphasise the need for regular monitoring and inspection;
- highlight advantages of early detection and prompt intervention;
- recognise the need to refer to experts (especially manufacturers and suppliers);
- realise that proper installation of the pitch, management of watering arrangements where appropriate and having knowledgeable local contacts are imperative.

1.3 Scope

- 1.3.1 This guide endeavours to address care and maintenance requirements of unfilled, sand-dressed, sand-filled and combined sand-rubber filled synthetic turf pitches.
- 1.3.2 This guide contains little information on long-fibred surfaces infilled with rubber granules because feedback on the hockey-playability of these surfaces is limited at this stage of their development.

2 General Principles

2.1 Optimum Playing Conditions

- 2.1.1 The prime objective of a properly maintained synthetic turf pitch is to provide the best possible conditions of playability and safety for the participants.

2.2 Economic Considerations

- 2.2.1 The capital cost of installing a synthetic turf pitch, and the cost of replacing or up-grading it later, are so high that maximising the interval between these two events (thereby increasing the longevity of an installation) is of the utmost importance. There are examples in several countries around the world where strict supervision of pitch use and conscientious following of proper maintenance practices has resulted in a pitch life of at least 12 years, for both filled and unfilled surfaces. On the other hand, there are also numerous examples where failure to follow recommended practices has led to failure in less than 5 years.

2.3 Design and Pre-Construction

2.3.1 Many facets of good maintenance practice can be incorporated into the design and pre-construction phase of the installation. This subject is dealt with in more detail in the FIH *Guide to Installing Hockey Pitches and Associated Facilities*. However, the following information is provided as a summary of the main points to consider in the design and construction of a hockey field:

- installation of a bounded sub-base – for example, to make it possible to drive special maintenance machines on the surface;
- installation of a stone coated area behind the overruns and in front of the surrounding fence – to make it easier to remove heaps of leaves in the autumn season;
- installation of concrete/tarmac paths – to separate natural grass areas from the synthetic turf surface areas;
- installation of security fences/gates – for example, in some regions it is necessary to protect the synthetic surface against smaller animals (eg rabbits) or from birds perching on goal frames;
- availability of synthetic turf practice/warm-up areas – to reduce some of the wear on the turf;
- provision of markings and extra goals for cross-pitch practice – to reduce wear on the main pitch markings especially because modern lines/markings are usually woven in, glued or sewed from the upper side, even for the circle arcs;
- installation of boot cleaners;
- provision and regular emptying of rubbish bins;
- routing of player traffic to minimise tracking of impurities;
- set up of food and beverage facilities well off-pitch.

2.4 Installation Supervision

2.4.1 It is vital that expertise is available during the installation to ensure that specifications are adhered to, that inspection is thorough, and that any corrections have been satisfactorily completed. This is especially pertinent if there is little or no prior experience of synthetic turf pitches and no local synthetic turf manufacturers.

2.5 Maintenance Plans, Positive Actions and Prohibitions

2.5.1 In order to be certain that maintenance regimens are clearly outlined, trained personnel is on hand and essential machinery is available, it is recommended manufacturers are required to ensure that:

- maintenance regimens and procedures are very clearly described;

- several local personnel receive full knowledge of requirements and sufficient training to ensure back-up;
- maintenance machinery is purchased/leased as necessary for carrying out the maintenance programme;
- monitoring takes place to ascertain that maintenance/inspection regimens are fulfilled;
- prominent signs are erected designating required positive actions and prohibitions for everyone.

2.5.2 Positive actions:

- clean boots before entering pitch area.

2.5.3 Prohibitions:

- no smoking;
- no chewing gum (but note that this can sometimes be removed with the use of dry ice - CO₂);
- no food or drinks (except water);
- no glass containers or bottles;
- no sharp tags on boots or stiletto heeled shoes.

2.5.4 Vehicles:

- observe all recommended static and rolling load limits.

2.6 Importance of Proper Watering of Unfilled Pitches

2.6.1 The FIH is working on specifications for synthetic turf which will require little and ideally no watering to achieve optimal playing conditions. However, in the immediate term it is recognised that large numbers of watered, unfilled, pitches exist so this section of the guide refers to their maintenance. Readers may also find it helpful to refer to a section of the *Guide to Installing Hockey Pitches and Associated Facilities* which deals extensively with pitch irrigation issues.

2.6.2 A very important aspect of maintenance is ensuring that the pitch is properly watered during all times of activity (matches and practices). As well as short-term considerations such as playability, injury avoidance and enjoyment, improper watering has negative long-term implications for pitch maintenance and life time. However, on environmental and cost grounds, unnecessary over-watering should also be avoided.

2.6.3 If not properly watered, a synthetic turf pitch loses its cleansing properties which results in deposits of impurities thus creating abrasion of the carpet. Furthermore, played on when dry, much greater forces are applied to the surface by player actions and they have a very

detrimental effect on the turf (fibres, joints, interface with sub-base/e-layer) causing wear and more rapid deterioration (rippling, tearing, uneven stretching). This greatly decreases the longevity of the pitch - a major economic consideration.

- 2.6.4 In the past, synthetic turf required extensive watering to improve the sliding properties of the surface. However, the permeability of more modern turf products is much less which reduces the maintenance costs considerably. It is also more environmentally acceptable.
- 2.6.5 Because of increased water throwing range and consistency using higher water pressures, it is possible to install modern watering systems outside the playing surface and the overruns. The possibility of damage to sprinklers by maintenance equipment is then reduced.
- 2.6.6 The optimum solution for ensuring that a pitch is properly watered at all times is the provision of a computer program controlled watering system. This is the most reliable practical solution.
- 2.6.7 If a pitch uses an individual well for its water source, the water must be free of ferric oxide. Also be aware of the possible need for pre-treatment of water if it has high concentrations of calcium carbonate (ie is "hard" water).
- 2.6.8 In some parts of the world, the carpet of an unfilled watered pitch may become frozen. In this case, because of injury risks and potential damage to the fibres of the turf, use of the pitch should be strictly prohibited.
- 2.6.9 Thoughtful choice of turf type together with carefully planned, installed and operated watering systems can greatly reduce the costs of watering and the maintenance of watering systems. With respect to watering, it is especially true that: "a cent well spent is a dollar well saved".

2.7 Access and Security Considerations

- 2.7.1 If the pitch is on public or unsupervised private land, a security fence and a gate to control entry and exit should be provided. A single access with distribution of keys to a limited number of responsible persons is advisable. The optimum situation in relation to access and security of a synthetic turf pitch is the appointment of a Facility Manager.

2.8 Prohibition Notices

2.8.1 To facilitate care and maintenance of the pitch, it is necessary to identify positive actions which are required and activities which are prohibited as noted earlier in this guide. A notice of such actions and prohibitions should be clearly and prominently posted when the facility is first installed. It is important that adequate supervision is maintained to ensure these actions and prohibitions are adhered to by all players and users and that failure to observe them results in appropriate sanctions.

2.9 Influences of Impurities to the Sports Surface

2.9.1 Typical examples of impurities are:

- organic mud substances: leaves, fir needles, algae, moss, pollen, particles of wind-born sand, soil, natural grass-tuft from movements etc;
- synthetic mud: cigarettes, paper and plastic, boundary tapes, substances from air pollution etc.

2.9.2 Organic mud stresses the synthetic turf with potentially significant lasting effects. These natural substances have the ability to decompose into humus or other compounds. Through sports activities, rain or watering, these substances penetrate into the deeper layers of the surface. In the course of time, the water permeability decreases, so that algae develop. Influenced by varying humidity, the mud will become compacted sooner or later. Often the mud components and the fibre of the turf will be compacted together.

2.9.3 Synthetic mud can stress or change the structure of the synthetic turf. In particular, this type of impurity makes the turf look unsightly. With rain or watering and over time, synthetic dirt and dust penetrates into the deeper layers of the surface and thereby reduces the water permeability.

2.9.4 Initially, these and other impurities are laying on the turf surface. Every motion on the turf will enable substances to penetrate from the surface into deeper layers. They can still be removed from there but only at higher cost.

2.9.5 The efficient and simple solution is: remove all impurities as soon as they are present and therefore while they are still on the turf surface. That will not take long, is cost-effective and is easy.

2.10 Consultation with Manufacturers

2.10.1 It is important to consult with manufacturers regarding maintenance and to conform with manufacturers' specified maintenance procedures. Warrantee conditions will typically demand fulfilment of a maintenance regimen. Some manufacturers will offer a separate

service contract in which they undertake to perform for a fee a pro-active role in the regular maintenance of a pitch (eg 3 visits in the first year and then 2 per year).

2.11 Planning Maintenance Actions

- 2.11.1 It is imperative that periodic monitoring and inspection is incorporated into the routine from the outset. Appointment of a Facility Manager to carry out these duties helps to ensure that vital tasks are undertaken.
- 2.11.2 In addition to normal adjustments and repair functions, a service contractor would be expected to undertake all tasks where special equipment is needed (eg high-pressure hosing, brushing and vacuuming and line re-marking).
- 2.11.3 Manufacturers should undertake to provide a periodic inspection service, particularly during the warrantee period, to detect early any need for adjustment or repair. Details of inspections should be defined in the warranty contract.
- 2.11.1 **With regard to pitch maintenance, the adage "a stitch in time saves nine" is certainly relevant.**

3 Maintenance

3.1 Monitoring and Inspection

- 3.1.1 Pitch proprietors should maintain complete and accurate details of the maintenance regimen, including a record of monitoring inspections.
- 3.1.2 On a daily basis, make a visual examination of the surface, especially in the seam areas and along line markings:
- if lines or seams come loose, they must be repaired as soon as possible;
 - a loose seam running a few centimetres can quickly become several metres unless quick action is taken;
 - report more serious damage or repair problems immediately to manufacturers/suppliers.
- 3.1.3 On a weekly basis, keep a close watch for algae invasion on unfilled pitches, especially in warmer climates:
- take early action on algae, moss, weeds, etc;
 - for a prophylaxis: it is useful to install a dosage device in watering systems, continually adding the appropriate amount of "DIMANIN" (Special or A) to the sprinkler system with a recommended dosage in the range of 10 ppm minimum, to 30 ppm maximum (see the appendix for more information about the treatment of algae).

3.2 Debris Removal

- 3.2.1 A leaf blower should be used regularly. A blower with adjustable settings usually gives the best result; blow the debris to one side of the pitch with the wind, where it can be collected with a lawn rake and removed. If there is regularly daily use of the pitch, the following routine actions should be undertaken daily using a leaf blower and/or manual work:
- frequent collection of foreign material from the pitch area (litter, canteen waste, tape, gum, etc);
 - sweep up grass, leaves, twigs and cones;
 - clean up organic materials such as food, faeces, compost, mud, etc.
- 3.2.2 On a filled surface, most of the coarse mud must be removed by hand.

3.3 Brushing and Suction

3.3.1 On an unfilled turf, a brush-suction machine should be used daily or once/twice a week depending on climatic conditions and extent of use:

- remove the fine dust from the turf surface as well as from deeper layers of the carpet; by overlapping the machine paths, every part of the surface can be cleaned and all fibres reset upright.

3.3.2 On a filled turf:

- a special type of machine is required to remove coarse mud from the turf surface as well as from deeper layers of the carpet. It uses a rotating brush to loosen impurities such as stones, leaves or fir needles which will then be taken up together with part of the filling material. An oscillating screen incorporated in the machine separates the mud from the filling material so that only the filling material drops back to the sports surface.
- a filled turf has to be brushed very regularly and the filling material consolidated. In the past, stripping mats and various tow-type smoothing brushes were used for this purpose and are sometimes still used today. However, with tow-type brushing the fine dust on the surface is disturbed in the first instance but remains in the turf and subsequently infiltrates into lower layers of the surface. Removal of coarse mud by means of a smoothing brush is not generally possible. Small amounts of coarse mud will be caught up in the bristles of the brush but will be deposited again as the brush moves on. The exclusive use of a smoothing brush should take place only if the turf surface is more or less free of coarse mud.

3.3.3 As noted above, filled surfaces must be cleaned using a special type of machine because of the dryness of the filling material. In certain (eg temperate) climates, this is a disadvantage of a filled versus unfilled surface.

3.4 Machinery Requirements

3.4.1 Machinery specifically designed for maintaining unfilled turf is available to carry out the required in-depth suction cleaning of the pitch. It is a brush-suction or sweeper-vacuum machine fitted with two contra-rotating brushes arranged at the front part together with a high-power suction device. It is also fitted with an appliance which raises down-trodden fibres. Wide-sized lawn tires reduce the surface loading considerably and allows the machine to cross gutter covers.

3.4.2 Special machinery for filled synthetic turf areas must place a very low load on the surface. Also, attachments must be arranged at the front of the machine to enable the cleaning of corners. Of particularly importance is a powerful suction turbine with adjustable suction performance, followed by a wide and large capacity filter to ensure removal of dust. A hydraulically controlled device for lifting the filter box and the cleaning attachments must also

be incorporated. As different systems of brushes will be needed, the attachments should be designed in the form of a quick-change system.

- 3.4.3 Before using a machine on the pitch, the surface should always be carefully inspected. Attention must be paid to weakened adhesive seams and line intersections. If any faults are detected, these must be repaired before cleaning begins.
- 3.4.4 If, over the course of time, impurities appear which can no longer be removed with the brush-suction machine, periodic flushing with a high pressure water jet can help to keep a pitch in good clean condition.
- 3.4.5 Machinery should only be operated by persons who have been trained in its correct and safe use.
- 3.4.6 Further information is provided in an appendix where a list of major suppliers of equipment can be found. Please note that this list is provided for guidance only. New companies enter the industry regularly and in addition there may be experienced local suppliers.

3.5 Treatment of Algae

- 3.5.1 Algae growth is a natural occurrence caused by humidity. Algae invasions in unfilled pitches occur more frequently in warmer climates especially in pitches that are not cleaned regularly and thoroughly. Usually the first sign is that, in patches, the green carpet turns brown and becomes very slippery.
- 3.5.2 As a preventive measure, use of an approved algae killer is recommended. However, note that too much algae killer will affect the coating of the turf.
- 3.5.3 For a prophylaxis, it is useful to install a dosage system, continually adding the appropriate amount of algae killer to the sprinkler system. Alternatively, the recommended dosage can be dispensed from a motorized high pressure sprayer (see details in the appendices).
- 3.5.4 The most effective treatment, so far, is use of "Dimanin Special" or "Dimanin A" or "m+enno ter forte".
- 3.5.5 More information about the treatment of algae is provided in Appendix A to this document.
- 3.5.6 If the pitch is under warranty or is subject to a service contract, treatment of algae is best left to the contractor. The most important action by the pitch proprietor is early detection and reporting.

3.6 Treatment of Moss/Weed

- 3.6.1 Filled pitches are not so affected by algae attacks but are subject to the growth of moss (particularly in shaded areas) and growth of weeds arising from seeds blown onto the surface. Early detection is important. In the case of moss, high pressure water cleaning wherever and whenever it appears is the best measure. With weeds, removal by hand is usually adequate, taking care not to damage the turf or its sub-base. However, if the problem is not solved, weedicide may be required under instruction from the pitch manufacturer or contractor.

3.6 Repairs to Seams/ Tears

- 3.7.1 If lines, seams, etc. come loose, they must be repaired as soon as possible. A loose seam of just a few centimetres can quickly become a tear of several metres unless quick action is taken
- 3.7.2 The need for carpet repairs can occur in any type of synthetic pitch but tends to occur most frequently at the seams of an unfilled pitch, particularly on a loose-laid surface. If the carpet is fixed to the sub-base, the seams will usually be held by a seam tape or butt-jointed with a glue bead or, alternatively, lap-jointed using glue. After exposure to weather and regular wetting, these seams may be subject to separation or peeling failures. These can be repaired, usually by re-gluing, if problems are detected early and reported to the manufacturer or contractor.
- 3.7.3 The stitching in the seams of loose-laid unfilled pitches will become exposed to sunlight and abrasion at a relatively early stage. Unless the stitching cord is treated for ultra-violet resistance (which should be checked with the manufacturer before deciding on the carpet), it will soon break up particularly in conditions of prolonged sunlight. Re-sewing can be undertaken but is not easy to do from the top of the carpet and often leads to smoothness imperfections which cause erratic ball behaviour. This is one of the major weaknesses of a loose-laid design which has led to the wider use in recent years of fixed carpets with either sewn or glued seams.

3.8 Line Marking and Painting

- 3.8.1 As this is often specific to the type of turf, details of line marking and painting procedures are best left to manufacturers' instructions.

3.9 Treatment of Chemicals and Stains

- 3.9.1 There are numerous toxic chemicals which may come in contact with the turf. The best advice is to take all possible precautions to avoid their incidence in the first place. However, if chemicals are spilt, or stains appear, it is important that they be detected early and action taken immediately. Remedial treatment will depend on the chemical and type of turf. Again, reference to manufacturers' instructions is advised.

3.10 Major Treatment of Filled Pitch (Rejuvenation)

- 3.10.1 Over time, impurities will intermingle with the sand in a filled pitch, detracting from its playability, creating potential for skin abrasions to become septic and causing hard spots in the playing surface. Periodically, a basic maintenance procedure should be carried out to cleanse the pitch.
- 3.10.2 First, the amount of sand is checked. Then systematic inspection across the width of the pitch is carried out. All seams and woven-in lines are checked for tears and loose parts. If present, weeds along the sides and ends of the pitch are removed (ensuring that the roots are removed as well) making sure not to damage the sub-stratum in which they have grown. The perimeter of the pitch is treated with herbicide (eg "Roundup" from Monsanto).
- 3.10.3 Next, all loose refuse and coarse impurities are cleaned from the surface. The pitch is now subject to a treatment which consists of "tossing" it intensively. The process is carried out by progressing lengthwise and, if necessary, cross-wise. The sand filling is extracted with a special rotating brush. This sand is separated during the brushing process by vacuuming up the very fine impurities and, if necessary, is fed back into the upper covering through a riddle sifter to separate sand and small stones. Hard spots should also be brushed up with a stiff (not metal) brush. Brushing out when the sand is damp is inadvisable because it is not possible to remove the dust which may subsequently be brushed back in.
- 3.10.4 The pitch is now brushed again to remove all remaining loose refuse. Then all "spots" are supplied with extra sand (ie new sand is strewn in and brushed with a synthetic broom).
- 3.10.5 This treatment has the following advantages:
- the structure of the sand becomes and remains loose, which makes the pitch more pleasant to play on and reduces the chance of injury;
 - the sand is "aired" so that moss and weeds get less chance to grow;
 - existing moss is partially or completely removed;
 - permeability is improved, which inhibits soiling of the top layer and reduces puddling.
- 3.10.6 During major maintenance, it is opportune to check all accessories such as goals, dug-outs, flag poles, etc as well as fences and gates. They should be repaired or replaced as necessary.

3.11 Replacing and/or Up-grading

- 3.11.1 The average life of a pitch (depending on playing intensity) is about 10 years, several years more if it is well maintained, considerably less if not. Provided the sub-base has not been damaged, and irrigation/drainage systems are in good condition, at the end of this period a further 10-12 years of life should be obtainable essentially by only having to replace the carpet.

4 Summary of Key Points

- 4.1 Take care in the design stages to facilitate simple and effective maintenance features.**
- 4.2 Post clear notices specifying positive actions and prohibitions and closely monitor adherence to them.**
- 4.3 Ensure that the pitch is appropriately watered before every match or practice activity.**
- 4.4 Carry out simple maintenance regimens and routine inspections regularly.**
- 4.5 Attend to any problems urgently and take remedial action immediately.**
- 4.6 Refer to manufacturers for expertise required to ensure proper maintenance.**
- 4.7 Adhere to the long-term maintenance programme recommended by manufacturers.**

Appendix A: Red Card for Algae

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How can the formation and spread on un-sanded synthetic turf sports fields be combated by preventative and remedial action?

According to the past emphatic motto of the manufacturers, the construction of a synthetic turf pitch provides trusting gullible users with a practical and low maintenance sports field with hardly any running costs.

In the course of years, and favoured by intensive watering during training and playing, a phenomenon occurs that the affected owner is virtually powerless to prevent. This phenomenon is the growth of algae.

Algae are unicellular and autotrophic (ie single-celled and self-feeding) plants that extract water, mineral salts, sunlight and carbon dioxide from the environment (air or water), and incorporate it into their plant structure (photosynthesis).

Normally algae grow in seas and lakes and are regarded as unpleasant and a nuisance by humans only when they occur in large masses (a phenomenon called "surface water eutrophy") or in unwanted places.

One example of this annoying plague is the explosive growth of this biological family in outside swimming pools and garden ponds unless these are protected by suitable preventative measures.

Frequent targets for the mass spread gratefully chosen by algae are the synthetic turf pitches of sports fields, as here they can sometimes find excellent living conditions.

The proprietors of a synthetic turf pitch must ask themselves a series of important questions, which I shall attempt to examine on the following pages of this guide:

- 1 How can the formation of these algae be prevented at all?**
- 2 How can a layman establish whether algae have even formed?**
- 3 What can be done to combat and remove existing algae growth?**

Regardless of their type of polymer (polypropylene, polyethylene or nylon) and type of construction (tufted, knotted or rustled), most unfilled synthetic turf pitches are sooner or later colonised by algae to some extent or another, depending on their location and surroundings, and therefore the prevention of growth should take first place in the solution of the problem.

The first important measure is "**cleanliness**".

Avoid planting deciduous trees, shrubs and hedges and where possible gradually replace these with evergreen varieties.

Poplars (and also weeping willows) in particular have no place at the edge of a synthetic turf pitch. These trees attack the turf not just by shedding leaves and a sticky white blossom but also by the destructive effect of their extensive root system, that can sometimes even break up and raise the foundations. More generally, be aware of the undesirable effects that nearby trees can have on drainage systems and water retention on the pitch surface.

One of the most important maintenance tasks is regular cleaning of the synthetic turf. A series of cleaning machines are offered on the market for this purpose. Experience has shown that the best machines are the specialist ones that have a suction unit and also two counter-rotating brush drums and are fitted with wide tyres. Single-drum cleaning machines are effective only where the pitch area is slightly dirty.

Drivable blowers that use air pressure to blow the dirt from the surface to the edge of the pitch are suitable in some cases. However, the dirt must then be disposed of in a second working step.

If the soiling of the synthetic turf can no longer be dealt with by the in-house equipment, then a specialist company must be entrusted with the task. These specialists have access to machines that use rotating fine jet nozzles and variable water pressure to drive the dirt particles from the floor and at the same time pick up the dirty water using a vacuum cleaner (vortex process).

Experience in swimming pools and own experiments with synthetic turf surfaces have shown that, for economic and ecological reasons, **prevention** of an unwanted algae infestation is clearly preferable to combating an already established species. For this method, the required amount of an effective algicide is continuously added to the sprinkler water. The applied product concentration is usually around 10 ppm (10 parts per million) and should be raised to 20 ppm only in recalcitrant cases.

The agent of choice is a quaternary ammonium chloride with the chemical name "didecyl-dimethyl-ammonium chloride", which is marketed by the firm Bayer under the name "DIMANIN spezial" and by the firm Menno-Chemie under the name "M+ENNO-TER forte". In addition to its purely algicidal action, the quaternary salt is also adsorbed onto the pile fibres by the "van der Waals" forces arising from its chemical structure, and this significantly extends its long term action and also reduces electrostatic charge build-up.

For continuous use with synthetic pitches, it is necessary to incorporate a dosing plant. The core item of this apparatus is a corrosion-resistant dosing pump that feeds the algicide from a reservoir container into the sprinkler water.

A description of the dosage plant and dosage instructions are incorporated at the end of this article.

Once algae have formed (for example, if preventative measures have not been performed), this can be seen as a change in the colour of the surface of the synthetic turf. If spread is severe, the playing properties of the affected areas can also change. When rained on or watered, the mat becomes increasingly slippery and the players can lose their grip even with the special synthetic turf shoes. Accidents and resulting injuries are then inevitable.

If safe playing on the pitch area can no longer be ensured, the next step is to combat the formed algae. The treatment of a hockey pitch (including the field margins outside the marked pitch) with an area of 5,500 to 6,000 m² requires 10 litres of the standard commercial 32.5 % "DIMANIN spezial" solution. For use, these 10 litres of concentrate must be stirred into 2,000 litres of water (not vice versa owing to possible foaming). The resulting 0.5 % end-use solution should be applied uniformly over the area to be treated using a mobile spraying unit during dry weather (it should not rain for several hours after spraying).

The biocidal action sets in relatively rapidly, and can be observed as a marked lightening of the initial brown colour.

As the breakdown product of the "dead" algae remains slippery, every combating action must always be followed by the intensive cleaning described above using the rotary vortex method. A period of 48 hours should be allowed to elapse between spraying on the algicide and mechanical pressure cleaning, in order to ensure that all algae are reliably killed.

A further agent suitable for combating algae is "DIMANIN A" (benzalkonium chloride) that is also manufactured and marketed by Bayer. However, as three times the amount must be used to achieve the same effect as "DIMANIN spezial", it is used only in rare cases where the waste water of a treated synthetic turf pitch runs directly into waters inhabited by fish.

Dr Schneider

Bad Dürkenheim, February 2001

Instructions for Use

DIMANIN spezial

10 litres of 32.5 % concentrate

2,000 litres of water (0.5 % solution)

DIMANIN A

Stir

30 litres of 33 % concentrate

into

3,000 litres of water (1 % solution)

After mixing well, apply evenly using a spray applicator. After waiting for 48 hours, perform thorough deep-cleaning.

Strictly observe the safety guidelines specified by the manufacturer when working with the undiluted liquids. Always wear protective spectacles and protective gloves during the dispensing and dilution steps.

The diluted end-use solutions are neither irritating to the skin nor harmful to health.

Continuous dosage of "DIMANIN spezial" or "M+ENNO-TER forte" to prevent algae formation on unfilled synthetic turf

Apparatus:

- dosing pump with corrosion-resistant pump head of polypropylene (e.g., type BT 4a 1005 PPE of the firm Prominent in Heidelberg);
- 140 litre reservoir container in polypropylene;
- suction lance with level switch;
- dosing valve;
- pressure hose.

The capital costs for this apparatus are about 800 EURO including tax. To this must be added the on-site assembly costs.

Dosing and dosing amounts

In normal cases an algicide concentration of 10 ppm (10 parts per million) relative to the 32.5 % original solution is used. 10 litres of this "DIMANIN spezial" original solution is diluted with water to give 100 litres of a 10 % working solution.

The output of the pump is adjusted so that 100 ml of the 10 % working solution is added per 1 cubic meter of sprinkler water.

For example, if the sprinkler system delivers 30 m³/hour, then 30 x 100 ml = 3 litres of the working solution must be dosed in.

Annual requirement for "DIMANIN spezial" original solution

An annual water consumption of 2000 m³ for sprinkling of the synthetic turf requires 20 litres of "DIMANIN spezial" solution.

Appendix B: Suppliers' Directory: Machinery Equipment

NB: this listing is not exclusive and inclusion in it does not imply endorsement of the supplier or any of its products or services by the FIH

Machine	Website
Brush-suction machines	www.smg-gmbh.de
Leaf blowers	www.stiga.com
Leaf blowers	www.toro.com
Leaf blowers	www.hondapowerequipment.com
High pressure sprayers	www.solo-germany.com