SAPCA

SPORTS AND PLAY CONSTRUCTION ASSOCIATION

The SAPCA Code of Practice for the Maintenance of Synthetic Sports Surfaces

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Contents

Introduction ..... **- 8 -**

Notes To Be Read In Conjunction with the Code of Practice ..... **- 9 -**

The Sports and Play Construction Association (SAPCA) ..... **- 10 -**

SAPCA's Aims and Objectives ..... **- 10 -**

Acknowledgements ..... **- 11 -**

Prologue ..... **- 12 -**

1. Section One: Pitch Maintenance ..... **- 13 -**

1.1 Maintenance of Filled Surfaces ..... **- 13 -**

1.1.1 Introduction ..... - 13 -

1.1.2 What Maintenance and Why ..... - 14 -

1.1.3 Sand-Filled Systems (second generation) ..... - 14 -

1.1.3.1 Keeping the Surface Clean ..... - 14 -

1.1.3.2 Grooming ..... - 14 -

1.1.3.3 Moss and Algae ..... - 16 -

1.1.3.4 The First Month or Two ..... - 16 -

1.1.3.5 Play Lines ..... - 17 -

1.1.3.6 Stain Removal ..... - 17 -

1.1.3.7 Weeds ..... - 17 -

1.1.3.8 Snow and Ice ..... - 17 -

1.1.3.9 Footwear and General Care ..... - 18 -

1.1.3.10 Maintenance Schedule (Sand-filled) ..... - 18 -

1.1.4 Long Pile Carpets (Third Generation) ..... - 19 -

1.1.4.1 Keeping the Surface Clean ..... - 19 -

1.1.4.2 Grooming ..... - 20 -

1.1.4.3 Moss and Algae ..... - 21 -
1.1.4.4 The First Month or Two ..... - 21 -
1.1.4.5 Rolling ..... - 22 -
1.1.4.6 Play Lines ..... - 22 -
1.1.4.7 Stain Removal ..... - 23 -
1.1.4.8 Weeds ..... - 23 -
1.1.4.9 Snow and Ice ..... - 23 -
1.1.4.10 Footwear and General Care ..... - 24 -
1.1.4.11 Maintenance Schedule (Third Generation) ..... - 24 -
1.1.5 Chemicals on Synthetic Turf ..... - 25 -
1.1.5.1 General ..... - 25 -
1.2 Maintenance of Non-Filled Surfaces ..... - 26 -
1.2.1 Introduction ..... - 26 -
1.2.2 What Maintenance and Why ..... - 27 -
1.2.3 Keeping the Surface Clean ..... - 27 -
1.2.4 Brushing ..... - 27 -
1.2.5 Moss and Algae ..... - 28 -
1.2.6 The First Month or Two ..... - 29 -
1.2.7 Play Lines ..... - 29 -
1.2.8 Stain Removal ..... - 29 -
1.2.9 Weeds ..... - 29 -
1.2.9.1 Snow and Ice ..... - 29 -
1.2.10 Footwear and General Care ..... - 30 -
1.2.11 Maintenance Schedule ..... - 30 -

2. Section Two: Athletics Tracks ..... - 31 -

2.1 Maintenance of Synthetic Surfaces ..... - 31 -

2.1.1 Introduction ..... - 31 -

2.1.2 What Maintenance and Why ..... - 31 -

2.1.3 Keeping the Surface Clean ..... - 31 -

2.1.4 Access over the Track ..... - 32 -

2.1.5 Spreading the Wear ..... - 32 -

2.2 Maintenance and Storage of Equipment ..... - 32 -

2.2.1 Track Equipment ..... - 32 -

2.2.2 Equipment for Field Events ..... - 34 -

2.2.3 Storage ..... - 37 -

3. Section Three: Tennis Courts ..... - 40 -

3.1 General Court Care Common to All Surfaces ..... - 40 -

3.1.1 Footwear ..... - 40 -

3.1.2 Furniture, Toys and Equipment on the Court ..... - 40 -

3.1.3 The Court Perimeter ..... - 40 -

3.1.4 Tree Roots ..... - 41 -

3.1.5 Overhanging Branches ..... - 41 -

3.1.6 Substances to Keep Away From Tennis Courts ..... - 41 -

3.1.7 The Net and Net Posts ..... - 41 -

3.1.8 Weeds ..... - 42 -

3.2 Porous Macadam Courts ..... - 43 -

3.2.1 Introduction ..... - 43 -

3.2.2 What Maintenance and Why ..... - 44 -

3.2.3 Keeping the Surface Clean ..... - 44 -

3.2.4 The Post Construction Period ..... - 45 -

3.2.5 Play in Hot Weather ..... - 45 -
3.2.6 Bird Damage ..... - 45 -
3.2.7 Worms ..... - 45 -
3.2.8 Snow and Ice ..... - 46 -
3.2.9 Maintenance Schedule ..... - 46 -
3.3 Maintenance of Sand-Filled Artificial Grass Courts ..... - 47 -
3.3.1 Introduction ..... - 47 -
3.3.2 What Maintenance and Why ..... - 47 -
3.3.3 Keeping the Surface Clean ..... - 48 -
3.3.4 Moss & Algae ..... - 49 -
3.3.5 The First Month or Two ..... - 49 -
3.3.6 Play-Lines ..... - 50 -
3.3.7 Stain Removal ..... - 50 -
3.3.8 Weeds ..... - 50 -
3.3.9 Snow and Ice ..... - 50 -
3.3.10 Footwear and General Court Care ..... - 50 -
3.3.11 Maintenance Schedule ..... - 51 -
***3.4* Maintenance of Acrylic Courts ..... - 51 -**
3.4.1 Introduction ..... - 51 -
3.4.2 What Maintenance and Why ..... - 52 -
3.4.3 Keeping the Surface Clean ..... - 52 -
3.4.4 Monitoring the Surface ..... - 53 -
3.4.5 Maintenance Schedule ..... - 53 -
3.5 Maintenance of Shale and Clay Courts ..... - 53 -
3.5.1 Introduction ..... - 53 -
3.5.2 Some General Principles ..... - 54 -
3.5.3 Tools and Equipment ..... - 55 -

3.5.4 The Basic Maintenance Operations ..... - 57 -
3.5.5 Finishing Touches ..... - 61 -
3.5.6 Moss Control ..... - 61 -
3.5.7 Salt in winter ..... - 61 -
3.5.8 Deliquescent in summer ..... - 61 -
3.5.9 The Post-Construction Phase ..... - 61 -
3.5.10 Scheduling Play ..... - 62 -
3.6 Maintenance Recommendations for Specific Surface Types ..... - 62 -
3.6.1 Introduction ..... - 62 -
3.6.2 Fast-Dry ..... - 63 -
3.6.3 General Maintenance ..... - 63 -
3.6.4 French Clay ..... - 64 -
3.6.5 UK Shale (or En-tout-cas) ..... - 66 -
3.6.6 Other Water-Bound Surfaces ..... - 71 -
3.7 Maintenance of Polymeric Courts ..... - 71 -
3.7.1 Introduction ..... - 71 -
3.7.2 What Maintenance and Why ..... - 72 -
3.7.3 Keeping the Surface Clean ..... - 72 -
3.7.4 Moss and Algae ..... - 73 -
3.7.5 Snow and Ice ..... - 73 -
3.7.6 Play lines ..... - 73 -
3.7.7 Maintenance schedule ..... - 73 -
3.8 Maintenance of Porous Concrete Courts ..... - 74 -
3.8.1 Introduction ..... - 74 -
3.8.2 What Maintenance and Why ..... - 74 -
3.8.3 Keeping the Surface Clean ..... - 75 -
3.8.4 Moss and Algae ..... - 75 -

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3.8.5 Movement of the Sections ..... - 76 -
3.8.6 Snow and Ice ..... - 76 -
3.8.7 Maintenance Schedule ..... - 77 -
3.9 Maintenance of Grey-Green Courts ..... - 77 -
3.9.1 Introduction ..... - 77 -
3.9.2 What Maintenance and Why ..... - 78 -
3.9.3 Keeping the Surface Clean ..... - 78 -
3.9.4 Brushing the Grit ..... - 79 -
3.9.5 Commissioning the Court in spring ..... - 79 -
3.9.6 The Post-Construction Phase ..... - 79 -
3.9.7 Frost, Snow and Ice ..... - 79 -
3.9.8 Play-Lines ..... - 80 -
3.9.9 Maintenance Schedule ..... - 80 -

4. Section Four: Artificial Cricket Wickets ..... - 81 -
4.1 Introduction ..... - 81 -
4.2 What Maintenance and Why ..... - 81 -
4.3 Establishing and Rolling the Pitch ..... - 82 -
4.4 Keeping the Surface Clean ..... - 82 -
4.5 Moss and Algae ..... - 83 -
4.6 Crease Markings ..... - 83 -
4.7 Pitch Perimeter ..... - 83 -
4.8 Footwear ..... - 83 -
4.9 Stump Areas ..... - 83 -
4.10 Surface Repair ..... - 83 -
4.11 Renovation ..... - 84 -
4.12 Maintenance Schedule ..... - 84 -

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Introduction

The Sports and Play Construction Association (SAPCA) has produced this document to provide owners, operators, grounds staff and managers of sports facilities with guidance on the basic maintenance requirements of tracks, pitches, and courts etc., which are surfaced with synthetic materials.

The document calls on the experience of SAPCA's member companies who have constructed and maintained wide range of installations for a variety of clients over many years. Whilst it is not necessarily intended that this document should become part of a contract, it is hoped that it will provide useful guidance to clubs all involved in the care and maintenance of sports facilities.

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Notes To Be Read In Conjunction with the Code of Practice

- This Code of Practice is intended for use by sports surfacing contractors, sports facility design professionals and facility purchasers and owners and maintenance staff. Although the Code of Practice has been produced by reference to facilities constructed under normal climatic conditions in the United Kingdom, the Sports and Play Construction Association cannot accept any responsibility whatsoever for any loss, damage or injury whatsoever arising from reliance on the recommendations contained within the Code of Practice.

- The information contained within the Code of Practice, whilst accurate at the time of publication, may be subject to change at a future date. Due to changing technology, new developments in construction methods, and the changing requirements of the sport's governing bodies, revisions to the recommendations are likely, and only the most recent edition of the Code of Practice should therefore be used.

- Where reference is made to weed killing in this document it should be noted that this operation should only be undertaken by competent, formally trained and certified operatives. The use of herbicides is governed by legislation under the Food and environment Protection Act 1985 and the Health and safety at Work Act 1974.

- This Code of Practice is available through the SAPCA web site at www.sapca.org.uk. Please ensure that you have the current version of the Code by checking the version number on the appropriate web page.

- A permanent joint committee will keep under review the use of the Code of Practice and will consider any suggestions for amendment, which should be addressed to the Chief Executive, The Sports and Play Construction Association, Federation House, Stoneleigh Park, Warwickshire, CV8 2RF. Revision to the Code of Practice will be made when it is considered appropriate and the current version will appear on the web site.

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The Sports and Play Construction Association (SAPCA)

As the recognised UK trade association, SAPCA fosters excellence, professionalism and continuous improvement throughout the sports and play construction industry, in order to provide the high quality facilities necessary for the success of British sport.

SAPCA's Aims and Objectives

- To promote high standards of design, construction and workmanship for sports facilities in the UK.
- To regulate the industry through the vetting and monitoring of SAPCA members.
- To participate fully in the development of British, European and other Standards for the construction and performance of sports facilities, for all levels of play.
- To liaise closely with the governing bodies of sport, both nationally and internationally.
- To encourage the use of new technology in the design and construction of sports facilities.
- To provide and support training and education for the industry's workforce.
- To provide a strong voice for the sports construction industry in the UK.

www.sapca.org.uk

The SAPCA web site provides a wealth of valuable information for anyone involved in the development of sports facilities. Visit www.sapca.org.uk - for Industry News, Technical Guidance, Exhibitions & Events, the SAPCA Membership Database, and more. Visitors are invited to subscribe to the free SAPCA News Update service, for regular news bulletins.

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Prologue

From the first considerations regarding the maintenance of a synthetic sports surface through to the final completion, a clear understanding is required of the process. The processes and decisions that need to be made can be complex and will depend upon many contributing factors.

This code of practice has been split up into sections that cover maintenance methods for surface's used for different sport applications.

- The first section has a focus on general pitch maintenance and is subdivided into:
    - Maintenance of Filled Surfaces
    - Maintenance of Non-filled Surfaces

    Maintenance is performed to ensure that the surface remains at relevant performance standard. It is essential that maintenance methods are performed regularly and this section explains why each one should be performed. Two surfaces are discussed in detail within this section; these are Sand filled systems (Second Generation) and Long Pile Carpets (Third Generation).

- Section two has a specific focus to the maintenance of **athletics tracks**. The maintenance methods to keep an athletics track are detailed along with why it is important to have a maintenance schedule. By properly maintaining the track, the surface ensures a safe condition for the athletes to perform. The maintenance of field and track equipment is also covered in this section and how they should be properly stored.

- Section three covers the maintenance methods for **cricket wickets** and details how to ensure that the wickets stay in a suitable and playable condition. The maintenance procedures for **tennis courts** are then described providing general guidance that is common to all surface types as well as specific guidance on certain surfaces.

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1. Section One: Pitch Maintenance

1.1 Maintenance of Filled Surfaces

1.1.1 Introduction

Many filled synthetic turf sports pitches consist of a permeable base, usually of macadam, upon which are laid a resilient shock-pad and then a sports carpet. This is known as an 'engineered' base. Other pitches may have base systems consisting of a variety of stone (or sand) aggregate, sometimes with the addition of rubber crumb. These 'dynamic' bases may also have resilient shock-pads and, as with engineered structures, may be surfaced with sports carpets using different manufacturing processes, including tufted, needle punched, woven and knitted.

The fibres vary in length and density depending on the performance requirement the pitch has been designed to meet.

The main play-lines are often either, tufted into the carpet during manufacture and are therefore integral with it, or are subsequently inlaid (cut in) using similar carpet materials of an appropriate colour. Play lines may also be painted onto the surface, but these can be decidedly temporary and may need frequent repainting. In certain circumstances it may be desirable to have more temporary markings, in particular where sports use may be seasonal and too many permanent lines would prove confusing for the users.

Sand-filled systems (Second Generation)

Sand-filled carpets generally have a pile height of between 10 and 25mm and have been in use for pitches, designed for a variety of sports, since the early 'nineteen-eighties'.

The carpet, which is loose laid, not stuck to the layers below, is dressed with graded silica sand, which fills the interstices between the fibres to within about 3mm of the fibre tips. The weight of the sand is sufficient to keep the carpet firmly in place.

Long pile carpet systems (Third Generation)

Long pile carpets were introduced in the 'nineteen-nineties' using carpets with pile heights in excess of 35mm, and up to 65mm, for specific sports use.

Again, the carpet is loose laid and relies on the weight of infill for anchorage.

Long pile carpets may be filled with a combination of sand and rubber granules or only rubber granules. These systems are often referred to as 'third generation' carpets and tend to be specified where football is the primary sport.

The resulting sports surface is fully permeable, hard wearing and requires a relatively modest amount of maintenance, indeed over maintaining the surface may shorten the useful life of the carpet. This basic maintenance is, nevertheless, of vital importance if the surface is to remain good to look at, consistent in play, permeable and long lasting. Indeed, the installer's guarantees will usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence.

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1.1.2 What Maintenance and Why

Maintenance procedures are designed to ensure that:

- The playing surface is kept scrupulously clean
- The playing surface remains level and of consistent texture so that it gives a true and predictable game
- The infill materials are evenly distributed over the surface
- The free drainage of surface water is maintained throughout the life of the pitch
- The facility looks attractive and well-kept at all times
- The system does not become over compacted and hard

These objectives are achieved by:

- Sweeping leaves and other detritus from the surface
- Grooming the surface through brushing and/or drag matting. Grooming freshens the fibre surface, redistributes evenly any infill that has been disturbed, and counteracts compaction of the infill and any tendency to form an impervious surface skin that might impair drainage
- Applying prophylactic treatments of moss-killer and/or algaecide

1.1.3 Sand-Filled Systems (second generation)

1.1.3.1 Keeping the Surface Clean

Leaves, tree flowers, pine needles and other detritus should not be allowed to remain on the surface for any length of time. If this does happen, they rapidly rot down forming a drainage-inhibiting 'skin' within the surface and providing a growing-medium for algae and moss.

A wide soft broom or a rubber-tined rake is ideal for removing surface vegetable matter and other rubbish. Better still, a mechanical leaf-sweeper or specialist vacuum cleaner, which does not remove the fill, will greatly speed up the operation. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface. Both sweepers and vacuum cleaners may tend to remove rather too much infill during the first few months of the life of the surface, but thereafter this should cease to be a problem. Some disturbance of the surface of the infill will be a positive benefit (see 'Grooming' below).

1.1.3.2 Grooming

Grooming the surface is a crucial operation if premature deterioration of play characteristics, appearance and drainage properties is to be prevented. Apart from freshening the look of the surface, the purpose of regular and fairly vigorous brushing, and/or drag matting, is to prevent the formation of a compacted and impervious skin on the top of the infill bed that will inhibit drainage and encourage moss and algae. Because the bed of infill is an effective

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filter, it unavoidably retains any particulate matter conveyed or blown on to the pitch or carried down by rainfall. By constantly disturbing, moving and re-levelling the upper layers of infill, grooming can delay, by several years, the time when problems of reduced drainage start to develop.

For drag brushing, a wide brush with bristles of medium stiffness is best; the installer should be able to recommend or supply the correct type. It can be dragged over the surface either manually or mechanically. Brushing should ideally be done in both directions each time: up and down the length of the pitch and then at right angles across it, but if this is too time-consuming, the direction of brushing can be varied from occasion to occasion. It will be noted that, following brushing, it is likely that more of the infill will be visible on the surface, so consideration should be given to the timing of brushing if particular users or sports prefer less infill to be visible.

For drag matting, a fine turf steel drag mat may be used, but it is essential that no damage has occurred on the meshing of the mat to avoid snagging of the surface. To avoid the risk of damage and slow down the fibrillation (the splitting of the carpet fibres) of the pile, it is known that a carpet ‘sock’ around a steel drag mat can be used. The sock consists of a section of synthetic turf material formed into a sleeve to fit the drag mat. This is used when a light re-distribution of the fill is required, without over agitating the material and bringing it to the surface.

If drag matting, with or without a 'sock', is regularly carried out, it is important that a frequent, deeper penetration of the upper infill layers also takes place with a drag brush or, ideally, a powered sweeper, to minimise the risk of a 'skin' or 'pan' forming on the infill layer.

The recommended frequency of grooming must depend on the amount of use the pitch receives and whether its location is open and ‘clean’. Once or twice a week is a recommended norm, but it may be advisable to groom and clean more often if the pitch is heavily used, shaded or subject to pollution.

There is a selection of mechanical brushing machines available that will speed up and lighten the operation. The machines vary in the vigour with which they brush the surface: some are rather fierce and are only recommended for use by experienced operatives and where heavy remedial brushing is needed. Combined brush and vacuum machines must be used with even greater care because infill brushed and then sucked from the surface may be difficult to replace, especially when the pitch is well worn.

The installer's advice should always be sought when considering the use of any but the lightest machines.

It cannot be overemphasised that to neglect the grooming of this kind of pitch may have serious long-term consequences even if, in the shorter term, the pitch does not appear to suffer. Grooming need not be either time-consuming or onerous, and its benefits are profound. To omit the process may result in a pitch ceasing to drain at half-life or sooner. An un-groomed pitch will look scruffy and be susceptible to moss infestation.

If**,** in spite of the regular maintenance described above, or as a result of a lack of it, the surface becomes over-compacted and impervious, this condition can often be corrected by appropriate treatment usually involving the use of specialist machinery. Machines vary from simple scarifiers to more elaborate proprietary machines that remove a proportion of the infill (containing almost all the filtered dirt) from the upper part of the carpet. This is then replaced

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with new infill. The best of these processes will improve the play characteristics, ball roll and surface/foot interaction and will prolong the useful life of the pitch by a number of years. It is essential that any scarification or very deep penetration of the surface is only carried out by experienced staff.

Power washing of sand-filled surfaces should be avoided as the action of the water, in the fill, mixes the contaminants through the depth of the pile and thus clogs the through drainage.

1.1.3.3 Moss and Algae

In certain situations, and in some seasons, algae or moss can become established on the surface. Since prevention is very much more effective than cure, it is important to treat the affected areas of the pitch with a good proprietary moss-killer and algicide at least once a year.

Moss is not usually found on the parts of the surface that are trafficked by play, and although it may not be essential to treat these areas it is still a wise precaution to do so. However, particular attention should be paid to the perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or are overhung by trees. Any good proprietary product should be satisfactory provided that it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Where moss becomes established it should be treated immediately, the application being repeated after the dead spores are removed until eradication is complete. In the case of very severe infestation, the installer should be consulted. High air-pressure cleaning equipment is available but its use is a skilled process.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this. Regular grooming and regular use of the pitch render moss an even less likely problem.

1.1.3.4 The First Month or Two

Immediately after construction there is an initial working-in period during which the final playing surface is created.

Initially the surface will be left rather sandy, but full penetration of the infill into the fibres of the carpet and its subsequent compaction into a uniform playing surface occurs naturally, through good initial grooming, helped by rainfall and by play on the surface. This process usually takes two to three months. It will be necessary to top up specific areas of high wear such as penalty spots, short-corner areas etc., at regular intervals depending on usage.

During construction every effort is made to ensure even distribution of infill over the whole pitch. Experience shows however, that increasing the frequency of brushing, and/or drag matting, in the early weeks of use is beneficial in creating the final playing surface.

If areas are found that are short of infill it should be possible to brush the infill into them from adjacent areas of ample or surplus material, provided this is done within the first few weeks.

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If the under-filled areas are extensive or do not respond to this treatment, the installer should be called in immediately to add more fill.

1.1.3.5 Play Lines

A synthetic turf pitch will normally be supplied with permanently inlaid play lines. The number of sports to be included and whether the lines are to be inlaid or painted on to the surface will be decided prior to construction. However, if additional lines are required for special events or changes in the sports being played, these can be painted onto the surface using proprietary line paint. Some of these are more effective than others and consultation with installers, suppliers and other users of synthetic turf pitches is recommended. Chalk lines can be applied but these tend to leave a lasting powder spread in the area of the line. Marking compounds for natural grass should not be used as these will leave a build-up forming a crust and potential trip hazard.

Permanent lines require no special attention, other than, if cut-in, occasionally checking they are secure. This regular check should also be carried out on the seams in the carpet. Any breakdown of the seams at lines or in the main carpet should receive immediate attention to avoid on-going deterioration. This should be reported to the installer if within the warranty period. If the warranty has expired, a number of specialist companies will offer seam repair services.

1.1.3.6 Stain Removal

Most stains can be removed easily with a solution of hot (not boiling) water and a household detergent such as washing-up liquid. The removal of chewing gum can be simplified by making the gum brittle with a proprietary aerosol freezing material but great care must be taken to avoid breaking the embrittled fibres. Heavy oil marks can be removed with a cloth and white spirit.

1.1.3.7 Weeds

No matter how much care is taken, weeds may occasionally appear on the surface, usually as a result of wind-blown seeds. Small numbers of weeds can be removed by hand without damaging the surface. If the weeds are removed by hand, it is important to ensure that the full root of the weed is extracted, not broken off. Some weeds are more prolific if they are simply cut off at surface level. If the weeds are deep-rooted it is advisable to kill them off with an appropriate weed-killer.

Localised areas of weed seedling infestation can be treated with domestic weed-killers without causing damage to the surface of the pitch. Oil-based weed-killers should not be used. (See Section 1.1.5)

1.1.3.8 Snow and Ice

Snow and ice are not harmful and can be permitted to melt through. If it is important to remove the snow to enable play to start sooner than would otherwise be the case, brushes or wooden scrapers may be used.

If the area to be cleared is of full pitch size, the logistics of transporting and disposing of snow may prove prohibitive. It is not advisable to use mechanical snow removal equipment.

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Metal shovels or scrapers may damage the surface and should not be permitted. Rock salt and chemical de-icing agents should not be used. In certain cases vacuum-dried salt or urea have been used as effective preventatives when applied in advance of the weather deteriorating.

Provided that the foothold is adequate the pitch may be played on when frozen, but heavy use is to be discouraged because the fibre is relatively brittle at low temperatures. The degree of shock absorption will also be substantially reduced and players should be made aware of this fact. Health and Safety should be a primary consideration.

If heavy rain falls immediately after a very cold spell, the pitch may become flooded for a few hours. The same thing can happen when snow or heavy frost starts to thaw. This is because the sand beneath is still frozen, but should not be a cause for concern, as the remaining ice will soon melt and the surface will then drain normally.

1.1.3.9 Footwear and General Care

Suitable footwear should always be used. Most shoe manufacturers produce a boot which is specifically designed for the sport played on an artificial grass surface. Some synthetic turf systems, e.g. long pile systems, are designed to take a normal soccer stud but, if any doubt exists, the pitch manufacturer should be consulted.

It is strongly recommended that the pitch should be treated as a 'no smoking' area, since a dropped cigarette can melt the fibres down to the surface leaving an unsightly mark. Chewing gum should also be banned.

1.1.3.10 Maintenance Schedule (Sand-filled)

A daily log of all maintenance operations carried out on the sand-filled pitch should be completed by the grounds manager.

Daily - at end of the days play

- Check fixtures and fittings.
- Check and top-up fill levels at penalty spots, short corners, etc.
- Make sure gates are shut.

Weekly

- Clear leaves and rubbish from the area.
- Deal with any new weeds, moss or algae.
- Groom the surface of the pitch to redistribute infill.

Monthly

- Check infill levels.
- Outside the fence, check and clear mowing strips and check cleanliness of access paths.
- Check seams, inlaid lines, etc., and report failures to installer

Periodically – at least every six months

- Check thoroughly for moss and algae growth, food stains, etc, and remedy as appropriate.
- Top up fill as required
- Treat pitch with moss killer, algaecide, etc.

Annually

- Treat pitch with moss-killer / algaecide
- Call in installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Cleaning, grooming and pitch inspection can always be done more frequently, to the benefit of the surface. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the pitch, call in the installer immediately.

1.1.4 Long Pile Carpets (Third Generation)

1.1.4.1 Keeping the Surface Clean

Leaves, tree flowers, pine needles and other detritus should not be allowed to remain on the surface for any length of time. If this does happen, they rapidly rot down forming a drainage-inhibiting 'skin' within the surface and providing a growing-medium for algae and moss.

A wide soft broom or a rubber-tined rake is ideal for removing surface vegetable matter and other rubbish. Better still, a mechanical leaf-sweeper or specialist vacuum cleaner, which does not remove the fill, will greatly speed up the operation. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface. Both sweepers and vacuum cleaners may tend to remove rather too much infill during the first few months of the life of the surface, but thereafter this should cease to be a problem. Some disturbance of the surface of the infill will be a positive benefit (see 'Grooming' below).

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1.1.4.2 Grooming

Grooming the surface is a crucial operation if premature deterioration of play characteristics, appearance and drainage properties is to be prevented. Apart from freshening the look of the surface, the purpose of regular and fairly vigorous brushing, and/or drag matting, is to prevent the formation of a compacted and impervious skin on the top of the infill bed that will inhibit drainage and encourage moss and algae. Because the bed of infill is an effective filter, it unavoidably retains any particulate matter conveyed or blown on to the pitch or carried down by rainfall. By constantly disturbing, moving and re-levelling the upper layers of infill, grooming can delay, by several years, the time when problems of reduced drainage start to develop.

Brushing or drag matting should be undertaken in a number of directions. It is important that the synthetic turf pile is maintained vertically and regular brushing is an important function that must not be neglected. The surface should be brushed in a number of directions alternating the direction in consecutive activities.

The type of brush or drag mat used should be determined by the condition of the surface. Drag brushes behind the power unit and drag mats tend to flatten the pile and therefore if such an implement is used the operation should be carried out twice, up and down on the same breed. The drag method is good for levelling of the infill, not cleaning or standing up the pile. Brushes that have a rotary action in a horizontal position, in front of a power unit are sometimes preferred so that they flick the blades of the synthetic turf. Types of specialist 'combing' devices are recommended for pile treatment by certain manufacturers. Alternatively, brushes that rotate in a vertical direction, may also be preferable to the drag type equipment. It must be borne in mind that any powered brushing will disturb the infill more, so the type of brushing should be relevant to the end result you are trying to achieve; e.g. stand up the pile and clean, or level the infill within the pile?

The recommendations of the installing company/carpet manufacturer must be followed when deciding on the type of brush to be used. Excessive brushing, particularly with a rotating action can cause premature wear and reduce the life of the facility.

The recommended frequency of grooming must depend on the amount of use the pitch receives and whether its location is open and ‘clean’. Once or twice a week is a recommended norm, but it may be advisable to groom and clean more often if the pitch is heavily used, shaded or subject to pollution.

There is a selection of mechanical brushing machines available that will speed up and lighten the operation. The machines vary in the vigour with which they brush the surface: some are rather fierce and are only recommended for use by experienced operatives and where heavy remedial brushing is needed. Combined brush and vacuum machines must be used with even greater care because infill brushed and then sucked from the surface may be difficult to replace, especially when the pitch is well worn.

The installer's advice should always be sought when considering the use of any but the lightest machines. (See above)

It cannot be overemphasised that to neglect the grooming of this kind of pitch may have serious long-term consequences even if, in the shorter term, the pitch does not appear to suffer. Grooming need not be either time-consuming or onerous, and its benefits are

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profound. To omit the process may result in a pitch ceasing to drain at half-life or sooner. An un-groomed pitch will look scruffy and be susceptible to moss infestation.

1.1.4.3 Moss and Algae

In certain situations and in some seasons algae or moss can become established on the surface. Since prevention is very much more effective than cure, it is important to treat the affected areas of the pitch with a good proprietary moss-killer and algicide at least once a year.

Moss is not usually found on the parts of the surface that are trafficked by play, and although it may not be essential to treat these areas it is still a wise precaution to do so. However, particular attention should be paid to the perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or are overhung by trees. Any good proprietary product should be satisfactory provided that it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Where moss becomes established it should be treated immediately, the application being repeated after the dead spores are removed until eradication is complete. In the case of very severe infestation, the installer should be consulted. High air-pressure cleaning equipment is available but its use is a skilled process.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this. Regular grooming and regular use of the pitch render moss an even less likely problem.

1.1.4.4 The First Month or Two

All particulate infill surfaces take time to settle and it is advisable not to test for compliance to the playing performance quality standards until the surface has been laid for at least three months. It will take up to twelve months for the infill to settle in the pile of the synthetic turf.

During the first three months the surface should be watched closely for any signs of vegetation developing in the surface and appropriate actions taken. Although grass, moss and other forms of plants will germinate in the infill within the pile this does not usually occur until the pitch has been down for a number of months.

Many different long pile systems are currently available in the market for Association Football and therefore, it is not possible to be specific as to the equipment most suitable or methodology in maintaining every pitch. Exchange of information is a key requirement between ground staff and the suppliers/manufacturers as the techniques are developed. Whichever method of brushing is used, it must not put a strain on the seams of the synthetic turf and must be used in accordance with installers recommendations regarding fibre wear.

From three months to nine months the pitch will be maturing and during this period regular brushing in a number of directions should be carried out as often as required. Ideally every time the pitch is heavily used it should be brushed, however this is not always practical therefore at every opportunity the surface pile should be brushed to ensure it stands vertical.

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As indicated for the settling in period, a careful watch should be kept for any signs of vegetation growing in the pile. A common occurrence when adjacent natural turf pitches have been renovated. Windblown seed will soon germinate particularly where pitches are not regularly maintained and the infill material is seldom disturbed.

It is essential to groom not only the areas within the playing area, but all the surrounds to a pitch must be treated the same. If vegetation does start to develop appropriate action must be taken without delay.

During construction every effort is made to ensure even distribution of infill over the whole pitch. Experience shows, however, that increasing the frequency of grooming, in the early weeks of use is beneficial in creating the final playing surface.

If areas are found that are short of infill it should be possible to brush the infill into them from adjacent areas of ample or surplus material, provided this is done within the first few weeks. If the under-filled areas are extensive or do not respond to this treatment, the installer should be called in immediately to add more fill.

When the settling-in period is over and the pitch has reached its optimum playing condition, the frequency of grooming can be reduced.

1.1.4.5 Rolling

Light rolling may be required from time to time, particularly during the period of settlement. The roller must be carefully selected according to the climatic conditions and the degree of firmness in the pitch. Rolling should take place across the pitch running in the direction of the seams. The weight of the roller should not exceed 5 cwt. This operation is to be carried out only if the pitch is constructed with an unbound base formation. NB. Determining when to roll is important and advice should be sought from the installer.

1.1.4.6 Play Lines

A synthetic turf pitch will normally be supplied with permanently inlaid play lines. The number of sports to be included and whether the lines are to be inlaid or painted on to the surface will be decided prior to construction. However, if additional lines are required for special events or changes in the sports being played, these can be painted onto the surface using proprietary line paint. Some of these are more effective than others and consultation with installers, suppliers and other users of synthetic turf pitches is recommended. Chalk lines can be applied but these tend to leave a lasting powder spread in the area of the line. Marking compounds for natural grass should not be used as these will leave a build-up forming a crust and potential trip hazard.

Permanent lines require no special attention, other than; if cut-in, occasionally checking they are secure. This regular check should also be carried out on the seams in the carpet. Any breakdown of the seams at lines or in the main carpet should receive immediate attention to avoid on-going deterioration. This should be reported to the installer if within the warranty period. If the warranty has expired, a number of specialist companies will offer seam repair services.

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1.1.4.7 Stain Removal

Most stains can be removed easily with a solution of hot (not boiling) water and a household detergent such as washing-up liquid. The removal of chewing gum can be simplified by making the gum brittle with a proprietary aerosol freezing material but great care must be taken to avoid breaking the embrittled fibres. Heavy oil marks can be removed with a cloth and white spirit.

1.1.4.8 Weeds

No matter how much care is taken, weeds may occasionally appear on the surface, usually as a result of wind-blown seeds. Small numbers of weeds can be removed by hand without damaging the surface. If the weeds are removed by hand, it is important to ensure that the full root of the weed is extracted, not broken off. Some weeds are more prolific if they are simply cut off at surface level. If the weeds are deep-rooted it is advisable to kill them off with an appropriate weed-killer.

Localised areas of weed seedling infestation can be treated with domestic weed-killers without causing damage to the surface of the pitch. Oil-based weed-killers should not be used. (See section 1.1.5)

1.1.4.9 Snow and Ice

Snow and ice are not harmful and can be permitted to melt through. If it is important to remove the snow to enable play to start sooner than would otherwise be the case, brushes or wooden scrapers may be used.

If the area to be cleared is of full pitch size, the logistics of transporting and disposing of snow may prove prohibitive. It is not advisable to use mechanical snow removal equipment other than snow 'blowers'.

Metal shovels or scrapers may damage the surface and should not be permitted. Rock salt and chemical de-icing agents should not be used. In certain cases vacuum-dried salt (PDV), at a maximum rate of 175g/sm, has been used as an effective preventative when applied in advance of the weather deteriorating. Such applications should be restricted to three times per winter.

Provided that the foothold is adequate the pitch may be played on when frozen, but heavy use is to be discouraged because the fibre is relatively brittle at low temperatures. The degree of shock absorption will also be substantially reduced and players should be made aware of this fact. Health and Safety should be a primary consideration.

If heavy rain falls immediately after a very cold spell, the pitch may become flooded for a few hours. The same thing can happen when snow or heavy frost starts to thaw. This is because the sand beneath is still frozen, but should not be a cause for concern, as the remaining ice will soon melt and the surface will then drain normally.

Underground heating systems will increase the availability of these pitch systems in cold climates.

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1.1.4.10 Footwear and General Care

Suitable footwear should always be used. Most shoe manufacturers produce a boot which is specifically designed for the sport played on an artificial grass surface. Most long pile systems, are designed to take a normal soccer stud but, if any doubt exists, the pitch manufacturer should be consulted.

It is strongly recommended that the pitch should be treated as a 'no smoking' area, since a dropped cigarette can melt the fibres down to the surface leaving an unsightly mark. Chewing gum should also be banned.

If at all possible wear should be spread over the entire pitch; the way a pitch is used can have a significant effect on the quality of the pitch surface, and particularly the playing characteristics. Where activities are concentrated in any one location the surface will harden off and this will in turn have an effect on ball bounce, traction, hardness and ball roll. Such areas need a higher concentration of maintenance than areas where the surface is not used to the same extent. Even when the surface is not used it still requires maintenance if it is not to deteriorate.

Maintenance inputs are dependent on the extent to which a pitch is used and how effective the maintenance operations are.

In certain situations, such as contamination of the particulate fill or lack of through drainage, due to such contamination, the infill may have to be replaced and therefore the extent to which it becomes contaminated is crucial to the quality of the playing surface during the life of the pitch.

Recognition of the change in the particulate infill is an essential requirement for the Grounds Manager. Testing infill materials should be carried out on a regular basis, at the very least every twelve months. If the change is noted early on, the extent of remedial works may be restricted to top-dressing. A simple operation of extracting some infill, then allowing it to settle out in a bottle or jar of water will indicate the amount of silt or fines in the pile. Comparisons from one test bottle to another can then be made, to ascertain the increase in fines.

1.1.4.11 Maintenance Schedule (Third Generation)

A daily log of all maintenance operations carried out on the 3G pitch should be completed by the grounds manager.

Daily - at end of the days play

- Check fixtures and fittings.
- Check and top-up fill levels at penalty spots, goal mouths, etc.
- Make sure gates are shut.

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Weekly

- Clear leaves and rubbish from the area.
- Deal with any new weeds, moss or algae.
- Groom the surface of the pitch to redistribute infill and maintain vertical fibres.

Monthly

- Check infill levels.
- Outside the fence, check and clear mowing strips and check cleanliness of access paths.
- Check seams, inlaid lines, etc., and report failures to installer.

Periodically – at least every six months

- Check thoroughly for moss and algae growth, food stains, etc, and remedy as appropriate.
- Treat pitch with moss killer, algaecide, etc.

Annually

- Treat pitch with moss-killer / algaecide
- Top dress with new infill as required
- Call in installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Cleaning, brushing and pitch inspection can always be done more frequently, to the benefit of the surface. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the pitch, call in the installer immediately.

1.1.5 Chemicals on Synthetic Turf

1.1.5.1 General

There is no easy answer as to which chemicals may be used on synthetic turf to treat weeds, moss, and act as cleaning agents, etc., because of the vast number of differing varieties of product available.

Generally speaking any product that is acidic in nature, i.e. pH less than 3 containing Halogens (chlorine, bromine, etc.), Sulphur and Nitrogen are likely to react.

Likewise, if a product is oxidising, like Bleach, Peroxide, etc., then this can liberate free ions of the above elements that can then form acidic species in the presence of water.

In brief:

- All products that are classed as 'non-acidic' and 'non-oxidising' should not cause a problem.
- Anything that contains 'Halogens', 'Acids' or 'Sulphur' are unsuitable.
- Pesticides and weed-killers should be pH neutral.
- Most detergents should be suitable.

For example:

Unsuitable weed-killers include:

- Paraquat
- Lawn sand
- 24D Growth Hormone

Suitable weed-killers include:

- Simazine
- Gesapo
- Round-up

If doubt exists as to the suitability of any chemical substance, the installer/manufacturer of the carpet should always be consulted before application to the surface.

1.2 Maintenance of Non-Filled Surfaces

1.2.1 Introduction

Most non-filled artificial grass sports pitches consist of a permeable base, usually of macadam, upon which are laid a resilient shock-pad and then a tufted or woven carpet of polypropylene or nylon fibre. The fibres vary in length and density. The carpet may be loose laid or stuck to the shock-pad and is normally stretched and anchored at the periphery. Play lines are either tufted into the carpet during manufacture and are therefore integral with it, or are subsequently cut in using similar carpet materials of the appropriate white or yellow colour. Occasionally play lines are painted onto the surface, but these are decidedly temporary and need frequent re-painting.

The resulting sports surface is fully permeable, hard-wearing and requires only a modest amount of maintenance. This basic maintenance is, nevertheless, of vital importance if the surface is to remain good to look at, consistent in play, permeable and long lasting. Indeed, the installer's guarantee will usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence.

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1.2.2 What Maintenance and Why

Maintenance procedures are designed to ensure that:

- the playing surface is kept scrupulously clean
- the playing surface remains level and of consistent texture so that it gives a true and predictable game
- the free drainage of surface water is maintained throughout the life of the pitch
- the facility looks attractive and well-kept at all times

These objectives are achieved by:

- Sweeping leaves and other detritus from the surface
- Brushing the surface to freshen the fibre
- Applying prophylactic treatments of moss-killer and/or algaecide

1.2.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles and other detritus should not be allowed to remain on the surface for any length of time. If this does happen, they rapidly rot down forming a drainage-inhibiting 'skin' within the surface and providing a growing-medium for algae and moss.

A wide soft broom or a rubber-tined rake is ideal for removing vegetable matter and other rubbish. Better still, a mechanical leaf-sweeper or vacuum cleaner will greatly speed up the operation. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface.

1.2.4 Brushing

Brushing the surface is a crucial operation if premature deterioration of play characteristics, appearance and drainage properties is to be prevented. Apart from freshening the look of the surface, the main purpose of regular and fairly vigorous brushing is to prevent infestation with moss and algae. Although a non-filled pitch does not have the same dirt-filtering properties as a pitch filled with sand, it does still retain a high proportion of the particulate matter carried or blown onto it. Regular brushing also minimises the risk of this dirt aggregating and becoming compacted, and can delay by several years the time when problems of reduced drainage start to develop.

A wide brush with bristles of medium stiffness is best; the installer should be able to recommend or supply the correct type. It can be dragged over the surface either manually or mechanically. Brushing should ideally be done in both directions each time: up and down the length of the pitch and then at right angles across it, but if this is too time-consuming, the direction of brushing can be varied from occasion to occasion.

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The recommended frequency of brushing must depend on the amount of use the pitch receives and whether its location is open and 'clean'. Once a week is a recommended norm, but it may be advisable to brush more often if the pitch is heavily used, shaded or subject to pollution.

There is a selection of mechanical brushing machines available that will speed up and lighten the operation. The machines vary in the vigour with which they brush the surface: some are rather fierce and are only recommended for use by experienced operatives and where heavy remedial brushing is needed. Combined brush and vacuum machines are also available from specialist suppliers.

The installer's advice should always be sought when considering the use of any but the lightest machines.

It cannot be overemphasised that to neglect the brushing of this kind of pitch may have serious long-term consequences even if, in the shorter term, the pitch does not appear to suffer. Brushing need not be either time-consuming or onerous, and its benefits are profound. To omit the process may result in a pitch ceasing to drain at half-life or sooner. An un-brushed pitch will look scruffy and be susceptible to moss infestation.

If**,** in spite of the regular brushing described above, or as a result of a lack of it, the surface becomes over-compacted and impervious, this condition can often be corrected by appropriate treatment usually involving the use of specialist machinery. Machines vary from simple scarifiers to elaborate rejuvenation systems. The best of these processes will improve the play characteristics, ball roll and surface/foot interaction and will prolong the useful life of the pitch by a number of years.

1.2.5 Moss and Algae

In certain situations and in some seasons algae or moss can become established on the surface. Since prevention is very much more effective than cure, it is important to treat the affected areas of the pitch with a good proprietary moss-killer and algaecide at least once a year.

Moss is not usually found on the parts of the surface that are trafficked by play, and although it may not be essential to treat these areas it is still a wise precaution to do so. However, particular attention should be paid to perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or are overhung by trees. Any good proprietary product should be satisfactory provided that it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Where moss becomes established it should be treated immediately, the application being repeated until the moss can be brushed and cleared away. In the case of very severe infestation, the installer should be consulted. High-pressure cleaning equipment is available but its use is a skilled process.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this. Regular brushing and regular use of the pitch render moss an even less likely problem.

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1.2.6 The First Month or Two

Immediately after construction there is an initial working-in period during which the final playing surface is created. Seams and inlaid lines will 'bed-in' during the initial few weeks of play.

1.2.7 Play Lines

An artificial grass pitch will normally be supplied with permanently inlaid play lines. However, if additional lines are required for special events, these can be painted onto the surface using water-based paints. Chalk lines can be applied but these tend to leave a lasting powder spread in the area of the line. Permanent lines require no special attention.

1.2.8 Stain Removal

Most stains can be removed easily with a solution of hot (not boiling) water and a household detergent such as washing-up liquid. The removal of chewing gum can be simplified by making the gum brittle with a proprietary aerosol freezing material. Heavy oil marks can be removed with a cloth and white spirit.

1.2.9 Weeds

No matter how much care is taken, weeds may occasionally appear on the surface, usually as a result of wind-blown seeds. Small numbers of weeds can be removed by hand without damaging the surface.

Localised areas of weed seedling infestation can be treated with domestic weed-killers without causing damage to the surface of the pitch. Oil-based weed-killers should not be used.

1.2.9.1 Snow and Ice

Snow and ice are not harmful and can be permitted to melt through. If it is important to remove the snow to enable play to start sooner than would otherwise be the case, brushes or wooden scrapers may be used. Metal shovels or scrapers may damage the surface and should not be permitted. Rock salt and chemical de-icing agents should not be used. In certain cases vacuum-dried salt or urea have been used as effective preventatives when applied in advance of the weather deteriorating.

Provided that the foothold is adequate the pitch may be played on when frozen, but heavy use is to be discouraged because the fibre is relatively brittle at low temperatures.

If heavy rain fails immediately after a very cold spell, the pitch may become flooded for a few hours. The same thing can happen when snow or heavy frost starts to thaw. This is because the sub-surface construction is still frozen, but should not be a cause for concern, since the ice will soon melt and the surface will then drain normally.

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1.2.10 Footwear and General Care

Suitable footwear should always be used. Most shoe manufacturers produce a boot which is specifically designed for the sport played on an artificial grass surface. Some artificial grass systems are designed to take a normal soccer stud but, if any doubt exists, the manufacturer should be consulted.

It is strongly recommended that the pitch should be treated as a 'no smoking' area, since a dropped cigarette can melt the fibres down to the surface leaving an unsightly mark. Chewing gum should also be banned.

1.2.11 Maintenance Schedule

Daily – at end of the days play

- Check fixtures and fittings. Make sure gates are shut.

Weekly

- Clear leaves and rubbish from the area.
- Deal with any new weeds, moss or algae.
- Brush the surface of the pitch.

Monthly

- Outside the fence, check and clear mowing strips and check cleanliness of access paths.
- Check the irrigation system.

Periodically – at least every six months

- Check thoroughly for moss and algae growth, food stains, etc, and remedy as appropriate.
- Check seams, inlaid lines etc, and report any failures to the installer.

Annually

- Treat pitch with moss-killer / algaecide
- Call in installer if any aspect is causing significant concern.

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2. Section Two: Athletics Tracks

2.1 Maintenance of Synthetic Surfaces

2.1.1 Introduction

By their nature, polymeric surfaces are extremely durable, being designed to satisfy arduous performance test criteria whilst withstanding constant spike use in climates varying from the Arctic to the Equator.

However, there is no such thing as a 'maintenance-free' sports surface, and all polymeric track surfaces will require a modest degree of maintenance. This basic maintenance is of vital importance if the surface is to remain good to look at, consistent in performance, safe for the athlete to run and jump on and long lasting. Indeed, the installer's guarantee will usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence.

2.1.2 What Maintenance and Why

Maintenance procedures are designed to ensure that:

- The track surface is kept scrupulously clean
- The track surface is safe for all standards of user
- In the case of a porous system, the free drainage of surface water is maintained throughout the life of the track
- The facility looks attractive and well-kept at all times

These objectives are achieved by:

- Sweeping leaves and other detritus from the surface
- Washing the surface to remove contaminants such as grime, algae, moss, sand, etc
- Applying prophylactic treatments of moss-killer and/or algicide
- Periodically removing weed growth from the perimeter kerb lines

2.1.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles and other detritus should not be allowed to remain on the surface for any length of time. If this does happen, they rapidly rot down, forming a contaminating 'skin' on the surface and providing a growing medium for algae and moss.

A mechanical leaf-sweeper or vacuum cleaner is ideal for removing vegetable matter and other rubbish. Restricted areas may have to be undertaken by hand. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface. Spillage of fuel or lubricating oil may damage the surface, so great care should be taken to ensure that the equipment remains in good mechanical order.

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At least once a year, it is advisable to wash the surface with high-pressure jetting apparatus. There are many varieties of high-pressure washer available for purchase or hire. These can range from a simple hand-held lance through to a tractor-mounted version. The higher the capacity of the machine, the quicker the operation will be completed.

Polymeric surfaces can withstand pressures up to 2000 p.s.i. without suffering damage to the structure. Many commercial washers allow for carefully metered quantities of detergent and fungal inhibitors to be added to the water. These chemicals will help prevent moss and algae from invading the surface.

2.1.4 Access over the Track

At all track venues, both pedestrians and maintenance machinery require regular access to the central grassed area.

It is good practice to provide protection for the track surface at regular pedestrian crossing points, e.g. from the dressing room on to a central pitch. This protection could take the form of roll-out matting to ensure that mud from football boots does not contaminate the track surface.

It is wise to provide plywood or similar sheeting to allow access to the central area for grass cutting machines, etc. The load imposed by such a machine should not normally exceed 1500kg, spread over four tyres.

At some tracks, specially designated crossing points are designed to allow heavy items of plant, such as lorries, forklifts etc, access to the central area. This extra loading is catered for by increasing the strength of the track base works, at the time of construction. Protection of the track surface will still be required in these locations.

2.1.5 Spreading the Wear

The inside lane of a track, along with the start areas, the long/triple jump runways, etc, are subject to a massive amount of wear compared with the outside lanes of the circuit. For this reason, it will extend the useful life of the facility if the athletes use these areas as little as possible in training. This 'athlete management' can be achieved by measures such as coning off the inside lane, etc.

Although the polymeric materials are highly resistant to damage, point loads from sports equipment etc should be avoided; otherwise localised damage to the track surface will occur.

2.2 Maintenance and Storage of Equipment

Simple and straightforward maintenance can, in the long term, save a considerable amount of time and money. It requires a little thought and a regular maintenance plan.

2.2.1 Track Equipment

Track Kerbing

This should be checked regularly for damage. Plastic kerbing is susceptible to cracking as a result of UV light degradation. The sections that are removable for the high jump and steeplechase should have the fastenings and bolts lightly oiled if made from steel.

If, when removed, brackets and pins are also removed, then care should be taken to ensure that no debris in the form of surface crumb etc. falls into the holes and hinders the replacement of kerbing. Kerbing when removed for this purpose should be placed so as not to cause a hazard to other users. The remaining kerbing should be visually checked to ensure that it is secure and undamaged. Any damaged joining brackets or kerbing should be repaired or exchanged at earliest opportunity.

It is a good policy to ensure that vehicles going onto the grass always enter and leave through a section where the kerb has been removed. This avoids damage to the kerbing by trucks and gang mowers.

Starting blocks

These should have the foot plate surface checked. Replacement pads are available and are fitted by screws or by means of contact adhesive according to design. Check that all the fixing spikes are present and straight. Please note that research has shown that, for starting blocks, the ideal length of spike to ensure stability is 11mm. The use of 6mm or 7mm spikes is likely to result in the blocks slipping during use and thereby causing damage to the track. (These shorter spikes are suitable for shoes but not for starting blocks). Check foot plate fittings and lightly oil any moving parts.

Track judges, Timekeepers stands and Starters' stands

These need little maintenance. Oil any wheels and check the metalwork and platforms – particularly the welding joins to ensure that stands are safe to use. If necessary repaint periodically.

Microphones, Amplifiers, Loudspeakers and Electrical Equipment

Check cables for damage and charge batteries. Check that any underground photo-finish cables have watertight ends – any screw on caps should be greased or lightly oiled.

Hurdles

Check regularly for splitting or damaged top boards. Plastic top boards whilst durable can be very dangerous to athletes if spikes leave a sharp spur on the upper surface. A little oil should be put on the bottoms or clips for height adjustment and on the sliding weights. Check that all weights have their mechanism for ease of movement and locking in place. The sliding tubes should be wiped with a lightly oiled cloth, or sprayed with Mr Sheen type polish.

Steeplechase Hurdles

Check tops regularly for splinters or other damage – if damaged either replace or turn upside down until damage can be repaired. Ensure that legs are fixed securely to tops and are vertical. If adjustable hurdles for height then ensure that mechanism for securing at correct height is working correctly. If there is adjustable and moveable water jumps then periodically check that all parts are greased or lightly oiled and that any 'drop in' spacers are easy to put in and take out.

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2.2.2 Equipment for Field Events

Pole Vault Landing Area

Check that all fastenings are intact. Look at the clips and buckles, and especially make sure that the internal fastenings are secure and all the units are held firmly together. Does the wear sheet fit and is it fastened to the base units? Look for depressions in the foam – a sign that the foam is deteriorating. If using pallets, ensure that they do not protrude at any point and that the sides facing the vault are solid-faced so that a pole or athlete's foot cannot go under the pallet.

Take-off box

Keep box painted matt white to assist sighting. If the take-off box has drain holes, clear them out to assist drainage. Check that, if an insert piece is required at the front of the box, it fits securely prior to each use.

Stands

Check that nuts and bolts are tight and that stands are vertical when in use. Lightly oil the base carriage wheels and sliders. Check that the sliders have cast sleeves in them and that the castings are complete. Check the tension on the tape – this works on friction between pulleys and the tape. DO NOT oil the tape or winding mechanism since this will cause the tape to slip. If the winding handle slips, tighten the tension adjustment at the top of the stands by a quarter turn only and try again. Do not over tighten. If winding is tight, loosen the adjustment a quarter turn. If the tape 'grinds' on winding it is likely that the winch pulleys are damaged and the tape may break – usually this requires servicing by the manufacturer. Check that the base rails are not bent – lubricate with light oil and check that the bar support pegs are not bent or loose. Check that support arms are not loose and if there is vertical movement then adjust pulleys on outside of stand to restrict this movement.

Vaulting Poles

Check that glass fibre poles have a bung on the bottom and that it is not worn through. Check that the part of the pole (bottom 30 cms) likely to touch the back of the take-off box is protected with layers of tape. Check poles for deep scratches and cracks – these are likely to cause the pole to break and so injure the athlete. Check cross bars for splitting at the ends and in the centre.

High Jump Landing Area

Check that all fastenings are intact. Look at the clips and buckles, and especially make sure that the internal fastenings are secure and all the units are held firmly together. Does the wear sheet fit and is it fastened to the base units? Look for depressions in the foam – a sign that the foam is deteriorating. If using pallets, ensure that they do not protrude at any point and that the sides facing the jump are solid-faced so that an athlete's foot cannot go under the pallet.

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Stands

Oil any wheels on the stands. Check the tightness of any bolts on the stand base and the uprights. Lightly oil the uprights or use Mr Sheen type polish. Oil the screw threads of the sliders and check that the bar supports are both tight and straight.

Cover

Oil the wheels, jacking points (if any) and the hinges. Check that any locking mechanism is working correctly.

Long Jump/Triple Jump

Lift the take-off and blanking boards and oil or grease any adjusters in the trough (if any) and underneath the boards. If fitted ensure that any lateral movement adjusters are also oiled or greased. Check that no jump indicators fit securely and are not bent. Ensure that plasticine is complete and maintained in good condition. Remove any sand from underneath the no jump indicator. If necessary adjust the blanking and take-off boards level with surface of runway. Check periodically that surrounding turf does not encroach on to runways.

Sand

Check the sand for undesirable materials such as stones, paper, glass etc. If necessary dig over and rake level. Also check sufficient sand is present in the pits. Check the availability of a watering can. Dampen the head of wooden rakes before use. Periodically, if open to the elements and animals, it may be necessary to disinfect or change the sand.

Javelin

Check for straightness, especially the tail end. Check that the grip cords are not frayed or unwinding (they can be glued with 'Copydex'). If possible check length, weight and centre of gravity because the tips wear due to ground conditions and alter the specifications. After use, wipe with a damp cloth to clean off dirt and finish with a dry cloth particularly on the grip if it is wet.

Shot

Often new implements are covered with a glossy paint – to avoid possible damage to athlete's fingers due to the implement slipping the gloss should be rubbed off the surface. After use wipe over with a cloth to remove dirt, then wipe with a dry cloth. Check for correct weight, since shots do lose weight with use –particularly if ground is full of grit or stones.

Discus

Wipe with a damp cloth after use to remove dirt and then with a dry cloth. Check the side plates for a flush and tight fit, and the rim for splits and deep dents. Damaged side plates should be replaced. If there is sufficient weight in the implement then dents in the rim may be filed or smoothed out – this however must be done in such a way as not to end up with a very flat section but must be evened out over a section of the rim. Centre plates, if fitted, may be removed and straightened if they become proud of the body. If the discus develops a 'rattling' noise it is necessary to take the implement apart and extend the spring inside.

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Hammer

Wipe with a damp cloth to remove mud (it may be necessary to use a brush to clean around the swivel) and then dry with a dry cloth. Check that the swivel is moving freely, oil it, and if stiff, use WD 40. If swivel can be depressed into the head and no resistance is felt, then swivel is damaged and should be replaced. If springy resistance can be felt then it is good. Check the wires are not damaged and badly bent. Check the handles for cracks (replace if damaged). Check overall weight of implements: the handles come in different weights so they may need changing to meet specification.

Discus/Hammer cages

Grease hinges, oil pulleys and check hauling ropes for fraying. Check nets for holes and if it does not affect the overall strength then tie together. Ensure that there is sufficient netting steel or fibre at the bottom to fold over and seal the cage, particularly in a wind. Note: the netting of the cage should be hanging free and not tied back to the posts or gate uprights (Rules demand that the opening at the mouth of the cage is 6m).

Scoreboards

Oil wheels if any, dry the shuttered number boards and check they are working correctly. If they get water inside they stick. Check any welding joins for cracks.

Trolleys

Oil wheels and swivels. Check any welding joins for cracks.

Guns

Clean and oil (with Youngs Aquaoil) after each use.

Scales

For electronic scales keep battery charged. For balance scales check that there is a complete set of weights (especially small ones which should be kept in a box). Recalibrate annually or as necessary.

Measuring tapes

Oil the spindle of the winding handle and check that the tape is not twisted. Check the zero end for wear. Periodically unwind completely and wipe clean with a damp cloth before drying.

Clocks

Check for working – replace battery annually. It might be necessary from time to time to re attach ‘hand’ to spindle.

Wind Gauges

Oil screws on the tripods (if made from steel) and check thread in under body of gauge. Check that gauge works and that the calibration is still valid. Replace battery as necessary. If blades are touching the body then need to be replaced by the manufacturer.

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Referee's Kit

Check that all parts are present. Lightly oil the steel tape and micrometer gauge.

Sensible spares to stock:

- Hurdle top bars, clips and buttons
- Pole vault bar supports, runway castings, bar support castings (if appropriate)
- Long Jump plasticine and No Jump indicator boards
- Hammer wires of different lengths, handles of different lengths and weights to suit different heads
- Cages – cable ties to repair nets
- Cross Bars for High Jump and Pole Vault

2.2.3 Storage

Microphones etc.

Wrapped up and in box on shelves out of harm's way. Cables to be coiled neatly. Keep dry.

Hurdles

On a trolley, or stacked normal way up in sets of 10.

Steeplechase Hurdles

If it is impractical to take indoors after each use then they should be stored with feet off the grass and preferably on a small stand to avoid water damage.

Pole Vault Landing Area

Keep base units out of lying water – if possible on a base or pallets under a metal cover.

Pole Vault Uprights

If possible store upright. If not, then support at both ends and in the middle. If stored inside, then store sections on their side with wear cover neatly rolled up. Periodically release slightly the tape tension.

Cross Bars

Store on hooks supported in the middle and at the ends or neatly on racks.

Vaulting Poles

Keep in the original cardboard tubes or in plastic water pipes. Store horizontal and supported at each end and in the mid

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High Jump Landing Area

Keep base units out of lying water – if possible on a base or pallets under a metal cover. If stored inside the store sections on their side with wear cover neatly rolled up.

Stands

Store upright. Alternatively store horizontally supported at ends and in the centre. It is acceptable to store on landing area under the metal cover if this is large enough.

Plasticine No Jump Indicators

(a) Plasticine should be in a sealed bag and kept reasonably warm (20°C).

(b) The bases should be stored upright if possible.

Rakes

Brush clean after use and store upright if possible.

Javelins

Keep upright – preferably in a rack with points resting on a soft surface (wood is acceptable). Do not use plain metal Terry Spring Clips as these damage the javelin paint. Keep javelins of the same weight together. The rack should be in a warm, dry area. Keep training and competition javelins separate.

Shots

Store in a warm dry place on a wooden rack if possible. Otherwise keep shot of the same weight together and clearly marked. Keep competition and training shots separate. (It is not easy to distinguish used training shots from competition shots without weighing and measuring).

Discus

Store in a warm dry place on a wooden rack if possible, preferably edge on, the wood will not damage the side plates. Keep discus of the same weight together. Keep training and competition implements separate

Hammers

Store in a warm dry place on a rack – hanging from handles to keep wires extended. Keep hammers of the same weight together and keep training and competition implements separate.

Scoreboards

Keep upright and assembled if possible, otherwise remove top from base and store upside down.

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Measuring tapes

Store open-reel tapes on a hanging rack and cased tapes in a box– each length separate.

Clocks

Store assembled if sufficient space otherwise store on a rack with clock faces to each other to avoid accidental damage.

Wind Gauges

Store in their original box.

Scales

Store in their original box– on work bench.

Referee's Kit

Keep in box in a secure place. Keep small weights in a small box.

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3. Section Three: Tennis Courts

3.1 General Court Care Common to All Surfaces

3.1.1 Footwear

Good quality tennis shoes are recommended for all surfaces. Training shoes or other types of footwear with bars, studs or sharp serrations on the soles should not be used.

Players will find it advantageous to have two or three pairs of shoes with different sole types. For instance, a smooth sole that may give perfect grip on a dry surface may need to be replaced with a sole with more grip when the same surface is damp or wet. Similarly some sole types may give too firm a foothold on some surfaces which may over-stress knees and ankles etc. Trial and error will soon indicate the optimum sole for any given type and condition of surface.

It is useful to have a notice at the entrance to the court recommending the correct type of footwear. A player wearing incorrect shoes with aggressive soles can do a great deal of damage in a very short time. It is also wise to avoid black soles on painted surfaces because these tend to leave unsightly black marks, which are difficult to remove.

It is advisable to have some form of mat, scraper or shoe-cleaning device at the entrance to the court so that players can clean their shoes before going on the court.

3.1.2 Furniture, Toys and Equipment on the Court

Most surfaces will be indented and therefore damaged by heavy or sharp objects standing on the court. Umpire's chairs, garden seats etc. should not be put directly onto the surface, but boards or pads should be placed under the legs to spread the load.

It is also essential to prohibit roller-skates, skateboards, bicycles, wheelbarrows full of sand and anything else that children may bring on the court and which could do damage to the surface. Family pets should also be excluded.

Machinery being used on the court surface, such as compressors, water-pumps etc. should be stood at all times on a piece of plywood or similar

3.1.3 The Court Perimeter

A strip of ground at least two feet wide outside the surround fence should be kept clear of vegetation at all times to form a barrier against plant and weed encroachment onto the playing surface. This may be done quite simply with an appropriate weed killer. It follows from this that climbing plants such as roses or clematis should not be planted to grow up the surround fencing. Not only may their roots disturb the court surface and their leaves pollute it, but they may cause severe damage to the fencing during high winds.

Shrubs, trees and hedges should be planted as far back from the court as possible, certainly allowing sufficient room between the surround fence and plants for maintenance to be carried out between them.

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3.1.4 Tree Roots

Trees, hedges and shrubs to be planted close to the court should be chosen carefully to avoid any with aggressive root systems, such as poplars and sycamores, as these can cause major disturbance of the surface. If their use is essential, the insertion of a root barrier between the trees and the court is strongly recommended, just as it is when the court has to be sited near mature specimens.

3.1.5 Overhanging Branches

Branches of trees which overhang the court invariably cause problems. Water dripping from the branches may cause slippery or discoloured patches, encourage the growth of algae or moss and sometimes even erode the surface. The secretions of aphids coat the court surface with a sticky blackish substance, which may impair foothold and encourage algae and, in severe cases, damage the surface paint. Last, but by no means least, the droppings of larger birds, such as pigeons and collared doves, can cause damage especially to painted macadam surfaces during the summer months. For all these reasons overhanging branches should be pruned well back.

3.1.6 Substances to Keep Away From Tennis Courts

Cigarettes

All tennis courts should be made a "No Smoking" area. Cigarettes are unlikely to constitute a fire hazard, but cigarette ends will leave unsightly burn marks on most surfaces.

Chewing-gum

This should always be banned from tennis courts. Chewing gum is invariably difficult to remove, although some people advise the use of ice cubes which harden the gum and allow it to be broken away more easily.

Petrol, oil and solvents

Petrol, oil or solvent spillages will seriously damage most surfaces, especially those that are bitumen-bound or are superimposed upon a bitumen-bound sub-base. Great care should be taken to ensure that any machinery used within the court area, such as a garden vacuum cleaner, is clean and in good repair and does not drip petrol or oil. It is strongly recommended that machines be removed from the court surface before refilling with petrol, diesel or oil. In the event of a spillage immediate copious irrigation with tepid water and detergent may minimise the damage.

Salt and de-icing agents

As a general rule salt or other de-icing agents should never be used to remove snow or ice from tennis courts; their effect is unpredictable and they may cause serious damage.

3.1.7 The Net and Net Posts

Do not over-tighten the tennis net. This will cause damage or even breakage of the steel cable and in severe cases may pull the net posts inwards, occasioning a very costly repair.

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A common cause of the net being over-tightened is that the centre band is too short preventing the correct net height from being achieved. The centre band will usually be provided with a screw adjuster and this should be slackened to allow the net to be adjusted correctly, and then carefully re-tightened.

The correct height for the net is 3' 0" (0.914m). The traditional method of using two rackets to provide the correct measurement is no longer practical, because of the diversity of modern rackets. A net measuring stick should be available at all times for this purpose.

The net should always be slackened after use to reduce strain on the equipment and to prevent lower temperatures at night causing the cable to contract and be stressed still further.

It is also a wise precaution to wrap the net over its headband to prevent the net being abraded by the surface as it blows in the wind. If the court is not to be used during the winter, both the net and the net posts should be removed and stored, ensuring that they are first carefully dried.

The winding mechanism should be greased occasionally to ensure smooth and quiet operation and the posts checked for rust. It can also be helpful to lightly grease the post sockets and that part of the posts that fits into the sockets. This can greatly facilitate the removal of the posts, especially if they are left in position for long periods.

3.1.8 Weeds

Before constructing the court, the installer will have applied a good, general weed killer to the site, following the manufacturer's recommended coverage rates. This is usually effective but sometimes some weed growth may occur, either involving highly resistant species or windblown seed. It should not be automatically assumed that the weed-killing process has, therefore, been carried out inefficiently. It is simply that, in spite of all the wonders of modern science, there is no safe herbicide in existence that can be guaranteed to kill all weeds on tennis court sites prior to construction and to ensure that no subsequent growth will take place. Such weed growth that does occur usually represents a temporary inconvenience and only very rarely constitutes a significant threat to the court.

The extent to which weeds may constitute a nuisance will also depend very much on the type of surface and the location of the court. Weeds are virtually unheard of on porous concrete surfaces and are rare on impervious acrylic surfaces. Windblown seedlings can sometimes establish themselves in sand-filled artificial grass surfaces, but usually wither away quite quickly. It is on bitumen-based surfaces, such as grey-green or porous macadam, where troublesome weeds are most likely to be encountered.

Whilst weeds are unlikely to constitute a major problem, they will appear in a small number of cases, more especially in the year following the construction of the court. The secret is to deal with them promptly and not to allow them to become established.

Courts sited in fields, paddocks or other weedy areas or adjacent to suckering trees, may be at increased risk beyond the immediate post-construction period. This is because of tree roots giving rise to suckers and certain weeds, such as creeping thistle, can spread rapidly underground and may re-infest the tennis court site thereby. In these circumstances, it is advisable to maintain a weed-free "cordon sanitaire" around the perimeter of the court by applying a good, general weed killer regularly to a strip of a minimum width of 1 m (3 ft)

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immediately outside the court surround fencing. This will check underground growth before it reaches the court.

Treating weeds

All grass, weeds, seedlings and shallow rooted plants should be treated with a paraquat-based weed killer, thoroughly wetting the foliage of the weeds. The weeds will be quickly scorched, then shrivel and die.

Note:

The paraquat solution is poisonous and any surplus should be disposed of safely. Once the solution is applied to the weeds or surface of the court, however, it no longer constitutes a significant risk to children, pets or wildlife.

Deep-rooted weeds, such as thistles, convolvulus, bindweed, mare's tail, tree suckers, etc. should be treated with a systemic weed killer, spraying all the growing parts of the weed thoroughly with the solution.

These weed killers work by being carried down to the roots of the plant and, therefore, act more slowly than paraquat-based herbicides. The weeds should be left in situ until the weed killer has taken effect. Systemic weed killers will only work very effectively on young, fast-growing weeds and will be less effective late in the summer when the weeds have hardened off and growth has slowed down.

General Hints

Treat weeds as soon as they appear - do not let them become established.

When the weeds are dead they may be carefully removed. Great care should be taken not to disturb the surface of the court. A sharp, narrow-bladed knife may be useful for cutting off thick weed stems below the surface. If the weed has lifted the court surface, it should be carefully trodden down with the flat of the foot once the weed has died.

If very deep-rooted weeds persist in spite of the spot treatment described above, advice should be sought from either the installer or a specialist weed-killing company.

3.2 Porous Macadam Courts

3.2.1 Introduction

Porous macadam tennis courts consist of a permeable foundation of broken, graded stone, on which is laid the macadam base-course and wearing course (or playing surface). This is then coated with a coloured, acrylic surface coating. The play-lines are then painted onto the coloured surface, but self-adhesive tapes may also be used.

The resulting tennis surface is fully permeable, hard-wearing, and playable throughout the year and requires relatively little maintenance. But however modest this maintenance requirement, it is, nevertheless, of vital importance if the surface is to remain good to look at, good to play on and long-lasting. Indeed, the installer's guarantee is likely to be conditional upon the recommended maintenance requirements being carried out with reasonable efficiency.

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3.2.2 What Maintenance and Why

The maintenance procedures are designed to ensure that:

- The playing surface is kept scrupulously clean.
- The free drainage of surface water is maintained throughout the life of the court; and that.
- The court looks attractive and well cared for at all times, and achieves a reasonable life span.

These objectives are achieved by:

- Sweeping or vacuuming leaves and other detritus from the surface.
- Occasionally washing the surface.
- Applying prophylactic treatments of moss-killer.

3.2.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles, fluff from tennis balls and other detritus should not be allowed to remain on the surface for any length of time. If this happens they rapidly rot down and settle into the interstices of the surface impairing drainage and providing a growing medium for algae and moss.

A wide soft broom can be used to sweep the surface but this has a tendency to push smaller material into the surface. A rubber-tined rake is usually better, albeit rather slow and arduous. Best of all is a mechanical garden vacuum cleaner, which will greatly speed up the operation and do it more efficiently. Mechanical leaf sweepers can also be good. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the playing surface.

At least once a year the court surface will benefit from a vigorous wash.

This not only has the effect of keeping the surface interstices clean and free-draining, but is also essential for maintaining good foothold. Courts near busy roads are particularly susceptible to becoming coated with "traffic film", whilst those near trees may become coated with "honey-dew" from aphids. The resulting black film from either cause can make the courts very slippery after rain.

If the water pressure is reasonably high, washing can be carried out with a domestic hose-pipe assisted by a mild cold water detergent. Even more effective are the cold water pressure washers that are available from most equipment hire outlets. These must be used with care, however, the greatest attention being paid to establishing that the process is not dislodging the coloured surface coating or stone chippings. Again mild, non-foaming detergent increases the efficiency of the operation. Steam cleaners should not be used. If the court surface has become very badly sealed and does not respond satisfactorily to this treatment, consult the installer or a firm that specialises in cleaning tennis courts.

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3.2.4 The Post Construction Period

The installer will have indicated when play can commence on the new surface, and his instructions should be followed meticulously. Thereafter, for the first few months the surface will still be slightly "tender" as the bitumen and surface coating achieve their final hardness. Whilst the surface can be kept in full and normal use, as with a new motor car, a little extra care and vigilance will pay dividends. In particular unsuitable footwear and other bad habits such as "racket abuse" should be prohibited, especially in warm weather.

On a very new court water will sometimes stand on the surface after heavy rain. This is a very temporary phenomenon resulting from surface tension, and should not cause concern unless it persists.

3.2.5 Play in Hot Weather

The modern porous macadam tennis surface can be produced with special additives to lift the temperature at which it softens in hot weather, significantly above that which renders normal macadam surfaces unusable. The surface coating is also beneficial in this respect.

Nevertheless, a court may still soften in hot weather, especially in the first season after construction. Thereafter the tendency to soften should diminish rapidly.

If the surface softens play should be stopped immediately, because serious damage can result from continuing to play. The first sign of the problem is usually when black marks begin to appear as a result of the paint being rubbed or scuffed off. It is sometimes possible to cool a hot surface by hosing it down with cold water to allow evening play to take place.

Softening is a phenomenon usually confined to the first season, but, even thereafter for a year or two, the surface should be checked if very hot weather is experienced.

3.2.6 Bird Damage

An unusual nuisance that may sometimes be experienced is damage caused by bird droppings. This is usually only a significant problem during the first year or two of the court's life, during the summer months, or where branches overhang the court.

The droppings adhere to the surface, dry out in warm weather and shrink. In the process the paint coating and even stone chippings may be pulled off.

The remedy is to cut back overhanging branches. If the droppings are already in situ they should be hosed away. Damaged spots should be carefully firmed with the foot and touched up with surfacing paint.

3.2.7 Worms

Another rare cause of surface damage is that caused by worms. In mild, wet weather worms sometimes appear on the court surface, usually in ones or twos but very occasionally in larger numbers. How they get there is something of a mystery, but once on the surface they seem unable to get any further and usually die. In warm weather, they then adhere to the surface and shrink causing very similar damage to bird droppings.

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Worms on the playing surface should be removed as soon as possible. Damaged spots should be carefully firmed with the foot and touched up with surfacing paint.

If the problem persists consideration should be given to applying an appropriate worm-killer. Repeat applications may have to be made, copiously watered in, to ensure that the subsoil beneath the courts is impregnated.

3.2.8 Snow and Ice

Snow and ice should not prove harmful and can be allowed to melt through in due course. Powdery snow can be swept away using a wide soft broom or wooden scraper. Metal shovels or scrapers should not be used because they may damage the surface, as ill mechanical snow removing equipment, such as mini tractors.

Do not use salt, urea or other chemical de-icing agents. Their effect is unpredictable and they can cause severe damage.

3.2.9 Maintenance Schedule

Daily - at the end of the days play

- Make sure the net is slackened and rolled up in the middle
- Make sure the gate is shut.

Weekly

- Clear leaves and rubbish from the court.

Monthly

- Deal with any moss or algae.

Annually

- Wash the court.
- Apply moss-killer
- Call in the installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the court, call in the installer immediately. It is better to be safe than sorry.

3.3 Maintenance of Sand-Filled Artificial Grass Courts

3.3.1 Introduction

Most sand-filled artificial grass tennis courts consist of a permeable sub-base, usually of macadam, upon which is laid a tufted, polypropylene fibred carpet. The fibres vary in length and density. The carpet, which is loose laid, not adhered to the sub-base, is then dressed with graded silica sand, which fills the interstices between the fibres to within about 3mm of the fibre tips. The weight of the sand is sufficient to keep the carpet firmly in place. Play-lines are either tufted into the car pet and are therefore integral with it, or are subsequently cut in using similar carpet materials of the appropriate white or yellow colour.

Occasionally play-lines are painted onto the surface, but these are decidedly temporary and need frequent re-painting.

The resulting tennis surface is fully permeable, hard-wearing and requires only a modest amount of maintenance. This maintenance is, nevertheless, of vital importance if the surface is to remain good to look at, consistent in play, permeable and long lasting. Indeed, the installer's guarantee will usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence.

3.3.2 What Maintenance and Why

Maintenance procedures are designed to ensure that:

- The playing surface is kept scrupulously clean;
- The play surface is level and of consistent texture to give a true and predictable game;
- The free drainage of surface water is maintained throughout the life of the court; and that
- The tennis court should look attractive and well-kept at all times.

These objectives are achieved by:

- Sweeping leaves and other detritus from the surface;
- Brooming the surface to freshen the fibre surface, counteracting any
- Slight sand drift or compaction and counteracting any tendency to
- Form an impervious skin on the sand surface that might impair drainage;
- Applying prophylactic treatments of moss-killer and/or algaecide.

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3.3.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles and other detritus should not be allowed to remain on the surface for any length of time. If this does happen, they rapidly rot down forming a drainage-inhibiting "skin" within the surface, and providing a growing medium for algae and moss.

A wide soft broom or a rubber-tined rake is ideal for removing vegetable matter and other rubbish. Better still, a mechanical leaf-sweeper or garden vacuum cleaner will greatly speed-up the operation. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface. Both sweepers and vacuum cleaners may tend to remove rather too much sand during the first few months of the life of the surface, but thereafter this should cease to be a problem. Some disturbance of the surface of the sand may be a positive benefit (see Brooming below).

Brooming

Brooming the surface is a crucial operation if premature loss of appearance and drainage is to be prevented. Apart from freshening the look of the surface (rather like a lawn mower striping a lawn), the purpose of regular and fairly vigorous brooming is to prevent the formation of a compacted and impervious skin on the top of the sand-layer which will inhibit drainage and encourage moss and algae. A three-foot wide broom with bristles of medium stiffness is best; the installer should be able to recommend or supply the correct type. It can be dragged over the surface or, better still, pushed. Brooming should ideally be done in both directions: in the length of the court and then at right angles across it, but if this is too time-consuming, the direction of brooming can be varied from time to time.

The recommended frequency of brooming must depend on the amount of use the court receives and whether its location is open and "clean". Once a month is a recommended norm, but it may be advisable to broom more often if the court is heavily used, shaded or subject to pollution. Similarly a little-used court, for instance in a domestic garden, will come to no harm if the intervals between brooming is longer, provided the location is open and clean.

There is a selection of mechanical brooming machines available, which will speed up and lighten the operation and these are recommended at clubs and other venues where there are several sand-filled artificial grass courts. The machines vary in the vigour with which they broom the surface: some are rather fierce and are only recommended for use by experienced operatives and where heavy remedial brushing is needed. Combined brush and vacuum machines must be used with even greater care because sand brushed and sucked from the surface may be very difficult to replace, especially when the court is well worn.

The installer's advice should always be sought when considering the use of any but the lightest machines.

It cannot be overemphasised that to neglect the brooming of this kind of court may have serious long-term consequences even if, in the shorter term, the court does not appear to suffer. Brooming need not be either time-consuming or onerous, and its benefits are profound. To omit the process may result in a court ceasing to drain at half-life or sooner. An un-broomed court will look scruffy and be susceptible to moss infestation.

If, in spite of the regular brushing described above, or as a result of a lack of it, the sand-filled surface becomes over-compacted and impervious, this condition can often be

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corrected by appropriate treatment usually involving the use of specialist machinery. Machines vary from simple scarifiers to more elaborate proprietary machines that remove a proportion of the sand from the carpet, which is then replaced with new sand. The best of these processes will prolong the useful life of the carpet by a number of years.

3.3.4 Moss & Algae

In certain situations and in some seasons algae or moss can become established on the court surface. Since prevention is very much more effective than cure, it is important to treat the court with a good proprietary moss-killer and algaecide at least once a year.

Moss is not usually found on that part of the surface that is trafficked by play, and although it may not be essential to treat these areas it is still a wise precaution to do so. Particular attention should, however, be paid to those perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or are overhung by trees. Any good proprietary product should be satisfactory provided that it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Where moss becomes established it should be treated immediately, the application being repeated until the moss can be brushed and cleared away. In the case of very severe infestation, the installer should be consulted. High pressure cleaning equipment is now available but its use is a skilled process.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this. Regular brooming and use of the court renders moss an even less likely problem.

3.3.5 The First Month or Two

Immediately after construction there is an initial working-in period during which the final playing surface is created.

Initially the court surface will be left rather sandy, but full penetration of the sand infill into the polypropylene fibres and its subsequent compaction into a uniform playing surface occurs naturally, especially as a result of rainfall and initial play. This process usually takes two to three months.

During construction every effort is made to ensure even distribution of sand over the whole court. Experience, however, shows that increasing the frequency of brushing in the early weeks of use is beneficial in creating the final playing surface.

If areas are found which are short of sand it should be possible to brush the sand into them from adjacent areas of ample or surplus sand, provided this is done within the first few weeks. If however, the under-sanded areas are damaged extensively or do not respond to this treatment, the installer should be called in immediately.

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3.3.6 Play-Lines

An artificial grass court will normally be supplied with permanently in-laid playing lines. However, if additional lines are required for special events, these can be painted onto the surface using water-based paints. Chalk lines can be applied but these tend to leave a lasting powder spread in the area of the line.

Permanent lines require no special attention.

3.3.7 Stain Removal

Most stains can be removed easily with a solution of hot (not boiling) water and a household detergent, such as washing up liquid. The removal of chewing gum can be simplified by using ice cubes to harden the gum. Heavy oil marks can be removed with a cloth and mentholated spirits.

3.3.8 Weeds

No matter how much care is taken, weeds may occasionally appear on the surface, usually as a result of wind-blown seeds. Small numbers of weeds can be removed by hand without damaging the surface. Localised areas of weed seedling infestation can be treated with domestic weed killers without causing damage to the surface of your court. Oil-based weed killers should not be used.

3.3.9 Snow and Ice

Snow and ice are not harmful and can be permitted to melt through. If it is important to remove the snow to enable play to start sooner than would otherwise be the case, brushes or wooden scrapers may be used. Metal shovels or scrapers may damage the surface and should not be permitted. Rock salt and chemical de-icing agents should not be used.

Provided that the foothold is adequate the court may be played on when frozen, but heavy use is to be discouraged because the fibre is relatively brittle at low temperatures.

If heavy rain falls immediately after a very cold spell, the court may become flooded for a few hours. This is because the sand beneath is still frozen, but should not be a cause for concern, as the ice will soon melt and the surface will then drain normally.

3.3.10 Footwear and General Court Care

Suitable footwear should always be used, i.e. good quality tennis shoes.

If the court is used occasionally for other sports, a multi-studded boot with a stud length of 1/4" will be satisfactory. Metal studs must not be used.

It is strongly recommended that the court should be treated as a "no smoking" area as a dropped cigarette can melt the fibres down to the surface leaving an unsightly mark. Chewing gum should also be banned.

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3.3.11 Maintenance Schedule

Daily - at end of the days play.

- Make sure the net is slackened and rolled up in the middle.
- Make sure the gate is shut.

Weekly

- Clear leaves and rubbish from the court.
- Deal with any new weeds, moss or algae.

Monthly

- Broom court to redistribute sand. Check sand levels.

Periodically - at least every six months.

- Check for moss and algae growth, food stains, shoe marks etc. And remedy as appropriate.
- Apply grease to the net winding gear.

Annually

- Treat court with moss-killer / algaecide.
- Call in the installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Cleaning, brooming and court inspection can always be done more frequently; Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the court, 'call in the installer immediately; It is better to be safe than sorry.

3.4 Maintenance of Acrylic Courts

3.4.1 Introduction

Impervious acrylic tennis courts consist of an impermeable foundation of crushed, graded stone topped with one or two courses of dense asphalt. Concrete is sometimes used instead of asphalt.

This foundation is then coated with a number of applications of coloured, acrylic surfacing compound, the details of the process depending upon the system used. To improve comfort "cushioned" layers may be interposed between the foundation and the acrylic surfacing layers.

Play-lines are painted on the surface.

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The entire court is laid to a gradient, usually a cross-fall, to assist rainwater run-off.

The resulting court provides excellent playing conditions; indeed approximately half of all top level tennis tournaments worldwide are .played on this type of surface. The courts require very little maintenance, are hard-wearing and are relatively easy and inexpensive to resurface.

It is important to remember, however, that the surface is completely impervious and that rainwater may take some time, especially in the UK climate, to run off and evaporate. If play is required to take place before the surface has dried naturally, special squeegees have to be used to remove excess surface water.

3.4.2 What Maintenance and Why

The maintenance procedures are designed to ensure that:

- The playing surface is kept scrupulously clean, to preserve its
- Playing characteristics; and
- The court looks attractive and well cared for at all times, and
- Achieves a reasonable life-span.

These objectives are achieved by:

- Sweeping or vacuuming the surface to remove leaves and other detritus; and
- Washing the court surface regularly to keep it clean.

3.4.3 Keeping the Surface Clean

Leaves, pine needles, dust, dirt rubbish and all other detritus should be removed from the surface regularly using a wide broom, (medium to soft bristles, not too stiff or hard) or, better still, a garden vacuum cleaner. If the latter is used, it should be well maintained and carefully operated to avoid contamination or physical damage to the surface.

At least twice a year, (and more often if the courts are heavily used or are in a location subject to pollution by traffic fumes, aphid secretions etc.), the surface should be thoroughly washed using cold water from a hose pipe and a soft-bristled broom. Stains can be removed with mild detergent.

Surface moulds and algae may be a problem in shaded areas, especially during damp periods. They can usually be removed very effectively by washing with diluted domestic bleach. The bleach should be diluted to at least three parts of water to one part of bleach. The solution can be left on the surface for up to half an hour, but should then be thoroughly washed away with copious quantities of cold water.

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3.4.4 Monitoring the Surface

Keeping the surface clean is the only routine maintenance that the court surface should require. In the unlikely event of other apparent defects arising, such as cracks or crazing, the installer should be consulted. The surface should also be maintained to enable surface re-coating to be scheduled when required. A newly-laid surface should give firm foothold and good medium-paced game. As the surface is used over the years, however, it will become smoother and more polished. This may result in a somewhat faster game and, eventually, some impairment of the foothold when the surface is damp. When this happens it will be time for the surface to be re-coated. How often this will be needed varies considerably depending upon the system used, the intensity of use and the requirements of the players. The likely re-coating requirement should be discussed with the installer when the new court is handed over, and the condition of the surface maintained in accordance with the recommendations.

3.4.5 Maintenance Schedule

Daily - at the end of the days play.

- Make sure the net is slackened and rolled up in the middle.
- Make sure the gate is shut.

Weekly

- Remove dust, leaves, rubbish and other detritus from the surface.

Monthly (or thereabouts depending upon the cleanness of the surface).

- Wash the surface, removing stains with a mild detergent and soft brush.

Annually

- Check the court surface carefully. Call in the installer if there is any cause for concern or it is suspected that the surface needs re-coating.

Note:

These are minimum recommendations. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the court, the installer should be contacted. It is better to be safe than sorry.

3.5 Maintenance of Shale and Clay Courts

3.5.1 Introduction

Unlike all other types of tennis surface in common use today except natural grass, shale and clay courts are only made fit for use by the regular implementation of detailed maintenance procedures. Given regular and expert maintenance these surfaces can provide playing conditions of the very highest quality; indeed clay courts are still used for many major international tournaments throughout the world. In the absence of this regular and expert maintenance, however, the court surface can deteriorate rapidly and may become unusable.

The installation of these types of court should only be contemplated, therefore, if adequate resources can be made available to maintain them, and unless there is a strong commitment to apply those resources on a permanent basis. However, it also has to be said that some types of clay court require less maintenance than others.

"Continental clay" from mainland Europe and the "fast-dry" surfaces from North America require less maintenance and are easier to keep in first class condition than indigenous UK clay courts. The difference is that the typical UK court can be kept in play in non-frosty weather throughout the winter whereas the overseas versions cannot.

There is one final point that needs to be emphasised by way of introduction. There is a limit to which the maintenance of these courts, especially the indigenous UK version, can be reduced to a set of instructions which, if followed by maintenance staff, can produce the optimum result. There is a point at which the instincts and experience of a successful grounds man must be allowed to take over and for which there is no written substitute if the best results are to be consistently achieved.

3.5.2 Some General Principles

All surfaces in the clay or shale category work on the same basic principle. A graded surfacing material, which may be clay (e.g. crushed brick or roofing tiles etc.), shale (e.g. crushed burnt pit shale or Scottish "blaes"), or fine crushed rock from various sources is transformed into a smooth and firm playing surface as a result of watering and rolling. In fact, most successful products are a blend of two or more of these materials. In particular, very fine shale or gypsum is frequently added to improve the cohesive qualities of the surface, or "bind".

The bind or cohesiveness which is so essential if the surface is to remain stable during play, results from the hygroscopic action of the water, the inherent cohesiveness of the clay, limestone or additives, and mechanical compaction resulting from the grading of the material and rolling. Usually all three sources of bind are needed to produce a successful playing surface. Thus a surface that has dried out will be brittle and will break up quickly, the mechanical bind alone being insufficient to hold it together. Similarly a poorly graded material will be difficult, if not impossible, to prepare for play because the mechanical binding properties are not present.

Finally, to complicate further the design and maintenance of these surfaces, the court must recover reasonably quickly from any rainfall that may be expected during the intended playing season, and must therefore be sufficiently permeable and without any undue tendency to become sticky underfoot.

It follows from the above that the maintenance regimes that are recommended for the various surfaces in this general category, all centre around first wetting the surface, and then rolling it. It further follows that the surface must remain sufficiently damp while in use to prevent it breaking up and becoming loose or pitted. Thus the availability of an adequate water supply and an efficient means of applying it to the court are no less essential than the availability of adequate, properly equipped and trained ground staff.

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The basic principles of maintenance can be slightly elaborated by saying that it is normally desirable, if not essential, to repair any damage or disturbance of the surface before watering it. Following watering it is also usually desirable to broom or drag the surface before rolling to counteract any disturbance or stickiness caused by the watering. The basic maintenance format can therefore be restated as:

- Repair - Water- Brush - Roll

It is not always necessary to follow this routine strictly, provided the basic principle is understood. The various materials differ in the degree to which it is possible to omit one or more of the four basic operations, (although watering and rolling are always essential), and sometimes it becomes desirable to deviate from the basic routine to produce a given result. For example, brushing, dragging or brooming a dry surface is usually highly undesirable because it will break up the surface cohesion and leave the surface very gritty. Sometimes, however, this is a desirable result if, for instance, the surface has become over-consolidated. There are other exceptions to the general rule of repair, water, brush, roll which will be mentioned later.

3.5.3 Tools and Equipment

The basic equipment needed is:

- Motorised roller and/or hand roller
- Broom - semi stiff 3ft wide
- Broom - soft 3ft wide
- Drag mat
- Line brush
- Loot (wooden scraper)
- Rubber rake
- Hose pipe and sprinkler rose
- Standard general purpose tools, e.g. wheelbarrow, garden fork, shovel, buckets, string line etc.

The roller

These days' people expect rollers to be motorised and this does, indeed, take most of the hard work out of the operation of rolling, and greatly speeds it up. A motorised roller is a must for a multi-court installation. However, it should not be forgotten that a clay court can be kept in excellent condition with a good quality hand roller, and if funds allow a hand roller should be provided in addition to the motorised roller. It will be very useful for localised repairs, and a valuable stand-by in the event of mechanical failure.

The installer's advice should be sought about the choice of motorised roller. The pedestrian or tandem rollers commonly used in footpath construction, and which are freely available from plant hire companies, are not really suitable for use on clay courts. They are too heavy,

often have rollers too small in diameter and in other respects are far from ideal. In particular, the roller is not required to vibrate, and it is better not to tempt providence by using a roller that will vibrate if required, as it could do untold damage. More suitable sports surface rollers are available, and the installer will be able to advise.

Whatever type is selected, the motorised roller requires careful maintenance and above all must not have a "snatchy" brake or reversing mechanism. Sudden or jerky stopping and starting can cause considerable damage to the surface. Suitable rollers will vary somewhat in weight but as a general rule should be around 1 /4 tonne (4-5 cwt) per roller (i.e., 1/4 tonne if of the pedestrian type, or 1/2 tonne if a two roller ride-on type). The hand roller should also weigh around 1/4 tonne. It should be of "double-cylinder" construction and have rounded not sharp edges. The twin cylinders act like the differentials on a car and make the roller much easier to turn and less likely to shear the surface.

When the court is damp, the surface material may adhere to the roller. It should be provided, therefore, with an efficient scraper to keep the roller surface clean. A good scraper can be improvised by wrapping hessian around a piece of wood, or by fixing a wide, semi-stiff broom so that it continuously cleans the roller.

The brooms

The brooms or brushes should not be less than three feet in width. They should be dragged and not pushed. The semi-stiff broom, which works as a "scarifier", can be wider still although five feet is about the widest that can be managed. The soft broom, which is for final preparation work, is plenty wide enough at three feet.

Once again, brooms should be in good condition and kept clean. Brooms with badly worn bristles can be used as roller scrapers!

The so-called "whale-bone" drag brushes are too fierce for most tennis court maintenance and should only be used with great caution. A narrow line-brush will be required to clean the line marking tapes. Excellent mechanical line-brushes are available.

The loot (wooden scraper or toothless rake)

This essential piece of equipment must be kept in good condition. With hard use the blade will wear, cease to be straight, and develop round edges. When this happens it should be planed straight or replaced.

Rubber rake

This is ideal for removing leaves and other debris without disturbing the surface.

Drag-mat

This is usually a homemade article consisting of old hessian bags, door mats, carpet or even an old coir gym-mat. It is dragged over the surface to level off disturbed surface material. Flexible metal drag-mats are also available and can be very good, if a little "fierce".

Hose pipe and sprinkler rose

All too often these days' water supplies are totally insufficient for watering hard courts. The bigger the bore of hose that can be used the better. 3/4" is a minimum, with 1" better still.

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The rose should not be too fine or the flow of water will be seriously restricted. A hosepipe is an essential item even if a permanent sprinkler system is installed. If a permanent system is not available and mobile sprinklers are used, the model chosen should be simple, robust and should not restrict the flow of water too much. Small, fine mist sprays are not very helpful and in hot weather completely ineffective.

Permanent irrigation systems

These, too, come in various forms. They are all designed to soak the whole of the court area at the turn of a valve by means of spray lines or pop-up jets down the sides of the courts.

They are great time savers. No-one has entirely solved the problem of wind which can affect even this type of system, but a well-designed installation will be reliable in all but the worst conditions.

The sprinkler lines or heads should be inspected regularly to ensure that a proper spray pattern is maintained. A partially blocked spray jet dribbling onto the court can dig a surprisingly large hole in a very short time.

3.5.4 The Basic Maintenance Operations

The basic maintenance operations such as repairing, brushing, watering and rolling are generally common to all types of surface, varying only in detail from one to another.

Repair

The maintenance sequence normally starts after the courts have been used and need to be restored before further use.

After use the court surface will have been disturbed to a greater or lesser extent and the first operation, before anything else is done, is to replace displaced material. Individual areas can be dealt with using the loot, pushing and pulling the loose material back into place and tamping it lightly with the flat edge of the loot blade if the damage is fairly deep.

If the damage is minor the loot may not be needed at all, going over the whole court once or twice with a drag broom, (usually the soft one), or a drag mat being all that is necessary.

Whether or not the loot is needed, drag brushing or drag matting is the operation that precedes watering and rolling (or just rolling if the material is moist enough).

When dragging a mat or brush, the operation should be performed systematically and with precision. Lifting the brush or mat will leave a ridge of loose material behind, so it is better to operate continuously, turning without stopping at the ends or sides. The straight systematic patterns on the surface are the sign of a conscientious and methodical grounds man.

If there is foreign matter on the surface, such as leaves or excessive large grit, then some of this can be removed by lifting the brush away at the end of the court and looting off the ridge of grit and debris left behind. If there are a lot of leaves or foreign matter it is better to take them off first with a rubber rake.

Occasionally, deeper holes may need repairing, usually at the baseline. Looting material into these may not be successful because this material will tend to be gritty and loose and soon

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comes out again. If this is the case, the hole should be made up with a little new surfacing material, tamping lightly before watering. If the base of the depression is smooth it is important to scarify it lightly with a fork to give a key for the new material.

Repair of larger depressions or areas of damage is dealt with elsewhere.

The most important thing of all is to perform this repair operation as soon as possible after play has ceased. If rain falls on the court after play but before the repair operation, it will be much more difficult to carry out and some of the benefit of the free watering will be lost. The sensible grounds man will always try to avoid leaving a court unrepaired for a moment longer than is necessary.

Remember:

- Repair before watering or rolling.
- Repair as soon as possible after play ceases.

Watering

There is nothing better than rain for watering a tennis court. Unfortunately there is a tendency for Mother Nature to overdo (or under do) the quantity of water and her timing is not always perfect. Nevertheless, the grounds man will keep his weather-eye open and make the most of the UK climate. It can save him a great deal of work (and water bills).

Failing rain, the water must be applied artificially by:

- Hand watering with a hose pipe;
- Portable sprinkler; or
- Permanent irrigation equipment.

Hand watering

This is a good method only if the water supply is copious and the pressure reasonably high. But with a 1 inch hose and a coarse spray the job can be done remarkably quickly. The disadvantage is obviously that the operation is labour intensive, but there are also advantages. The water can be put exactly where it is needed, in exactly the right quantity. No automatic sprinkler has ever been invented that does this.

The water should be directed slightly upwards to allow the water to fall on the surface rather than being aimed straight at it with the danger of washing it away.

Always apply plenty of water, sufficient to soak right through the surface. Half way through is not good enough, and can cause serious problems. Be careful when pulling a hose-pipe over the playing surface, especially if it is a heavy rubber one, as it can cause damage.

Portable sprinklers

There are a large number of mechanical sprinklers available on the market. Many are good, being reliable, effective, and robust. However, some are lightweight and gimmicky, being designed for small gardens, low water pressures and 1/2 inch hose-pipe.

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The latter should be avoided in preference for simple, robust designs that put down as much water as possible in a short time. Sprinklers that give mist sprays over large areas should be avoided: they are often of little use, especially in windy or hot dry weather, much of the water blowing off the court area, or evaporating before it can soak in.

The sprinkler should be positioned so as to cover as much of the court as possible, taking into account the direction of the wind. It is rarely possible to soak the whole area of a court this way, but areas missed can be quickly watered by hand.

Remember:

- Thoroughly soak the surface right through.
- Rain is the best watering system of all. Be prepared to take advantage of it.

Brushing

After watering and before rolling, the surface should normally be brushed lightly with the soft broom.

The watering process will leave an uneven and often unsightly pattern of whorls on the surface. Brushing will obliterate these, before rolling completes the maintenance process.

Where water has stood before draining away, the surface may be sticky because the very fine clay suspended in the water has been filtered out by the surface. The process of brushing will break the skin of stickiness and bring a small amount of fine grit to the surface to give a better surface for rolling.

Timing of the operation is important. It should not be carried out too early, when the surface is still wet and too sticky, nor too late, when the drying surface will become too gritty to roll down properly. At this stage the brushing, by dragging the broom, should be neatly and carefully carried out, turning and not lifting the broom at the ends. The brush lines should be kept straight and of even width. They will help to a good-looking surface as well as a good one to play on.

Remember:

- Time the brushing correctly: not too early; not too late.

Rolling

Rolling is ostensibly a very simple operation, but one where the basic principles are more than usually important.

When rolling a steady and even pace should be maintained, rolling methodically so that the entire surface receives the same amount of rolling at the same time.

The roller should not be stopped, started or twisted suddenly: all movement should be slow and controlled. When arriving at the end or the side of the court the movement over on to the next pass should be made slowly so there can be no chance of the twisting action of the roller shearing the surface. This is why a double cylinder roller with rounded edges makes the operation easier and less likely to cause damage.

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These recommendations are all the more important when a motorised roller is used.

A vibrating roller should never be used. If the only roller available is of the type that can be made to vibrate, it is a good idea to ask a mechanic to render it impossible to engage the vibrator.

"Shearing" is one of the most difficult problems encountered in clay court maintenance. It is caused by a "shear line" developing between the surface layer and the foundation, or within the surface layer itself. Whatever the cause and wherever the shear-line is, the result is the same. The uppermost part of the surface becomes more or less permanently detached and will not re-attach itself automatically. The visual indication of shearing is close horizontal parallel wavy cracks in the surface, which are usually noticed after the roller has passed.

No amount of rolling will correct the situation. Sideways pressure with the foot will result in the unattached layer being pushed off altogether. A player running to recover a ball and stopping or turning on a sheared layer will lose all grip and displace deep divots.

The most frequent cause of shearing is careless rolling, such as over-sudden stopping and starting or changes of direction. Even more problematical is rolling the surface when, after frost, the surface has thawed but is still frozen lower down. A whole court can be sheared and ruined in a few minutes in this way.

When starting rolling it is important to make sure that the surface is not too wet. If it is, excessive amounts of dressing will cling to the roller, and it is then better to wait until the surface is drier.

A dry surface should only be rolled if it has become exceptionally powdery and loose and needs watering. If it is watered in a very dry, loose, unbound state, there is a danger of working the fine particles through. One pass of the roller will prevent this - a rare example of where the surface should be rolled before watering.

The surface should be rolled in, straight, consistent lines and patterns. The roller marks will remain behind when the court is returned to the players. Like the patterns left on a grass court by the mower they create a good impression.

The direction in which rolling is carried out should be varied, alternating between rolling lengthways and across the court. Consistent rolling in one direction results in the surface beginning to wave or undulate, a tendency more pronounced the smaller the diameter of the roller.

Rolling, like all other maintenance operations, will be much more difficult with the post and net in position. A good grounds man makes sure the net posts can be lifted out quickly and easily and that there is an efficient lid on the sockets.

The surface of the roller should be clean at all times. Even if a roller scraper or brush is attached, lumps of fine, sticky material sometimes build up on the surface of the roller drum. The bigger the lumps get, the more obvious the pattern they stamp into the court surface, and they should therefore be scraped off.

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3.5.5 Finishing Touches

After rolling, only final tidying and preparation is required, before play can commence.

The play-lines must be swept clean of grit and dust, either by hand with a special, narrow brush or with one of the small brushing machines made for the purpose.

Any loose bits, pieces or lumps that have fallen from the roller should also be removed.

The net should be replaced, and a final check made that everything is complete, neat and tidy. The court should now be ready for play.

3.5.6 Moss Control

Normal routine maintenance should prevent weeds from becoming established on the surface, but moss can be a problem, especially in shaded perimeter areas or if the surface is heavily compacted. It should be treated with a proprietary moss-killer, and when brown and dead the moss should be carefully removed with loot. A further, preventative application of moss-killer is then a good idea.

3.5.7 Salt in winter

Traditional UK clay or shale surfaces are designed to be used during open weather in winter. They are, however, quickly put out of action by frost and this can happen even until late May. To reduce the effect of frost common salt may be used.

Rock salt cannot usually be obtained crushed sufficiently fine, so vacuum dried salt is to be preferred, which is easily obtained from chemical merchants. It should be applied evenly to a damp surface at a rate of approximately 100kg per court. Top up applications can be made as required. Too much salt, however, makes the surface sticky, and if this happens no more should be applied until the rain has washed through the excess salt. Salt is not easily stored so only sufficient should be purchased to meet immediate requirements.

3.5.8 Deliquescent in summer

Salt, which may be used in frosty periods in winter, is also an effective deliquescent, i.e. it attracts and retains moisture in the surface, slowing down the rate at which the surface dries out and reducing the need for frequent watering.

Vacuum-dried salt should be dressed evenly over a damp surface at a rate of 100kg per court per application. Once again, it should be remembered that too much salt will make the surface sticky. An even more effective deliquescent is calcium chloride, which is easily obtained from local chemical merchants. It is, however, even more difficult to store than salt. It should be applied just like vacuum dried salt, but not in excess because it too will make the surface sticky.

3.5.9 The Post-Construction Phase

Shale and clay courts require some time to settle down after construction and, depending on the type, may take anything from one to six months of restricted use before they cease to be "tender" and are ready for full and normal use.

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Leaving the courts to lie "fallow" after construction serves no useful purpose, indeed quite the reverse. Full consolidation can only be achieved by a combination of carefully controlled use and regular maintenance.

In the very early stages a new court is best used by the less robust and athletic players - the more elderly gentlemen and ladies are the ideal it candidates for breaking in the new surface. Vigorous men's singles I should be kept for later on. The groundsman must be allowed to dictate the extent and scheduling of this early use, to enable him to water and roll before the new surface becomes unduly disturbed.

Having said this, the more the new court is used and the more regularly, therefore, it has to be maintained, the quicker it will settle down, and the restrictions can be lifted.

A full understanding of these post-construction limitations is important if disappointment and soured relations with the installer are to be avoided.

3.5.10 Scheduling Play

It is the nature of shale and clay courts that, unlike most other types of tennis court, they are not permanently in a suitable condition for play to take place. They may be rendered unfit by frost or heavy rain, or in a heavily worn state following lengthy periods of play, and before the maintenance operations described above have restored them to full readiness. To attempt to use them in these circumstances will, at best, result in a very poor game of tennis, but could also result in the playing surface being seriously damaged.

It follows from this that there must be close liaison between the club manager, players and the grounds man. The grounds man must be aware, sufficiently in advance, of the intended schedule of use, and he must be able to dictate changes in the schedules if he is unable to prepare the courts adequately and in time for whatever reason. The best shale and clay courts are only produced when all the involved parties work as a team, understanding and respecting each other's requirements and problems.

3.6 Maintenance Recommendations for Specific Surface Types

3.6.1 Introduction

This section has dealt so far with general maintenance principles and procedures more or less common to all surfaces in this category. The following notes now provide more detailed recommendations for three main types of shale or clay courts.

- Fast-dry
- French clay
- English shale (or 'En-tout-cas')
- Other water-bound surfaces

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3.6.2 Fast-Dry

This surface, which is marketed under several proprietary brands in the U.S and elsewhere, consists of finely-crushed, greyish-green naturally occurring rock, to which gypsum is usually added as a binding agent. The surface is pale grey when dry, but dark green when damp.

Whilst only recently introduced into the UK, early experience suggests that these surfaces will be the least demanding in terms of maintenance in the whole category. This is not to imply that their maintenance can be neglected or that the general procedures set out above do not apply. Early indications are, however, that given efficient watering equipment fast-dry surfaces are robust and relatively undemanding.

3.6.3 General Maintenance

Brushing or drag-matting

The court should be brushed by pulling a broom or drag mat over the surface after play has finished. If the court is being heavily used for long periods, it may also be helpful to carry out this operation half-way through the day.

This regular brushing, brooming or drag-matting should be carried out in different directions, i.e. in the length of the courts and then across the courts more or less alternately.

Watering
Fast-dry courts play best when slightly damp and thus dark green in colour. When the surface becomes too dry it will change to light grey and it is time for it to be watered. The frequency of watering and the amount to be applied to maintain the "slightly damp and dark green" condition is a matter of observation and experience.

The best time to water the courts is at the end of the day when play has finished and the surface has been brushed or drag-matted.

Rolling
The court should be rolled after heavy or prolonged rain, and at least three times per month in addition.

Rolling should be carried out in alternate direction using a suitable ¼ tonne roller. Rolling is most effective when the surface is damp. In the immediate post construction phase the court should be rolled in alternate directions daily for not less than a week.

Patching

If small depressions appear, for example on the baseline, which do not respond to routine brooming or drag-matting, they must be patched.

The area of the depression should be cut out down to the foundation material with a brick layer's trowel or similar. The removed material must then be replaced with new surfacing material. The new material should be dry. It should be consolidated and struck off level with the surrounding areas with a loot or small straightedge. The patch should then be thoroughly soaked, and when only damp again lightly broomed and rolled. The patching process is then complete.

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Top dressing

Some surfacing material will be lost as a result of wind, rain and continuous play. This should be replaced by top-dressing the whole surface annually with a minimum of one tonne of new surfacing material. This is best done after the winter when preparing the courts for play again.

Cross falls & rainwater run-off

To assist in the dispersal of rainwater from a surface that is relatively slow-draining, fast-dry courts may be laid to a gradient. It is important to ensure that in these circumstances, rainwater flowing across the surface can run off the surface freely and not be held up by edging kerbs.

If this happens large puddles can develop which will not only delay the start of play but may also render the surface sticky and unsightly. Adequate gaps should be left in edging kerbs to allow the water to flow through freely to catchment drains or gullies. Care should be taken to ensure that the gaps in the kerbs or other means of getting rid of surface water are kept clean and operate efficiently.

Restoring the surface after the winter

During the winter the surface will have lifted and become puffed up as a result of frost action. In this condition it retains a lot of water.

In the spring when the worst of the winter weather is past, and at a time when the court surface is relatively dry, it should be rolled carefully once in each direction.

The line tapes should then be removed and the levels checked, and any low areas corrected (see above). This should be followed with an even top dressing of new surfacing material over the whole court, applied at a rate of approximately one tonne per court. The surface should then be lightly drag-matted, watered and rolled. Thereafter, normal maintenance routines with somewhat more frequent rolling initially will produce the new playing surface for the coming season.

3.6.4 French Clay

The surface layer consists of decomposed limestone, which is buff or grey in colour, top-dressed with bright red, fine top dressing. The surface is laid to a significantly greater thickness than is usual for other types and is very moisture retentive. It is also relatively slow draining. Routine watering, therefore, needs to be carefully controlled and should not be over-done. Only sufficient water should be applied to re-soak that part of the surface that has dried out and no more. If excess water is applied it may lie on the surface and delay play. Should the whole surface layer have been allowed to dry out completely, then watering will indeed have to be more copious and prolonged and the courts may not be ready for use for some hours.

Because of the relatively slow drainage rate, it is important to maintain very accurate surface levels, so that puddles do not form. The coin test is a good one. If standing water is deeper than, say, a two pence piece, the area should be top dressed with the fine red material. Fine top dressing should not be applied in large quantities at anyone time. Two or three bags per application per court should be sufficient.

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If puddles do persist, the water can be dispersed by boring through the surface layer into the foundation with a large nail or fine-tined fork. The low area should then be eliminated by top dressing.

The need for frequent watering in hot, dry weather can be reduced somewhat by using calcium chlorate as a deliquescent. The court should first be watered copiously until the water shows signs of standing. The calcium chlorate should then be applied evenly over the surface at a rate of 100kg per court. The court should be kept out of action for a full day before play recommences.

Routine maintenance

At the end of the day

At the end of the day after play has finished, the whole surface should be drag-matted, having first carefully repaired any holes or damage with the foot or a loot. The play-lines should then be swept and the court watered evenly and generously, but stopping before the water begins to stand. The surface will begin to "shine" when sufficient water has been applied.

Before play commences

Before play commences the surface should be drag-matted again, sweeping the lines and watering the surface lightly if it shows signs of drying out.

If warm dry conditions persist during the day, it may be necessary to water again lightly, once or twice. An efficient sprinkler system should apply sufficient water in about two minutes.

Preparing the court for winter

With the first frost of autumn, the court must be put out of use until next season. Plastic lines should be carefully lifted, washed and stored for re-use. If the lines have been painted they should be chipped off with a shovel and discarded. As much as possible of the red surface grit should be swept to the perimeter with a birch besom or similar, and discarded.

During the winter the surface will become puffed up and waterlogged after rain. It should not be walked on in this condition.

Restoring the surface after the winter

As soon as the risk of heavy frost is past (usually not before the end of April), the limestone layer has to be painstakingly broken up using a hand scarifier, rake and other suitable equipment, ensuring that the whole limestone layer down to the foundations is treated, but without mixing foundation material into the limestone. The initial effect will be to produce a very lumpy surface. These lumps then have to be broken down with the rake, taking care at all times to preserve the general level. Then a good level and an initial degree of compaction must be achieved with a loot.

Rolling can now commence in alternate directions - two or three times in each direction.

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Levels should be adjusted with the loot as the rolling proceeds. Once the final level has been achieved, together with partial compaction, top-dressing with red fine top-dressing can commence. 300kg per court at a time should be dressed evenly over the entire surface.

The surface should then be well watered until puddles begin to form. When they have drained away the court should be rolled once in each direction.

The top-dressing should be repeated twice more so that approximately one tonne of dressing will have been applied per court.

Final adjustments to the levels and top-dressing can then take place, followed by a further rolling when the court has dried.

The play-lines can now be re-laid in accordance with the manufacturer's instructions. The play-lines can also be painted, but only by applying an initial coat of boiled linseed oil before using white line paint. At least two coats of line paint are usually required.

At least two days should elapse after the completion of this restoration work and line-painting, before play commences. Initially play should be carefully controlled and the performance of the surface carefully monitored.

3.6.5 UK Shale (or En-tout-cas)

Introduction

This surface was once the dominant tennis surface in the UK. It was not until the 1930s that the so-called "all-weather" surface began to make significant progress. After the Second World War, however, the high cost of maintaining the "En-tout-cas" surface resulted in it being systematically replaced at most venues until today relatively few remain, and even fewer are still maintained in good condition.

Shale courts differ from both American fast-dry and continental clay in having a more coarsely graded surface layer. This greatly assists drainage, and thus increases frost resistance. This allows the surface to be kept in play during frost-free weather throughout the winter, something that cannot be done so easily with the overseas products.

Unfortunately the presence of the coarser particles in the surface layer also renders the surface much more demanding of skilled and regular maintenance; without it the surface soon becomes gritty, slippery and unpleasant to play on.

A further difficulty is the declining availability of good top dressings for maintenance purposes. Nevertheless some courts remain - a few still in excellent condition.

General maintenance

The most desirable surface is one that is firm, level, free of grit and slightly damp. Except in special circumstances this is the surface condition that should be achieved during the summer playing season. In winter it is usual to prepare a somewhat grittier surface.

The routine maintenance procedure starts after the courts have been used and need to be restored before further play. The first stage of the "repair, water, brush, roll" cycle should be carried out as soon as possible after play has finished, typically in the evening. This enables

full advantage to be taken of any overnight rain. If heavy rain falls on a badly disturbed surface, the subsequent repair process will be significantly more difficult.

Repair

All disturbed areas should be quickly repaired by pushing and pulling the loot over them to leave holes filled and bumps levelled. Loose material pulled into depressions should be lightly tamped with the back of the loot.

If the damage is minor the loot may not be needed at all, and going over the whole court once or twice with a drag broom (usually the soft one), or a drag mat is all that is necessary.

Whether or not the loot is needed, drag-brushing or drag-matting is the operation that precedes watering and rolling (or just rolling if the material is moist enough).

If there is foreign matter on the surface, such as leaves, or large grit in excess, then some of it can be removed by lifting the brush away at the end of the court and looting off the ridge of grit and debris left behind. Occasionally, deeper holes may need repairing, usually at the baseline. Looting material into these may not be successful because this material will tend to be gritty and loose and soon comes out again. If this is the case, the holes should be made up with a little new medium material, tamping lightly before watering. If the base of the depression is smooth it is important to scarify it lightly with a fork to give a key for the new material.

The repair of larger depressions or areas of damage is dealt with elsewhere.

The most important thing of all is to perform this repair operation as soon as possible after play has ceased.

Watering

The shale surface drains more rapidly than either American fast-dry or continental clay and can be watered more copiously. Indeed, it is particularly important to apply sufficient water to soak completely through the surface layer. The surface is also more vulnerable to damage by careless watering or badly maintained sprinkler equipment, which can wash away the fine surface skin and expose the grittier material below.

It should be remembered that rain is the best watering system of all. It is well worth repairing the surface in plenty of time to take advantage of it.

Brushing

After watering and before rolling the surface should normally be brushed lightly with the soft broom.

Rolling

The court should now be rolled, making sure that the surface is not too wet and therefore too sticky, nor too dry when rolling will be much less effective.

Following rolling and any final tidying up, the court should be ready for play.

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Top dressing

The preferred surface for play is fine in texture with no loose, larger grit on the surface. This will involve top-dressing from time to time with fine dressing. Loose grit on the surface must either be removed altogether (if it is worn and rounded), or rolled back into the surface. Thereafter the secret is to top-dress little and often, ensuring that the fine top-dressing forms a continuous playing surface, suppressing the coarser grit in the process. If too much top-dressing builds up the surface may become sticky and slow draining. If this occurs then more vigorous brooming than usual should break the skin and re-incorporate the excess fine dressing with the larger material, (if necessary when the surface is dry). In extreme cases, judicious top dressing with medium material may be necessary.

A single top-dressing should not involve more than three 50 kg bags of fine dressing. A skilled person can broadcast this thinly and evenly with a shovel, but someone less experienced may prefer to do it by hand or with a fertiliser distributor.

It is usual to apply fine dressing before watering. On an already damp surface top dress before brooming and rolling.

Fine material should not be used to build up levels; medium material should be used for this purpose. Otherwise, medium is not usually applied during the playing season except to counteract stickiness (see above).

Repairing damaged or low areas

From time to time, for a variety of reasons, low areas will occur on the surface of the court. These may be quite extensive and shallow caused by settlement or wear, or they may be very localised and quite deep, usually on the baseline or other points of heavy localised wear.

Occasionally the problem may be damage caused by a heavy object falling on the surface or careless use of maintenance equipment. It may, for example, be necessary for an oily patch to be removed.

If possible the treatment of large, shallow depressions should be left to the end of the season (or the beginning of the next). However, small, deeper areas must be dealt with straightaway. The procedure is as follows:-

Firstly, the area to be treated should be delineated. Then the whole area to be lifted should be raked or forked (using the point of the tines only), to give a thorough and positive key to the new material.

The new medium should now be added, using a straight edge of the appropriate length (or the blade of the loot if the area is very small), to gauge the right amount, striking off the surplus.

When an even application of new medium has been applied, the material should be rolled or lightly tamped while it is still dry. Then, checking with the straightedge again, more medium should be added if required, and the process repeated.

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Normal maintenance of the whole court can then recommence. It is important to remember that until it is fully integrated the new patch will be "tender". It will therefore need rather more watering and rolling and less matting or brooming than the remainder of the court.

If the area is deep or if there is any indication that the "key" is suspect, the new dry material should be forked right through into the old surface below, covering the whole area at very close centres, (holes 1 inch apart). This will achieve an even better join between the new and the old.

Repairing a flaked or sheared surface

This is one of the most difficult problems that are likely to be encountered. It is caused when a shear line develops between the surface layer and the foundation, or within the surface layer itself. Whatever the cause and wherever the shear-line the result is the same. The uppermost part of the surface becomes more or less permanently detached and will not re-attach itself automatically. The visual indication of "flaking" is close, horizontal, parallel, wavering cracks in the surface which are usually noticed after the roller has passed. No amount of rolling will correct the situation. Sideways pressure with the foot will result in the unattached layer being pulled off altogether. A player running to return a deep shot, stopping or turning on a flaked layer will lose all grip and displace deep divots.

The condition is usually induced by careless or clumsy use of the roller.

Rolling when there is still some frost left lower down in the surface layer is another classic way of shearing the surface. A roller that is too heavy can also induce this problem.

When a small area becomes sheared, the condition will tend to spread if it is not dealt with quickly.

There is no quick and easy way of dealing with this problem. The affected area should be marked out, and then be carefully forked at very close centres with a sharp tined fork. The tines must penetrate through the loose upper layer and into the hard lower layer over and over again so as to create a new "key", whereby the upper layer will re-adhere to the lower. The process is tedious but must not be skimped. Indeed, it may have to be repeated, if the first pass is not fully effective.

When the whole area has been forked it should be very lightly broomed, carefully rolled (initially with a hand roller), and then checked to ensure that process has been effective. Prevention is very much easier than cure.

Standing water

Water may begin to stand on the surface after heavy rain. This suggests that the fine top layer is too thick and over-compacted. The temptation to spike through into the foundation layer with a fork or large nail should be resisted if play needs to start imminently, because the surface may break up as a result. It is better to soak up the water with old blankets or similar. The blankets can then be squeezed out into a metal wheelbarrow. If done with care the surface will be undamaged and play can re-commence very quickly. The blankets should not be dragged, as this will disturb the surface.

In due course the root cause of the slow drainage must be tackled.

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Winter use

As already stated, the shale court can be used in open, frost-free weather during the winter, but the maintenance required should be varied to make this possible.

It is advisable to create a grittier surface for winter play. This can be done by "gritting-up" the summer surface, for example by brushing it when dry, or very lightly raking it with a springtime rake. Medium dressing may also be added at a rate of approximately three 50kg bags per court. Top dressing with fine material must be discontinued. After heavy frosts the surface will become puffed up and if left in this condition any subsequent rain will wash the fine particles through, leaving the surface far too gritty and storing up problems for the future.

To prevent this, the surface should be rolled after frost, but not until all the frost has thawed and the surface has dried and ceased to be sticky. The rolling should be carried out in alternate directions.

Winter closedown and maintenance

If the court is not required during the winter months, or if it has become over-compacted and slow-draining, it should be put out of use at the end of the season and a programme of pre-winter maintenance carried out.

Firstly the whole surface should be checked for levels and any low areas corrected (see above).

The line tapes can then be removed. If the surface layer has become too thin, medium dressing can now be added to correct this.

The whole surface must now be carefully broken up using a thin-tined fork at very close centres. The surface material should be broken up by this operation but not displaced. This operation will also thoroughly incorporate any new medium that has been added. This is a slow and laborious procedure, but it is essential that it should be carried out most years if the court is to remain in good, free-draining condition. It is not usually necessary, however, in the first few years of a new surface's life.

Should it be judged that the surface material is too fine and dirty, as may happen on old or heavily used courts; "winter medium" may be added at this stage. This is medium dressing from which all fine material has been removed. It should be used sparingly, for example four to six 50 kg bags per court.

The surface, when sufficiently broken up, can then be lightly rolled and left to weather down further. Winter wind, rain and frosts will continue the process of breaking down and revitalising the surfacing material. It is important that the surface be lightly rolled in a transverse direction whenever there has been heavy frost to prevent rain washing the fine particles through.

Pre-season maintenance

Spring restoration can start when it is judged that the worst of the winter is past, typically in late March.

It is best to remove the line tapes before starting the restoration programme. The court surface itself may look a mess, so the first step is to remove any detritus or foundation

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material brought to the surface by frost action. This is best done first with a rubber rake, and then, if necessary, with the loot. The surface levels should be checked, and any low areas corrected.

The whole surface should now be top-dressed evenly with medium dressing. About five 50kg bags per court should be sufficient. This should be followed by brooming the court with a medium broom in both directions, then rolling in both directions.

The surface should now be top dressed very carefully and evenly with fine dressing, (about three 50 kg bags per court), then watered, brushed and rolled. If the surface is still too gritty, the fine dressing will need to be repeated, watering, brushing and rolling again. It is important not to apply too much fine dressing too quickly. Finally, the line tapes should be replaced.

The newly restored surface now needs to be observed carefully, top-dressing and adjusting as required until the required texture and degree of firmness is achieved. To begin with the surface may be a little ender, and the grounds man's instructions should be followed carefully.

3.6.6 Other Water-Bound Surfaces

Other similar water-bound surfaces may still exist in small numbers. Courts made from crushed rock of UK origin are the most common and have proprietary names such as "Griselda", "Dri-pla" and "Red-gra". In Scotland "blaes" courts are made from the crushed, burnt shale, which is to be seen in great heaps in the central industrial areas. All of these and various other similar surfaces may be maintained by following the general principles set out in this Code of Practice. Their particular peculiarities and requirements must be a matter of both experience and trial and error.

3.7 Maintenance of Polymeric Courts

3.7.1 Introduction

Polymeric tennis courts consist of a permeable foundation of crushed, graded stone, topped with porous macadam and a playing surface made from a coloured polyurethane binder and rubber crumb or powder, applied directly to the macadam, or to a polyurethane and rubber cushion layer. The play-lines are painted on the surface.

The resulting surface gives a medium to slow paced game, is free- draining and playable throughout the year, and requires very little maintenance. Depending on the system used the surface also has a distinctly "cushioned" feel underfoot.

The small amount of maintenance required is, nevertheless, very important if the court is to provide a good quality game and is to remain free-draining for its expected life-span. Indeed, the installer's guarantee is likely to be dependent upon the maintenance recommendations being carried out with reasonable efficiency.

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3.7.2 What Maintenance and Why

The maintenance procedures are designed to ensure that:

- The playing surface is kept scrupulously clean;
- The fee drainage of surface water remains unimpaired throughout the life of the court
- Moss and algae are not allowed to grow on the surface
- The court looks attractive and well cared for at all times and provide a good surface for playing tennis whenever required; and that
- The court achieves its intended life-span.

These objectives are achieved by:

- Sweeping or vacuuming leaves and other detritus from the surface;
- Occasionally washing the surface; and
- Applying prophylactic treatments of moss-killer and algaecide.

3.7.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles, fluff from tennis balls and other detritus should not be allowed to remain on the surface for any length of time. If this does happen they rapidly rot down and settle into the interstices of the surface impairing drainage and providing a growing medium for algae and moss.

A wide soft broom can be used to sweep the surface but this has a tendency to push smaller material into the surface. A rubber-tined rake is usually better, albeit rather slow and arduous. Best of all is a mechanical garden vacuum cleaner, which will greatly speed up the operation and do it more efficiently. Mechanical leaf sweepers can also be good. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to the surface.

At least once a year the court surface will benefit from a vigorous wash. This not only has the effect of keeping the surface interstices clean and free-draining, but is also essential for maintaining good foothold. Courts near busy roads are particularly susceptible to becoming coated with "traffic film", whilst those near trees may become coated with "honey-dew" from aphids. The resulting black film from either cause can make the courts very slippery after rain.

If the water pressure is reasonably high, washing can be carried out with a domestic hose-pipe assisted by a mild cold water detergent. Even more effective are the cold water pressure washers that are available from most equipment hire outlets. These, however, must be used with care, the greatest attention being paid to establishing that the process does not dislodge the coloured surface coating. Again a mild, non-foaming detergent increases the efficiency of the operation. Steam cleaners should not be used. If the court surface has become very badly sealed and does not respond satisfactorily to this treatment, the installer or a firm that specialises in cleaning tennis courts should be consulted.

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3.7.4 Moss and Algae

In certain situations and in some seasons algae or moss can become established on the court surface. Since prevention is very much more effective than cure, it is important to treat the court with a good roprietary moss-killer and algaecide at least once a year. Particular attention should be paid to those perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or overhung by trees. Any good proprietary product should be satisfactory provided that it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Should the moss become established, it should be treated immediately. The application being repeated until the moss can be brushed or vacuumed. In the case of very severe infestation, the installer should be consulted.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this. Keeping the surface free of vegetable debris on a regular basis renders moss an even less likely problem.

3.7.5 Snow and Ice

Snow and ice should not prove to be harmful and can be allowed to melt through in due course. Powdery snow can be swept away using a wide soft broom or wooden scraper. Metal shovels or scrapers should not be used because they may damage the surface, as will mechanical snow removing equipment, such as mini tractors.

Salt, urea or other chemical de-icing agents should not be used. Their effect is unpredictable and they can cause severe damage.

Re-colouring the surface

Re-spraying the surface is a very skilled operation and should not be attempted except by the installer or a specialist company.

3.7.6 Play lines

Play-lines can be repainted by brush when required, using the line paint recommended by the installer.

3.7.7 Maintenance schedule

Daily - at the end of the days play.

- Make sure the net is slackened and rolled up in the middle.
- Make sure the gate is shut.

Weekly

- Clear leaves and rubbish from the court.

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Monthly

- Deal with any moss or algae.

Annually

- Wash the court.
- Apply moss-killer.
- Call in the installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the court, the installer should be contacted. It is better to be safe than sorry.

3.8 Maintenance of Porous Concrete Courts

3.8.1 Introduction

Porous concrete tennis courts consist of a permeable foundation of broken graded stone on which is laid the porous concrete playing surface. The surface is laid in sections or slabs each measuring approximately 20 feet by 10 feet and 3.5 inches in thickness. Between the individual sections is expansion jointing material to absorb the slight expansion and contraction typical of concrete. Unlike ordinary concrete, a "no-fines" mix is used which results in a fine, smooth honeycomb texture, which is fully porous. The playing surface will be pigmented, but is usually also colour sprayed. The play-lines are painted onto the surface.

The resulting court gives a very true and consistent slow to medium paced game. It is free-draining, playable throughout the year and very robust. It requires very little maintenance, but the maintenance that is needed is vitally important if the court is to provide a good, safe game and to remain free-draining for its expected life span. Indeed, the installer's guarantee is likely to be dependent upon the maintenance recommendations being carried out with reasonable efficiency.

3.8.2 What Maintenance and Why

The maintenance procedures are designed to ensure that:

- The playing surface is kept scrupulously clean;
- The free drainage of surface water remains unimpaired throughout
- The life of the court;
- Moss and algae are not allowed to grow on the surface;
- The courts look attractive and well cared for at all times and provide a good surface for playing tennis whenever required; and that

- The court achieves its intended life-span.

These objectives are achieved by:

- Sweeping or vacuuming leaves and other detritus from the surface;
- Occasionally washing the surface; and
- Applying prophylactic treatments of moss-killer / algaecide.

3.8.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles, fluff from tennis balls and other detritus should not be allowed to remain on the surface for any length of time. If this does happen they rapidly rot down and settle into the interstices of the surface, impairing drainage and providing a growing medium for algae and moss.

A wide soft broom can be used to sweep the surface but this has a tendency to push smaller material into the surface. A rubber-tined rake is usually better, albeit rather slow and arduous. Best of all is a mechanical garden vacuum cleaner, which will greatly speed up the operation and do it more efficiently. Mechanical leaf sweepers can also be good. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface. At least once a year the court surface will benefit from a vigorous wash.

This not only has the effect of keeping the surface interstices clean and free-draining but is also essential for maintaining good foothold. Courts near busy roads are particularly susceptible to becoming coated with "traffic film", whilst those near trees may become coated with "honey-dew" from aphids. The resulting black film from either cause can make the courts very slippery after rain.

If the water pressure is reasonably high, washing can be carried out with a domestic hose-pipe assisted by a mild cold water detergent. Even more effective are the cold water pressure washers that are available from most equipment hire outlets. These, however, must be used with care, the greatest attention being paid to establishing that the process does not dislodge the coloured surface coating or stone chippings. Again a mild, non-foaming detergent increases the efficiency of the operation. Steam cleaners should not be used. If the court surface has become very badly sealed and does not respond satisfactorily to this treatment, the installer or a firm that specialises in cleaning tennis courts should be consulted.

The court surface should be inspected regularly for minor damage. Any small unsightly areas can be touched up using the appropriate surface paint obtained from the installer. Completely re-spraying the surface, however, is a very skilled operation and should not be attempted except by the installer or a specialist company. Play-lines can be repainted by brush when required, using the line paint recommended by the installer.

3.8.4 Moss and Algae

In certain situations and in some seasons algae or moss can become established on the court surface. Since prevention is very much more effective than cure, it is important to treat the court with a good proprietary moss-killer and algaecide at least once a year.

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Particular attention should be paid to those perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or overhung by trees. Any good proprietary product should be satisfactory provided that it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Should moss become established it should be treated immediately, the application being repeated until the moss can be brushed or vacuumed away. In the case of very severe infestation, the installer should be consulted.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this. Keeping the surface free of vegetable debris on a regular basis renders moss an even less likely problem.

Note:

Moss is the greatest enemy of porous concrete surfaces, slowing drainage and initiating frost damage. Moss prevention is the most effective single action to prolong the life of these surfaces.

3.8.5 Movement of the Sections

It is of the nature of concrete that it expands and contracts with variations in temperature and moisture content, and the porous concrete sections used to construct this type of tennis court are no exception. However, the size and layout of the sections and the expansion jointing material will all have been designed with this in mind. Thus such movements that do occur on porous concrete tennis surfaces are usually imperceptible and easily accommodated within the design. Just occasionally, however, the effects of expansion may be apparent for short periods, such as in the cool of the evening after a very hot day when the differential cooling of the sections may cause them to lift slightly at the corners. This effect should have dissipated by the following morning. No action is therefore required or should be attempted.

Should differential movement of the individual sections occur' resulting in significant steps between them, the installer should be contacted. Hair cracks may become apparent on older surfaces, but these are usually characteristic of this type of surface and need not cause concern, nor do they necessarily constitute a defect. If, however, pronounced cracks appear, then the installer should be contacted.

3.8.6 Snow and Ice

Snow and ice should not prove harmful and can be allowed to melt through in due course. Powdery snow can be swept away using a wide soft broom or wooden scraper. Metal shovels or scrapers should not be used because they may damage the surface, as will mechanical snow removing equipment, such as mini tractors.

Salt, urea or other chemical de-icing agents should not be used. Their effect is unpredictable and they can cause severe damage.

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3.8.7 Maintenance Schedule

Daily - at the end of the days play

- Make sure the net is slackened and rolled up in the middle
- Make sure the gate is shut.

Weekly

- Clear leaves and rubbish from the court.

Monthly

- Deal with any moss or algae.

Annually

- Wash the court.
- Apply moss-killer.
- Call in the installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the court, the installer should be contacted. It is better to be safe than sorry.

3.9 Maintenance of Grey-Green Courts

3.9.1 Introduction

Grey-green tennis courts usually consist of a permeable foundation of broken, graded stone (it may be ash or clinker under old courts) on which is laid the porous, bitumen-bound wearing course. This in turn is dressed with a fine grey-green grit from which this type of court gets its name. Some of the grit will adhere to the bitumen but some will form a loose top dressing. The play-lines are painted onto the surface.

The resulting court requires relatively little maintenance, but the modest maintenance requirement is nevertheless essential if the court is to perform well and achieve its designed life. Indeed, the installer's guarantee is likely to be dependent upon the maintenance recommendations being carried out with reasonable diligence.

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3.9.2 What Maintenance and Why

The maintenance procedures are designed to ensure that:

- The playing surface is kept clean at all times;
- The free drainage of surface water remains unimpaired throughout the life of the court;
- Moss is not allowed to grow on the surface;
- The loose surface grit is kept evenly distributed, whilst leaving the play lines clear and fully visible;
- The court looks attractive and well cared for, and provides a good surface for tennis when required; and that
- The court achieves its intended life-span.

These objectives are achieved by:

- Sweeping leaves and other detritus from the surface;
- Brushing the surface to keep the loose grit evenly distributed;
- Applying moss-killer annually; and
- Rolling the surface each spring.

3.9.3 Keeping the Surface Clean

Leaves, tree flowers, pine needles, fluff from tennis balls and other detritus should not be allowed to remain on the surface for any length of time. If this does happen they rapidly rot down and settle into the interstices of the surface impairing drainage and providing a growing medium for algae and moss.

A wide soft broom can be used to sweep the surface but this has a tendency to push smaller material into the surface. A rubber-tined rake is usually better, albeit rather slow and arduous.

Mechanical garden vacuum cleaners and leaf sweepers may also be used, and they will speed up the operation significantly. They do have the disadvantage, however, of removing surface grit (especially the vacuum cleaners), and should be operated in such a way as to minimise this. The equipment should be well maintained and carefully operated to avoid contamination of or physical damage to the surface.

If any moss growth appears a good proprietary moss-killer should be applied to the surface. Particular attention should be paid to shaded, non-trafficked areas. Provided the surface grit is brushed regularly moss should not prove to be a problem on this type of surface, but an annual application of moss-killer is a worthwhile precaution.

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3.9.4 Brushing the Grit

The surface grit will require brushing from time to time, the frequency depending upon how much the court is used. This will greatly improve the appearance of the court by removing footmarks and will ensure an even distribution of the grit to optimise playing conditions.

A wide broom with soft or medium stiff bristles is ideal for this purpose. It should be dragged rather than pushed. The brooming should be a continuous process, the brush remaining on the surface when the surround fence is approached and being turned through 180 degrees without its forward progress being checked. Stopping and lifting the brush to reverse direction will leave unsightly and inconvenient ridges of grit. It is also good practice to alternate the direction in which the court is broomed, i.e. lengthways brooming should be followed by carrying out the process across the court.

Brushing the court will inevitably result in grit remaining on the play-lines and partially obscuring them. The play-lines should therefore be brushed clean using a special narrow brush or small mechanical cleaner made for the purpose.

Occasionally it will be necessary to add a little extra grit to replace natural wastage. It is usual to do this in the spring, but it can take place at any time of the year. Extra grit should only be added in small quantities, such as three to five bags at a time, taking care to ensure even distribution by brooming. Care should also be taken to avoid excess grit, which may impair foothold.

3.9.5 Commissioning the Court in spring

To commission the court for the season's play, it is recommended that it be rolled during early spring using a garden roller of three to five cwts. The court should first be cleaned of all surface detritus. Rolling should not be carried out in very cold weather when the bitumen binder will be brittle; it is better to wait for a warmer day. This operation is usually only required during the first half of the court's life, i.e. for four or five years. Thereafter rolling will be less effective.

3.9.6 The Post-Construction Phase

The grey-green surface, in common with all bitumen-bound surfaces, has a tendency to soften during spells of hot weather during the early part of its life. If this occurs play should be suspended until the surface has cooled down and hardened. Failure to take this precaution can result in damage to the new surface causing it to become uneven and less porous.

This softening effect is only a passing phase, usually confined to the first season or two after construction, and is rare thereafter.

3.9.7 Frost, Snow and Ice

In very cold weather the bitumen binder will become brittle and play should be suspended to avoid damage to the surface. Similarly snow and ice should be left in situ and be allowed to melt away naturally. Salt or other chemical de-icing agents should not be used.

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3.9.8 Play-Lines

Play-lines can be repainted as required using line paint recommended by the installer.

3.9.9 Maintenance Schedule

Daily - at the end of the days play.

- Make sure the net is slackened and rolled up in the middle.
- Make sure the gate is shut.

Weekly

- Clear leaves and rubbish from the court.
- Broom the court surface to re-distribute grit. Clean the play-lines (the frequency of this operation will depend on the frequency of use of the court).

Monthly

- Deal with any weeds or moss.

Annually

- Roll the court in spring.
- Apply moss-killer.
- Add surface grit if required.
- Call in the installer if any aspect is causing significant concern.

Note:

These are minimum recommendations. Common sense and careful observation should prevail. If any serious doubt exists about the effectiveness of the maintenance regime or the condition of the court, the installer should be contacted. It is better to be safe than sorry.

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4. Section Four: Artificial Cricket Wickets

4.1 Introduction

Artificial Cricket Pitches are normally constructed by installing a short pile synthetic carpet over a free draining 'dynamic' base, and on most occasions they will also have performance enhancing under-lays or bowlers shock-pads beneath the surface. The carpets (and sometimes the under-lays) are normally secured using galvanised nails or staples to either the surrounding ground or a perimeter wooden board if installed (the board depends on existing ground conditions and pitch type).

The 'dynamic' base consists of a compacted and levelled layer of hard porous aggregate between 40 – 50mm thick, which may be installed over a dry stone layer between approximately 50mm and 200mm thick. The stone type can vary between clean angular stone to Type 1 road stone.

In addition, some systems also include geo-textiles, which separate the hard porous material from the stone or completely enclose the aggregate, therefore reducing the amount of maintenance required. Other systems are directly laid onto prepared existing ground, cutting out the need for performance aggregates.

4.2 What Maintenance and Why

In order to get the most out of an artificial Cricket pitch there is a certain amount of initial and routine maintenance that needs to be carried out. Adhering to this maintenance will help to extend the useful life of the facility whilst ensuring the best is got out of the pitch in terms of performance.

If maintenance is not carried out then the life and performance of the pitch <u>will</u> deteriorate.

It should also be noted, that most systems on the market are approved by the England & Wales Cricket Board (ECB) under their 'Standard for Non-Turf Cricket Pitches', and if maintenance is not carried out, then the pitch could fall outside of the performance requirements within this standard.

Maintenance procedures are designed to ensure that:

- The surface is kept scrupulously clean
- The surface is safe for all standards of user
- The compaction is consistent over the whole area of the pitch ensuring an even performance
- The carpet remains porous throughout its life
- Moss and algae are not allowed to grow on the surface
- The pitch achieves its intended life-span
- There are no undulations on the pitch that would affect the game

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These objectives are achieved by:

- Sweeping leaves and other detritus from the surface
- Rolling to ensure compaction
- Applying prophylactic treatments of moss killer and algaecide
- Washing if required
- Removing weed and grass growth from the periphery
- Cutting the perimeter grass
- Repairing the surface

4.3 Establishing and Rolling the Pitch

During the first few weeks and months of the pitches life it will take time to 'bed-in' and the playing characteristics over this time could be inconsistent and below the expectation of the system installed. The length of 'bedding-in' is dependent on the type of system installed; those without aggregate bases that are utilising the existing compacted ground generally need less time. If performance under-lays are used, then the effect on the performance during this period can also be less noticeable.

To assist this settling in process, rolling of the pitch should be carried out with a light roller of approximately 0.5 tonnes (as a general rule, one that can be moved by two people). The pitch should be rolled in both directions (i.e. across the width as well as along the length), and if the pitch is dry, watering it will aid the compaction when rolling.

Also the pitch will settle over the winter months, and frost may affect the overall levels so it is important to carry out pre-season rolling to restore the firmness and levels.

During the season you may find that pitches whose performance is affected by moisture may play slower and lower than normal. Again, rolling the pitch to firm it up will return it to normal. Remember to also roll pitch across the width as this can help greatly, as the moisture has less distance to go before being 'squeezed' out.

4.4 Keeping the Surface Clean

Leaves, pine needles, grass clippings etc., should not be allowed to remain on the pitch for any length of time. If this does happen they will rapidly rot down and encourage the growth of moss and algae, which will result in a slippery and dangerous surface, which will also affect the performance. Therefore the pitch should be swept regularly by hand brushing with a stiff broom.

Stains or discolouration can be washed from the surface with a hose or high-pressure washer if required.

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4.5 Moss and Algae

In certain situations moss and algae can become established on the surface carpet. Since prevention is very much better than cure it is important to treat the surface with a good proprietary non-oil-based, moss-killer and algaecide once per year. If moss is already established, then the resulting dead moss should be brushed from the surface with a stiff broom.

4.6 Crease Markings

The crease lines should be re-marked regularly with the paint which has been recommended by the supplier / installer of the pitch or surface.

4.7 Pitch Perimeter

At the perimeter of the pitch, when it is not fixed to an edging board, it is normal for grass to grow through the carpet and creep onto the pitch and this will aid the anchorage of the surface to the ground. However, if the grass is allowed to creep too far or grow too long this could cause rucking or ripples in the surface. If this does occur the nails should be released at the perimeter and re-fixed (3 metres at a time).

Even if an edging board is used, the perimeter grass can still impose itself on the surface if left to grow too long.

Therefore, it is important to cut the perimeter of all pitches carefully with a cylinder mower. If the grass gets too long a strimmer should be used with a nylon blade only.

4.8 Footwear

It is not recommended that Cricket boots with metal studs / spikes are used on any Cricket surface, doing so could cause damage to the carpet. The ideal footwear is mutli, rubber-studded boots to minimise the wear and tear.

4.9 Stump Areas

Some Artificial Cricket Pitches will have an area of clay around the stumps in order that proper stumps can be used instead of portable ones. If this is the case there is normally enough clay in the stump holes such that you shouldn't need to put any more in. If you do then it is likely that a mound will form which can look unsightly. The clay should be worked around with your heel to re-firm it, adding a little water if necessary to soften it up.

4.10 Surface Repair

Depending on the amount of use per year, after a number of years, the carpet may show signs of fraying in high wear areas such as the bowler's delivery area and batsmen's 'block-hole'. Any such areas should be given immediate attention by applying a suitable adhesive to bind together any loose fibres (consult the supplier / installer of your pitch). If this work is not carried out then it will be necessary to patch the surface by letting in a new strip of synthetic turf. The supplier / installer of the pitch should be able to provide instruction on how this is best carried out.

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Note: It is important that no repairs to the surface are carried out in areas where a ball is likely to pitch, as it could cause a dangerous bounce.

4.11 Renovation

As already mentioned, pitch systems with a hard porous aggregate base can be affected by frost in the winter. Also, during the summer the base can become over compacted in heavy wear areas such as the crease and bowlers run-up.

This is far less likely with systems that also have performance under-lays or separation geo-textiles, and light rolling on these pitches will normally be sufficient on affected areas. Although, in exceptional circumstances, the method outlined below should be used if rolling doesn't work. This may be because the pitch has not been rolled enough to help its settlement when first laid.

On pitches without any under-lays or shock-pads, or those with just bowlers' shock-pads, the best way to even out the surface is to lift the carpet (and bowlers shock-pad if present) in the spring when the frosts are over, and level out the top of the hard porous aggregate with a loot. In some cases it may be necessary to add new hard porous to make up the levels.

When the surface of the aggregate has been levelled it should be thoroughly compacted with a light roller or vibrating compactor plate in both directions before replacing the shock-pad. This is best done when the hard porous is damp. The carpet is then stretched back into place and nailed or stapled at the perimeter to ground or board whichever is appropriate. The pitch can then be rolled again on top of the carpet.

Some people may find it easier to only lift half the pitch at a time to carry out the re-levelling work, as this can make it easier to re-pin the carpet down.

4.12 Maintenance Schedule

The following schedule will vary dependent on the type of pitch system as detailed above. Some systems require less maintenance, especially watering, rolling and renovation.

Daily – before each match

- Brush to remove debris
- Re-mark if needed
- Roll with a light roller if required

Weekly – throughout the season

- Brush to remove debris
- Mow the perimeter to the pitch
- Water if required
- Roll if required

Monthly

- Deal with any moss, algae or weeds
- Repair any areas of frayed carpet

Annually

- Carry out pre-season rolling
- Apply moss and algae treatment
- Patch any damaged areas if required

Note:

All artificial cricket wickets benefit from a regular routine of rolling. The rolling should always be carried out after rain or when the wicket has been thoroughly watered.

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