National Squash Centre
Sportcity,
Manchester,
M11 3FF

TECHNICAL INFORMATION SHEET NUMBER 9

November 2013

SQUASH COURT HEATING & VENTILATION
Including Basic Principles of Condensation and Moisture Diagnosis Chart

GENERAL
This paper is intended as a short guide for heating systems suitable for squash courts.

TEMPERATURE – SQUASH COURT & VIEWING AREAS
It is suggested that the ideal temperature for the squash court and viewing area is between 15°C-20°C. Where some form of heating is necessary, a specialist consultant or contractor should be used to determine the most appropriate type and size of heating system. The following gives some guidance as to the types available.

The heating will, to a large extent, depend on the availability of a suitable method of providing a heat source, e.g. mains or bottle gas, oil or mains electricity. If mains gas or electricity is available on site then a check should be made on the present load and if the capacity of the supply is in doubt discuss the projected increased load with the primary suppliers. If the supply has to be reinforced then the increased costs incurred should be examined at an early stage.

ACCESS AREAS
Heating of the access areas is also necessary. The ideal temperature for the access areas is between 15°C-20°C, similar to the court viewing areas. Where a wet system from a boiler plant, radiators in both locations should be installed. Where overhead gas heaters, Quartz Halogen or electric radiant pattern heaters are installed in the court, heating of the viewing and access areas by means of radiant pattern, convector type or night-store heaters should be considered.

RADIATORS & WET SYSTEM
If the court has to be built as an extension to an existing building or sports centre which already has a heating system based on wet system radiators, i.e. boiler installation which provides both heating and hot water to changing rooms, bar or kitchen and there is spare capacity or provision for installing another boiler either increasing the output of the existing or a second boiler using the same gas or oil supply, a system utilising radiator panels or copper or steel finned tubes could be used.

GAS RADIANT HEATERS
This type of heater is sited at high level on the length of the court at the same level as the lights. It consists of a steel tube in a ‘U’ pattern directly heated by a gas burner, the heat being directed into the court by a polished reflector. This type of heater should have a flue to discharge the elements of combustion directly to the open air. Provision for an incoming supply of air is also necessary. Gas heaters must be installed so that they are level.

If the courts have a sloping ceiling, this may result in the heaters being below the recommended clear height of 5640mm. An alternative siting for the heaters is across the width of the court at the rear. This method may have to be adopted on existing courts with a sloping ceiling and this siting is not as efficient at heating the wall surfaces. Heaters can be controlled by an air thermostat or black bulb thermometer, manually or by a time clock.

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Heating a court prior to play is the preferred method of operation as there is a certain amount of noise due to firing, which some players may find disturbing.

ELECTRIC HEATERS, RADIANT PATTERN

This type of commercial twin zone radiant heaters sited parallel to the side walls and directed at a slight angle at the same height as the lights. It is essential to have wire guards fitted to this type of heater. It is usually necessary to have at least four 3KW heaters in each court, two on each side. The available capacity on the incoming main should be checked. Control may be by air thermostat or black bulb thermometer – consult a heating contractor. Heaters are silent in operation.

ELECTRIC HEATERS: QUARTZ HEATERS

This type of heater will heat the players and the walls but not the air in the court. Two 4.5KW heaters have been found to be affective, one sited each side of the gallery balustrade and directed diagonally across the width of the court towards the front third of the wall will provide instant heat when switched on and minimise preheating times and running costs. Mesh guards should be fitted. These should not allow a squash ball (40mm diameter) to pass through the mesh. This system will not be as efficient as the radiant heaters but if the supply is limited it should be considered. Capital costs for this type of equipment is approximately that for radiant heaters.

Underfloor Heating. In new constructions, underfloor heating is available. If this is considered, at an early stage additional underfloor insulation will be required including the edges of an oversite concrete slab.

GENERAL

Whichever method of heating is to be employed, much will depend on the type of structure and, in particular, the standard of insulation that is provided in the walls and ceiling. Seek professional advice on each system before deciding.

SQUASH COURT HEATING

Suppliers of Overhead Gas Heaters

Ambi-Rad Ltd
Fenspool Avenue
Brierley Hill
West Midlands
DY5 1AQ
Tel: (01384) 489700
Fax: (01384) 489707

Combat Engineering Ltd.
Oxford Street
Bilston
West Midlands
WV14 7EG
Tel: (01902) 494425
Fax: (01902) 403200

Gas Rad
For spares & servicing contact
Advent Services
Tel: (0121) 608 2262
Mob: (07971) 964402

Reznor UK Ltd
Park Farm Road
Folkstone
Kent CT19 5DR
Tel: (01303) 259141
Fax: (01303) 880002

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Quartz Ray Heaters

The following are also suitable but they heat the players, not the air. These heaters, which require a ball guard, are available from any reputable electrical wholesaler.

- Claudgen Heating
- Quartz-Zone Radiant Heaters (with quartz halogen lamps)
- 4.5KW (2 required on each court)
- Dimplex Quartz Heaters 4.5KW
- Xpelair Quartz Linear Heaters 4.5 KW

THE BASIC PRINCIPLES OF CONDENSATION IN SQUASH COURTS

INTRODUCTION

Few things spoil a game of squash more than condensation. Sweating walls make it impossible to play angles successfully and if the front wall is affected, lobs start flying into the roof. Worse still, if the floor is affected, players can lose their foothold and injury can easily ensue. The attached moisture diagnosis chart analyses causes and effects of moisture in squash courts and suggests cures. Condensation problems often arise in certain weather conditions. Clubs that have no problem for most of the year can have an exhibition match, or the finals of a tournament, ruined by the sudden onset of condensation. It is no coincidence that problems abound when crowds congregate, and when crowds gather at a time when the external weather conditions are already conductive to condensation, the problem is heightened.

There is a common principle underlying all condensation problems. Warm air can contain more water vapour than cool air, with the vapour content becoming so great that vapour turns to water droplets such as cloud, fog or dew when in contact with a cold surface. The limit at which this happens is known as the ‘dew point’.

MOISTURE IN THE AIR

All air contains a varying degree of moisture which is usually in the form of invisible water vapour. The amount of water vapour contained in the atmosphere at any given time is measured by the relative humidity; this figure gives the percentage of water vapour present compared with the air’s ‘saturation level’ at which point water vapour becomes visible as water droplets. If air at 20°C and with relative humidity of 90% is subjected to cooling, the relative humidity will rise to 100% and water droplets will form. These may form in the atmosphere to give mist or fog or, on cold surfaces when the cooling is localised, such as an iced drink glass on a warm, humid summer day.

The moisture level in the atmosphere can be increased locally by:

1. **Breathing**
   This can have considerable significance when many people congregate to watch a match. The players, through breathing and sweating, introduce into the court atmosphere seven times more moisture than a spectator. For this reason, adequate ventilation in the form of extraction fan/s is necessary particularly if a large crowd of spectators is present.

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2. **Sweating**
   Sweat generated during a match is absorbed by the atmosphere. The more sweat that is generated, the greater the amount of moisture which will be added to the ambient level in the atmosphere.

CONDENSATION

Some wall surfacing plaster materials are slightly absorbent and only in extreme conditions will condensation form on the surface.

Painting of squash court walls with a plaster surface should only be considered if the court is heated and has adequate ventilation to maintain a temperature level to offset any possibility of condensation settling on the wall surfaces. Should condensation occur, it will render these unusable for play.

AFFECTS OF CONDENSATION ON THE FLOOR

The effects of sweat will always be emphasised if moisture cannot soak easily into the wood. Quite often the cause is sealant on the floor. England Squash recommend that floors are not sealed and would advise that the sealant should be removed by sanding. If your courts are slippery and have not been sealed they should be sanded to leave a slight nap on the surface.

BASIC CURES

1. **Temperature**
   To overcome problems in a squash court it is essential to prevent condensation taking place when warm moisture bearing air comes into contact with walls or floors which are at or below the dew-point for that particular air mass. This can be achieved by ensuring that the walls and floor of the court are kept at a temperature above the critical dew point. Gas or electric radiant heaters provide the correct form of heating to ensure that this happens. Courts within centrally heated and/or air conditioned buildings or halls are never likely to suffer from condensation because the fabric of the walls serves as a storage heater, and are never in danger of cooling off to dew-point level.

2. **Insulation**
   Insulation of walls can reduce the rate at which internal playing walls cool down during a cold spell. Background heating may prevent the walls becoming excessively cold during severe weather. It is when moist warm air flow follows a cold spell that condensation risks increase. This is because the walls retain their low temperature for some time after the change of atmospheric conditions.

3. **Air Charges**
   Ventilation of courts and spectator areas is essential and four air changes per hour are recommended for each court. This rate can often be obtained by use of a 300mm fan diameter placed at high level in the wall behind or in the roof above the gallery or the back third of the court which will draw the air across the court from the ventilation inlet holes in the ‘tin’. Grass or other vegetation near the external ventilation holes should be cut as if wet, moisture will be drawn into the court.

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4. **Vents**
   If high level vents have been installed on the playwall, it may be necessary to seal these. This will ensure that the air is drawn across the court from low to high level. Additional ventilation for the viewing gallery area should be installed, the size needed will relate to the volume of the gallery. Extractor fans, when fitted with a speed controller, will enable the fans to be run at low speed when the courts are not in use and manual control to a higher speed when they are in use. Fans should be allowed to run on for 20 minutes after the court has been used.

5. **Over Heating**
   Where courts become excessively hot it may be necessary to install a larger fan. A speed controller will be required to reduce the extract rate in cold weather.

6. **Mould Growth**
   If there are any signs of mould growth inside the court, this may be the result of a water leakage through the outside structure. If mould appears internally in the corridor, spectator's gallery or changing room, and if a leak in the structure can be discounted, then these growths are usually the result of high humidity which may be caused by poor ventilation. Mould can also appear on an emulsion painted surface, where the paint has been applied to a structure which, although appearing dry on the surface, has not completely dried out. Mould growth is best dealt with by brushing down to remove the loose mould growth and then treating with a proprietary mould inhibitor fungicide or a diluted solution of household bleach, containing chloride. The surface should then be washed down with clear water and left to dry thoroughly.

7. **Changing Rooms**
   Changing rooms with shower s and sanitary facilities should comply with the relevant requirements of the Building Regulations F.1. Section 2- Non Domestic Buildings. There is a requirement for the fans to over run for 15 minutes. We suggest that it is more satisfactory for the fans to run continuously.

8. **General**
   Some courts have their own special problems which may be the result of their location or construction. If effective and efficient use is made of existing heating and ventilation systems, or consideration is given to installing such systems, it should be possible to minimise the risk of condensation.

MOISTURE DIAGNOSIS CHART

The moisture diagnosis charts follow. The level of problems relating to moisture is not exhaustive and if the chart does not help to resolve the problem, then professional assistance should be sought.

Please note that the information for the maintenance and provision of squash courts contained in the England Squash Technical Information Sheets apply to courts built in the United Kingdom only.

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SQUASH COURT MOISTURE DIAGNOSIS CHART

	SYMPTOMS	CAUSES	CONTRIBUTORY FACTORS	CURES	ACTION REQUIRED
A	A film of water appears on the playing surface of the walls when the court is in use on very cold days.	CONDENSATION ("Sweating")	**1**. Moisture in the air from players. **2**. Cold walls as a result of poor thermal insulation	**1**. Heat the walls, particularly on cold days and/or **2.** Improve the thermal insulation of the walls. **3.** Remove the moisture from the air in the court.	**1**. Install background heating (seek specialist advice) to give 15ºC +/- 3ºC. (60ºF +/- 5ºF) **2**. Install cavity fill or external insulation (specialist advice needed). **3**. Install extract ventilation to give 4 air changes per hour (300mm diameter extract fan) to run continuously whilst courts are open for use.
B	A film of water appears on the walls when the court is in use on a warm day following one or more cold days.	CONDENSATION ("Sweating")	**1**. Moisture in the air from players. **2**. Cold walls as a result of high thermal capacity.	**1.** Remove moisture from the air in the court. **2.** Heat the walls, particularly on warm days.	**1**. Install extract ventilation to give 4 air changes per hour (300mm diameter extract fan) to run continuously whilst courts are open for use. **2**. Install background heating (seek specialist advice).
C	A film of water appears on the walls of the court whether it is used or not, particularly on cold days; the problem may be worse when the court is in use.	CONDENSATION ("Sweating")	**1**. Moisture laden air coming from another part of the building, e.g., changing or shower areas, swimming pool. **2**. Cold walls **3.** Additional moisture put into the air by players.	**1**. Make sure that moisture laden air from elsewhere does not enter the court. **2**. Other cures as in B.	**1**. Provide separate ventilation systems for the court and other areas. Arrange for a ventilated lobby between the courts and other areas where moisture is formed. **2**. As B.

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SQUASH COURT MOISTURE DIAGNOSIS CHART

	SYMPTOMS	CAUSES	CONTRIBUTORY FACTORS	CURES	ACTION REQUIRED
D	Drips of water appear on the floor at a limited number of points, and only on cold days, whether or not the court is in use.	CONDENSATION	**1**. Moisture-laden air coming into contact with very cold surfaces. **2**. Poorly insulated roof with cold spots, e.g., steel beams or pipes.	**1**. Remove moisture with an extract fan. **2**. Stop moisture laden air coming into contact with cold surfaces. **3**. Improve insulation locally or generally.	**1**. Install extract ventilation to give 4 air changes per hour as A. **2**. Install a continuous vapour barrier on the warm side of insulation in the ceiling structure or underside of the roof. **3**. Provide insulation as in 2 above.
E	"Bloom" appears on the floor, and the floor becomes slippery when the court is in use.	CONDENSATION	**1**. Moisture in the air from players. **2**. Cold floor.	**1.** Remove moisture from the air in the court. **2**. Provide heating. **3.** Sand floor.	**1**. Install extract ventilation to give 4 air changes per hour as A. **2**. Install background heating. **3**. Sand floor in direction of grain to leave a nap on the surface, do not seal.
F	Drips of moisture appear all over the floor, when court is in use.	PERSPIRATION from players	If court becomes slippery, floor is too heavily sealed.	Sand floor.	See E above.
G	Drips of water appear at specific points on the floor during or after rain, snow, etc., whether or not the court is in use.	ROOF LEAK(S)	**1**. Cracked glazing. **2**. Inadequate sealing of joints between materials. **3**. Broken tiles or slates. **4**. Cracked roof finish.	Locate and repair leaks	Seek professional advice (Architect or Surveyor).

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	SYMPTOMS	CAUSES	CONTRIBUTORY FACTORS	CURES	ACTION REQUIRED
H	Water runs down the walls from the top during or after rain, snow, etc., whether or not the court is in use. Isolated patches of damp appear on external walls after rain, particularly on walls facing the prevailing wind. Fungus or mould growth may appear, particularly in corners.	ROOF OR WALLHEAD LEAK(S) RAIN PENETRATION	**1**. Broken or misplaced copings. **2**. Choked gutters. **3**. Porous brickwork or faulty pointing. **4**. Cavity bridged or no cavity. **5**. Broken or split external cladding.	**1.** Inspect and locate leaks. **2.** Check gutters and rainwater pipes. **3**. Inspect. **4.** Inspect. **5**. Inspect.	**1.** Get professional advice. **2.** Clean gutters and rainwater outlets. **3.** Seek professional advice. **4**. " **5.** "
I	The lower parts of walls feel damp persistently and a more or less horizontal "tide mark" appears. Floors may be damp and / or rotten. Fungus or mould growth may appear.	RISING DAMP	**1.** Breakdown of damp course. **2.** No damp course. **3.** Soil bridging the damp course on the external face.	**1.** Install new damp course . **2.** Install new damp course. **3.** Inspect and lower the ground level externally.	**1.** Seek professional advice **2.** " **3.** "

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	SYMPTOMS	CAUSES	CONTRIBUTORY FACTORS	CURES	ACTION REQUIRED
J	**1.** Cupped or decayed flooring. **2.** Excessive movement in the floor. **3.** Floor expands.	RISING DAMP	**1.** Breakdown of the damp proof membrane in or on the oversite concrete. **2.** Leak from faulty plumbing or drainage. **3.** Local external flooding. **4.** Breakdown of floor suspension system.	**1.** Install new damp proof membrane. **2.** Locate and repair leaks. **3.** Check watercourses and stormwater/foul drains. **4.** Lift floor and replace suspension system.	**1.** Seek professional advice. **2.** " **3.** " **4.** "

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