



## FOR SQUASH CLUBS

### VENTILATION FOR CONDENSATION CONTROL

Ref: Squash-2 (Writins/ads&broc)

#### 1) What causes Condensation ?

a) Condensation results when *humidity*, or water vapour, that is invisible when "suspended", in warm air, contacts a surface that is colder than what is known as the "*dew point*" of the humid air, (ie... a cold window or concrete wall). The "dew point" of the air containing the water vapour is reached, as the air cools down (commonly, by contact with a cold surface).

*Simple comparisons are .....*

- The condensation that immediately forms on a cold drink can or bottle, even in a room or atmosphere that is warm and regarded as a "dry room" atmosphere.
- When one breathes directly on to a cold glass window.

#### 2) What is the source of Condensation in Squash Clubs ?

a) *Human body fluids from occupants*. An adult, *at rest*, gives off 1.5 litres of water vapour every day (24 hours), for strenuous athletic activities *0.5 litres per hour*. Even when "*dry*", every square centimetre of a human body is continuously evaporating moisture, as well as large amounts from breathing, and evaporation from our nose, eyes, etc.

This moisture is directly evaporated into the surrounding air, and raises the humidity of the indoor air. Unless the humidity is *removed*, it will condense on cold surfaces.

b) *All air contains some water vapour* (humidity), that is invisibly suspended in the air. Generally, the *colder* the air, the *higher* the humidity, & the *warmer* the air, the *lower* the humidity. As the temperature of any air reduces, humidity increases to a point where the air is saturated, and can contain no more moisture. This is known as the "*dew point*" of the air. Condensation occurs when the "dew point" temperature is reached. Commonly this occurs when the moist air contacts a surface, that is cooler than the moisture laden air. The colder the surface, the faster, and greater, the rate of condensation forming on the cold surface. The *Simple Comparisons* given above are examples of this.

c) If the results of a) and b) are allowed to accumulate inside a building ie... the typical Squash Club, then copious volumes of condensation on walls, windows etc, is the natural consequence.

### 3) How can Condensation be removed and controlled in a Squash Club ?

Squash Clubs are difficult buildings in which to control condensation. There are two basic methods, **Mechanical Dehumidification** and **Ventilation**.

#### a) Mechanical Dehumidification

Avon markets a mechanical dehumidifier that can easily remove all the moisture from a Squash Club, at temperatures as low as 1°C. However, Mechanical dehumidifiers **do not change the air**. If the air is changed (by ventilation), more moisture is introduced, and few mechanical dehumidifiers can cope with the rate of air change necessary to **ventilate** a Squash Club.

#### b) Controlled Ventilation

Adequate indoor Ventilation is required by legislation. For any new or renovated building, the 1991 Building Code (Section G4) specifies ventilation requirements, and New Zealand Standard 4303 - **Ventilation for Acceptable Indoor Air Quality** details requirements.

In all activities relating to Health and Fitness, the necessity for participants to have access to and to breathe fresh, uncontaminated air, is surely the most important and basic fundamental.

Playing any sport, designed to increase human metabolism to very high levels, in an indoor environment that is *inadequately ventilated*, forces participants to breathe, and share, the stale air expelled from the lungs of other participants. To an increasing number of participants these conditions are unacceptable in the 1990's.

A healthy indoor environment, should be the most important facility provided by any indoor sports club. The consequences of inadequate ventilation, should also be considered.

**For example...** It is *not usual* for strangers or acquaintances to eat or drink from the same cup, glass, plate, knife or fork, or to share the same apple or banana, yet participants attending an inadequately ventilated indoor sports facility, directly share (by breathing) air that has been expelled as waste, stale, air from the lungs of other participants. Overseas publicity on the subject often compares stale indoor air in a densely occupied space, with **sewer gas**.

The stale air that humans expel when breathing out, is low in oxygen, and contains a high level of Carbon dioxide (CO<sub>2</sub>). Carbon dioxide is a gas that is poisonous to humans. Air expelled from human lungs is also humid and warm, (ie... conditions that sustain and incubate bacteria) and confined, poorly ventilated spaces, breathing "second hand" air expelled by others, is one of the very best ways of transmitting many types of bacterium between occupants.

NZ Standard 4303 - **Ventilation for Acceptable Indoor Air Quality**, recommends that ventilation should control CO<sub>2</sub> to less than 1000 parts per million. Two persons in an average unventilated office produce enough CO<sub>2</sub> to exceed 1000 ppm in approx 45 minutes. The effects of sustained exposure to high CO<sub>2</sub> varies between humans. Sore eyes, drowsiness, hyper-activity, skin rashes, & stomach illness are common complaints often associated with sustained exposure to high levels CO<sub>2</sub>.

For the basic need to provide a healthy facility, adequate **ventilation** to maintain **indoor air quality** is more than essential. A natural consequence of a healthy **Indoor environment** is the automatic control of condensation.

#### 4) How does ventilation control Condensation ?

Water vapour (humidity) is exhausted (from the building) while it is still in suspension (invisible) in the air, **before** it condenses as visible water droplets on cold surfaces.

#### 5) How is this achieved ?

We calculate the amount of moisture that has to be removed, then install equipment that can remove that amount of air, along with the water vapour. This requires a Supply fan, with a multi stage automatic heating system to "temper" incoming fresh air to a controlled temperature and ventilation rate. An Exhaust fan, matched to the capacity of the "Supply" fan, operates simultaneously with the supply fan.

Selection of equipment that has the correct capacity, and installing it in a manner and location that effectively distributes the air to provide controlled ventilation is very important.

For most systems, operation is automatic, requiring minimal, or no input from members. An example of a "user friendly" control panel is *Fig. 2*.

*Fig. 1* is a simplified illustration of an installation at the Ashburton Squash Club. Note how the supply and exhaust fans are placed so the building becomes an **air duct**, so that fresh dry air is constantly diluting away, stale humid air. Spectators benefit from their position as in close proximity of the warm incoming air, while the players are in the same airflow, but *downstream*, which is a little cooler. The air temperature can be preset, and is then controlled by a three stage automatic thermostat, that senses, and controls the temperature of the fresh air as it leaves the supply fan. Temperature on the playing floor is set to approx 14°C to 16°C.

Other design techniques, as may apply to each individual site are included as necessary for each system and its customised controls, to ensure that it controls the indoor environment and so removes condensation.

#### 6) What other benefits are there ?

**a) Reduced Building Maintenance.** Damp cold air is unhealthy, not only for the occupants but for the building. How much damage has condensation caused to your building? With a controlled ventilation system, damage by dampness, condensation, mildew and mould is virtually eliminated.

**b) More members and higher attendances --** A warm comfortable environment is the direct result of installing a controlled heating and ventilation system that automatically controls condensation.

Today, a high proportion of the average population, recognise and understand the difference between a healthy and an unhealthy indoor environment. Many club members who **would** attend events **if** the indoor environment was more pleasant and comfortable, **will stay away** if they know conditions may be cold, damp, or where a poorly ventilated building is filled with the stale humid air expelled by occupants with coughs colds and other winter ills.

**Additional benefits** are where the ventilation system can be extended for a token extra cost to control the environment in shower/ changing rooms.

## 7) Does your Squash Club need ventilation and Condensation control ?

Use the diagrams below to rate the indoor air quality in your club.

Tick the box that applies ....



Pleasant



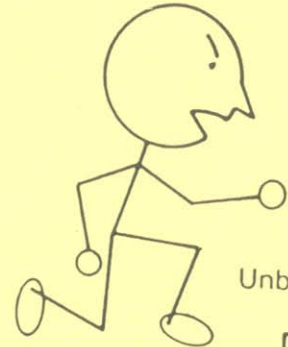
Neutral



Unpleasant



Very  
Unpleasant



Unbearable

If you ticked anything other than *Pleasant*, you *need* to find out more.

Send us a copy of the building plans for your club. Be sure to show North, and explain where condensation is worst. We may need to visit, but usually, a budget proposal can be prepared from plans. Our equipment is custom built for each specific site, and is made as a "kitset" of components, that can be installed by local trades, or club members.

**AVON** ELECTRIC Ltd

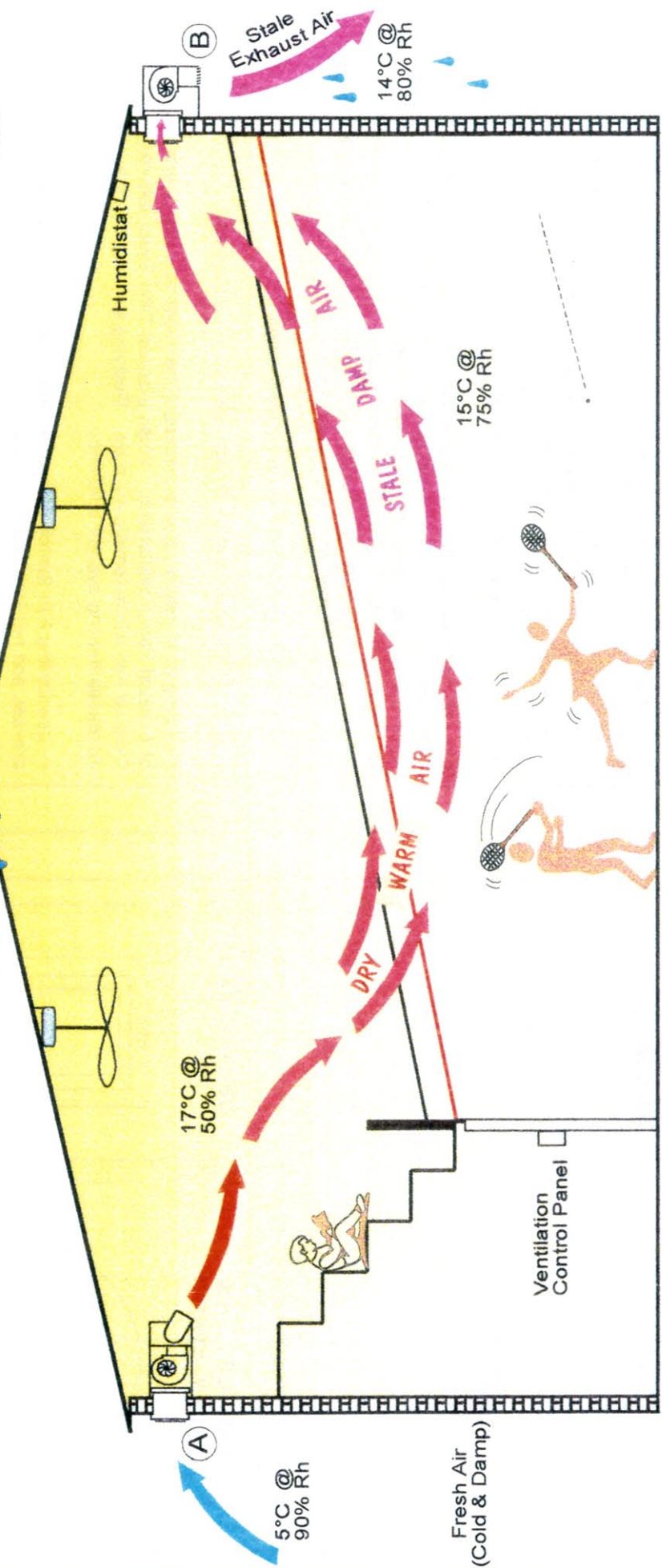
25 Taurus Place, (PO Box 19-748), Christchurch, New Zealand

**0800 DRY AIR (0800-379-247)**

*Improving lifestyles since 1952*

# VENTILATION for CONDENSATION control in Squash Clubs

Fig. 1

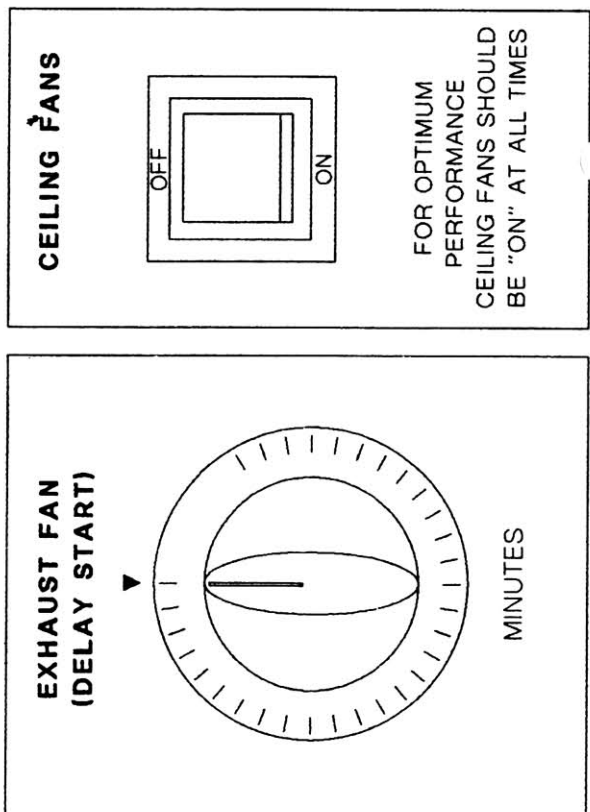
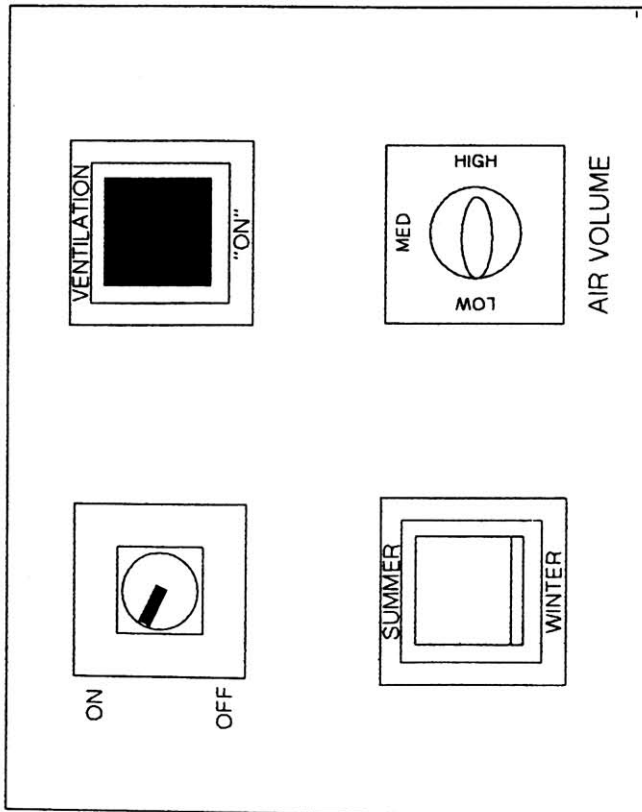


- (A) **Supply Fan** -- Heats & Dehumidifies 100% fresh air
- (B) **Exhaust Fan** -- Removes stale, humid air

Note: 1) Temperatures & RH% (Humidity) are approximate for a typical Squash Court (Winter)  
 2) In Summer, use as a simple ventilation system.

**Avon**  
 ELECTRIC Ltd  
 PHONE (03) 381-5595  
 FAX (03) 381-5596

## VENTILATION CONTROLS (COURTS 1 & 2)



## OPERATION

When the "On/Off" Switch is left in the "On" position, the Heating & Ventilation system will operate automatically whenever the building "Master Switch" is switched "On".

The On/Off switch is to enable the system to be shut down whenever ventilation is not required i.e. when cleaning the building.

Switching the Building Master Switch "Off" automatically starts a control programme that dehumidifies the Building using night rate power. This occurs between 11pm & 7am, (controlled by a preset time clock & a humidistat). If the building "Master" Switch is not used each 24 hours, the system will not operate at all, e.g. Christmas Holidays, etc. Each time the Building "Master" Switch is used it automatically starts the overnight ventilation cycle.

For casual squash games, as long as the "On/Off" key switch is "On", adequate ventilation, heating & humidity control will occur. "Low" air volume is the most economic mode. On Club & Competition nights (i.e. high Occupancy use --- "Summer/Winter" Switch --- "Air Volume" Switch --- "Ceiling Fan" Switch, and "Exhaust Fan" Timer, as appropriate. Details are.....

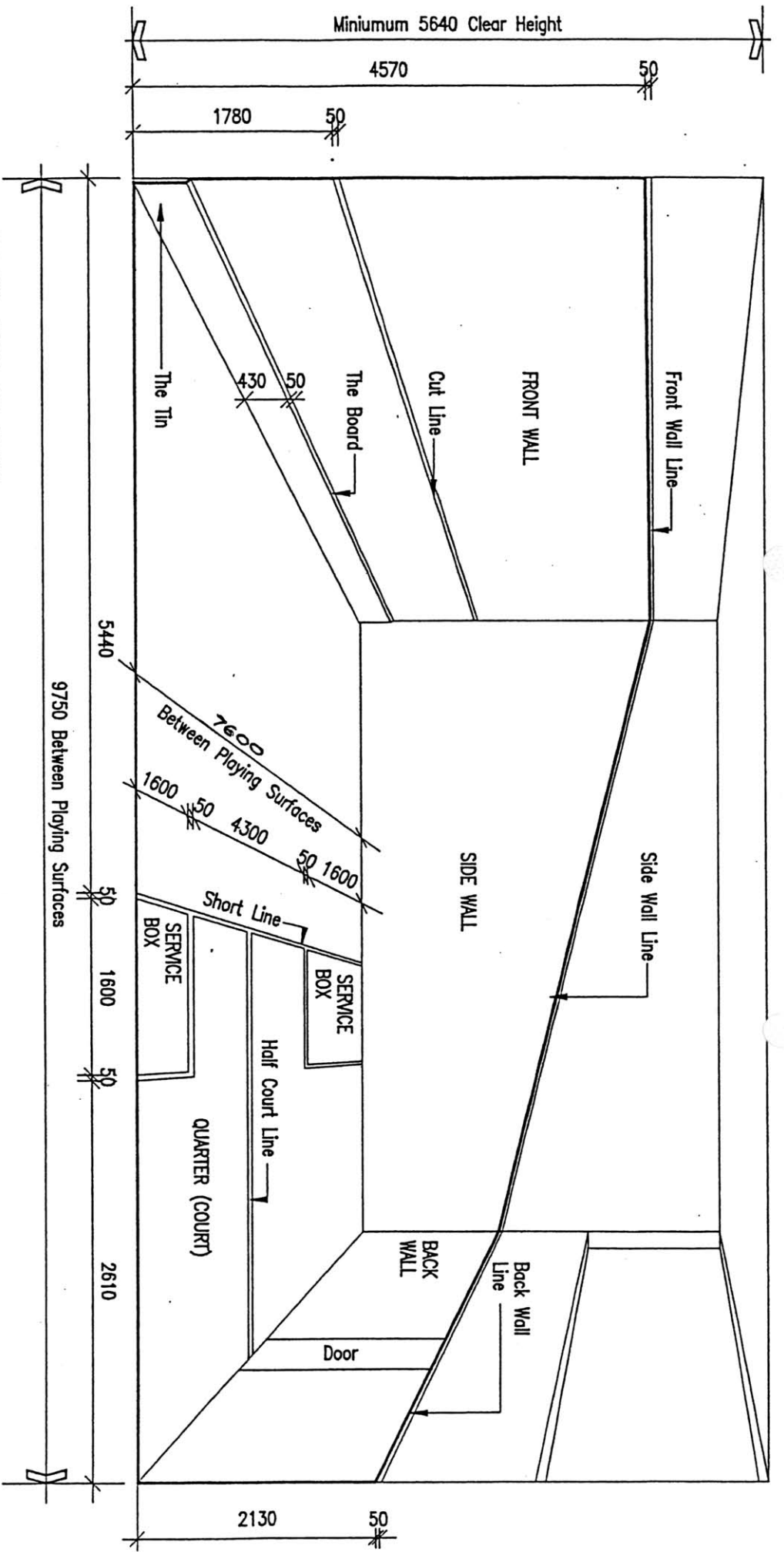
- Use "Summer/Winter" Switch as appropriate
- Use "Air Volume" Switch as appropriate, for ventilation.
- During initial warm up, use Elapsed Time Timer to delay operation of Exhaust Fan in Wintertime. When Elapsed Time Timer expires, Exhaust Fan will automatically start. Delaying Exhaust Fan start-up increases heating system efficiency.
- Use Ceiling Fan Switch as appropriate. Ceiling Fan speeds are pre-set, and not intended be varied.

## Maintenance

Air filter must be clean & in place at all times (See Handbook for maintenance details).

DESIGNED BY:

**Avon** ELECTRIC Ltd.  
69 RURU RO CHRISTCHURCH 6, NEW ZEALAND



NEAR SIDE WALL OMITTED FOR CLARITY  
 DIAGRAMS 12365

Description and Dimensions of an  
 International Doubles Court.



DIAGRAM NO. 2 Date November 1993

WORLD SQUASH  
 FEDERATION  
 8 HAVELOCK ROAD, HASTINGS, TN34 1BP, GREAT BRITAIN  
 TELEPHONE: + (44) 0424 428245 FAX: + (44) 0424 428250

