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PAPER 3

TYPICAL SWIMMING POOL FILTRATION & DECK EQUIPMENT
You will encounter these items ...

POOL PUMP

Pool water is pumped from the pool through a filtration system and returned to the pool. The Pool Pump is the Heart of this action. Typically, 550w to 1100w self-priming pump with attached Hair & Lint Strainer at front end to stop detritus from entering the rototating parts. This part has a removable lid. Can you guess why?

POOL FILTER

Tanks ranging in size from (typically) 400mm to 800mm for home pools. Silica Quartz sand Filter media is typically graded Washed River Sand. Graded to .45 to .55 mm, it wears down and needs replacing – typically every five years. Similar sized Crushed Glass is becoming popular, resisting water-wearing so lasts longer.

WATER SKIMMER

A "Skimmer" (it "skims" the top of the pool water) is fitted into the pool wall, taking care of all floating detritus (leaves, etc.) by suction creating a water flow over a floating internal weir at the pool water level. A single skimmer usually does pools up to 4.5 x 9.0m. larger pools may need two (or more) skimmers. Weirs need replacing occasionally. Smimmers incorporate a large bucket-shape PVC basket to trap leaves for manual removal by the pool operator.

EYEBALL RETURNS

The design of the water filtration system means it sucks pool water from the skimmer, through the filter and back to the pool through these "Eyeballs" (they look a bit like eyes) on one or more locations in the pool wall. Distributing these in strategic locations on the pool walls ensures proper recirculation of the filter water

MAIN DRAIN and/or HYDROSTATIC VALVE

Concrete pools typically have combination Main Drain/Hydrostatic valve. Fibreglass pools generally have a Hydrostatic Valve somewhere low down to stop the pool lifting due to ground-water pressure. Safety Rules require a minimum of two Main Drains (To break excessive suction and entrapment of swimmers)

POOL LIGHTS

Most pools have (a minimum of) two pool lights in one side of the pool – facing away from the house for safety reasons (potential blinding at night – people approaching the pool could fall into it)

MANUAL POOL CLEANING ITEMS

Manual "scooping and vacuuming" is a weekly chore for most pool owners.

AUTOMATIC CLEANING DEVICES

These devices run around the pool taking care of cleaning issues. Nice but often expensive.

The pool builder normally supplies the pool owner with one of each of the following items when handing over the pool. See Fig. 4.1.

1. Flexible Vacuum Hose – length to suit the pool dimensions
2. Vacuum Head, usually a flexible PVC item with brushes on the underneath side
3. Telescopic Handle to attach Head, Scoop and Proom heads onto
4. Leaf Scoop
5. Pool Broom

POOL VACUUM

While regular filtering removes suspended and floating matter from the water, heavier debris which settles on the bottom must be removed by vacuuming. This should be carried out regularly, preferably weekly during the summer months, if no automatic cleaning device is fitted to the pool.

To do this, the telescopic handle is inserted into the vacuum head, the vacuum hose is attached to the head which is then lowered to the bottom of the pool. The remaining hose is fed vertically into the pool to expel all air, until the free end is just below the surface. When the air bubbles have stopped rising, the free end is fed through the mouth of the skimmer box and inserted into the vacuum plate. The filter is turned on and the vacuuming of the pool is carried out in a methodical manner. If the filter needs backwashing, this should be done before vacuuming to ensure adequate and efficient suction.

Vacuum hoses, and indeed all cleaning equipment, should not be left in the sun, as this will shorten their life.

BRUSH

Calcium deposits form and accumulate on the floor, walls and steps of pools. This is due to the use of chemicals, particularly calcium hypochlorite, and by the leaching of calcium compounds from newly finished plaster surfaces used on concrete pools. If allowed to remain, these deposits will form an unsightly scale, which can only be removed by draining and acid-washing the pool.

Regular brushing of the walls, floor and steps of the pool with the nylon pool broom attached to the telescopic handle will remove the calcium before it forms a scale. If brushing is carried out on the day before vacuuming, the calcium will settle on the pool floor from where it can be vacuumed.

LEAF SCOOP

Leaves have to be removed regularly. If allowed to remain, they decompose and stain the pool surface finish. They are easily removed while still floating on the surface, using the leaf rake attached to the telescopic handle. The leaf rake consists usually of a plastic frame with a mesh bag insert which is designed also to scoop leaves from the bottom of the pool in one continuous forward motion and carry them to the surface in the bag.

AUTOMATIC CLEANING DEVICES

These cleaners fall into two categories, the first type working on the principle of disturbing the dirt and holding it in suspension so that it may be removed by the filter, and the second type operating as a vacuum cleaner.

IN-POOL POOL SWEEPERS

Three systems available – two using trailing hoses.

Not so common these days, the first such system called the Flip Hose Pool Cleaner uses a permanent layout of trailing, or flip hoses as they are commonly called, located at the pool wall and connected to the filter return line through an auxiliary return line built into the wall of the pool, with a stop valve installed to control their operation. The flip hoses are detachable at the wall. With the filter operating, these flexible, clear plastic hoses, several metres in length, jet water and swirl randomly around the pool, dislodging dirt from the walls and the floor. Suspended particles are removed by the filter in the normal manner. The system reduces vacuum cleaning time as debris is swept into the middle of the pool.

The second system uses a floating head to travel freely around the surface, dislodging dirt and debris and sweeping it to the centre of the pool floor via water jets from hoses. Some use a separate booster pump to supply water pressure to the head, such as the Porpoise Automatic Pool Cleaner, and the Arneson Pool Sweep shown in Fig. 4.3.

The third sysytem (gaining popularity due to advertising by some Fibreglass pool companies) is the "Pop Up" system. Special-designed fittings in the pool floor "Pop Up" when the system is initiated. The theory is that this will flush the dirt and detrius off the pool floor and into entrapment into the filtration system where the pool filter takes care of it.

Historically, the main disadvantage of this system is that the feeder pipes must run completely under the pool floor and will be subjected to damage should the pool shift (even just a few millimetres). In a sprayed concrete pool, the chance of the pool shifting and cracking these embedded pipes is low. In a fiberglass pool the chance is increased as these pools are typically installed on a gravel base, within under-ground water flow conditions, which could undermine the pipes, creating damage and leaking. This creates a difficult situation to fix, as the pool shell would have to be excavated under or removed. It is therefor essential in these cases that the pipes must be set in a permanent base.

AUTOMATIC POOL VACUUM CLEANERS

These units travel around the floor and walls of a pool in a random pattern, sucking in dirt. There are three distinct types, distinguished by the manner in which they are powered.

1) Submersible self-directing products

This type travles around the pool floor and up the pool walls, sucking dirt into a built-in bag which is later removed for emptying. This type has a low-voltage electrical power lead to the unit encased in waterproof plastic for safety. Suitable for all types of swimming pools, but and are becoming quite common due to the reasonable purchase cost.

2) External Separate Pump Supplying Water Pressure
This type such as the Polaris Vac-Sweep relies on a turbine inside the machine which turns the wheels for motion and creates the vacuum. It has a detachable bag for the collection of debris. Suitable for all types of swimming pools

3) Suction powered from Skimmer Box

This type (such as the original Kreepy Krauly and subsequent copies) operates in much the same way as manually cleaning the pool with the vacuum hose and head. A special vacuum plate in the skimmer box, incorporating a vacuum relief valve, allows a surface skimming action through the skimmer box to proceed while the unit is operating, drawing in water and debris along the vacuum hose and into the filter system.

These units have been around for many years, and as the Kreepy Krauly patents expired some years ago, there are many copies (of all sizes) on the market today with kreepy-krauly becoming the generic name for this type of cleaner.

These units travel in a random fashion and uses the suction pressure from the skimmer box via the vacuum hose to power itself, climbing walls and obstacles and reaching almost all submerged surfaces.

Other models do not require a special vacuum plate, but do require a vacuum relief valve in the vacuum hose to overcome too strong suction. This type of cleaner may damage a vinyl-liner pool, and can also lift the plaster finish off a concrete pool, so should be used with caution, as these are best suited to fiberglass pools.

Another type introduced quite a while ago, but many still being used is the Questa Max-i-vac so popular that spares are still available. This is a water-powered turbine type cleaner, and is suitable for all types of pool finishes. Be sure to understand which cleaners are unsuitable for certain pool types – you may recommend something that inadvertently causes damage to your customer's pool finish!

TIME SWITCHES

A time switch can be regarded as an essential item of equipment to ensure automatic filtration by switching the filter on and off automatically at predetermined times every day. A 24 hour clock is used.

The best type of time switch for swimming pool use should have two sets of switching levers to enable the pump to be turned off and on twice within the 24 hour period. This provides for morning and evening filtration. A manual switch or button should also be provided to enable the filter to be turned on or off at any time.

A time switch should be housed in a weather-proof enclosure, and should preferably be installed by an electrician as a permanent fixture.

POOL COVERS

Pool covers are installed for the following reasons.

- Thermal: Reduce heat loss from the water while heating during cooler weather.
- Debris: Keep the pool clean by largely preventing the entry of leaves, dirt and other air-borne debris.
- Blanket: To decrease the quantity and hence the cost of sanitizers required when the pool is not in use, and reduce the loss of water by evaporation and in turn, the build-up of total dissolved solids.

A cover which is primarily designed for safety to prevent children drowning when they fall into an unsupervised pool is called a safety cover, if it conforms to AS2020-1977: Safety Covers for Private Swimming Pools and Wading Pools (For the protection of children 5 years of age and under). There is no New Zealand equivalent Standard at this time.

The Australian code outlines the stringent tests which the cover must pass during manufacture, to act primarily as a safety device. Safety covers are discussed further in another section.

Pool covers which are primarily designed to reduce heat loss during cool weather are generally called solar or thermal blankets. These float on the water surface.

Most pool covers available commercially are designed as solar blankets. Rollers are available to be fitted at one end of the pool for removal and storage of the cover. A Thermobubble cover in action

Research carried out by the CSIRO (Australia) has indicated that swimming pools have their greatest heat loss through both evaporation and transpiration. This depends on the area of water exposed to the air, the wind strength, and the humidity. In 1973, Aquatech Ltd developed a cover by adapting bubble packaging material, consisting of two layers of clear plastic with air space between the layers, (the "bubble cover") which floats on the water and reduces heat losses due to radiation and convection, as well as evaporation. Radiation from the sun passes through the blue tinted plastic and is absorbed into the water. The heat generated is prevented from escaping by the insulating air space between the two layers of plastic.

There are many pool covers now on the market which employ the same system of insulation as the Aquatech cover notable Daisy (WA) BMH Industries and Leisuretime Industries (now Zodiac) in Auckland selling insulating covers from solar buble material. The typical bubble cover has one side made up of air bubbles and the other side flat and smooth. The solar cover must be used with the air bubbles laid on the water and the flat side up. These air bubbles perform the same insulating task via the air spaces between them as the insulating air space in the experimental CSIRO cover.

AUTO RETRACTING POOL COVERS

A relatively recent introduction has been the Automatic Retractable pool cover. There are several varieties, from tightly stretched flexible vinyl covers to extruded slat types not dissimilar to a "venetian blind" in appearance. Some types run overground, thus may be considered as "Safety" covers as they completely cover the pool and partially the pool surrounds as well. Others may float on the pool water, or are supported by a notch constructed into the pool wall, or a hand-rail attached internally into the pool. Both of the supported type may be considered "Safety" covers by the Local Authorities, but the type "floating-only" covers will not pass the requirements of a barrier against unauthorised access to the pool by children so cannot be considered "Safety Covers".

SPAS AND HOT TUBS

These work on the principle of providing heated, turbulent water in a small container, usually constructed of acrylic plastic (a.k.a. "Perspex"), concrete or wood, as part of the pool or at a separate location at or above ground level. A separate pump and filter and an air blower operating together pump aerated water jets into the spa. The bubbles of air released are trapped on the minute hairs on the body of the bather and shatter, creating millions of microscopic explosions on the skin. This stimulates the nerve ends, dilates the blood vessels and open the skin pores, producing a feeling of well-being and relaxation. The best results are produced from high water turbulence, and a heater to raise the water temperature to around 38^0C, even in tropical areas.

The following points should be borne in mind in maintaining a spa to ensure that the maximum benefit is derived from it.

1. Filtration

The spa should be fitted with its own filter and pump, as large as that needed for a standard size home swimming pool. Although the volume of water in the spa is small, it quickly becomes contaminated by the large build-up of body fats that occurs in heated water. For this reason, a sand-type filter is not recommended.

If a cartridge filter is used, it may be necessary to soak the cartridge in detergent for several hours after use, to remove the accumulated body fats. For this reason, it is a good idea to have two cartridges so that a clean one is always available for immediate installation.

2. Santisation

Be careful to maintain an adequate level of spa water disinfectant to keep the water in an hygienically safe condition. Most health authorities recommend the use of either bromine or Ozone in spa pools. Four people in an 1,800 litre heated spa are the equivalent of 120 people in an average home pool. The quantities of chemicals will need to be increased for large tubs or heavy usage. Many people simply "dump" the spa pool every month, as the cost of 1,880 liters of water at 30c a cubic meter is less than 50c, and this is often preferable to messing around with chemicals trying to balance and sterilise the spa. If it is preferred to chemically maintain the pool, a standard test kit or dip strips should be used in the usual way.

3. TDS Level

Total dissolved solids (TDS) is a measurement of all the chemical compounds dissolved in the water. A high TDS level may affect the chlorination process. Heated water evaporates more quickly, leaving behind the chemical compounds and building up the TDS level quickly. Hence it is necessary to change the water in the spa or hot tub quite frequently.

4. Corrosion

Never fill the spa with softened or de-ionised water. The calcium element has been replaced and the water is said to be hungry for calcium or other mineral elements. The result is corrosion – which will damage the surface of a plasteed concrete pool.

5. Scale

Calcium precipitates out of solution and forms scale on heater coils more readily with rises in pH or temperature. There are descalant chemicals available to help prevent this.

6 Chemicals

Water is unquestionably the cheapest chemical!

Empty the spa at least 4 to 6 times a year. Use only sodium-based chlorines such as sodium hypochlorite (liquid chlorine) or sodium dichloroisocyanurate (dichlor) to prevent scale formation. The level of stabiliser must be closely watched to be sure it does not rise above recommended levels. Never add chemicals through the spa skimmer.

When adding chemicals to the water, turn on the pump to mix the chemicals quickly and thoroughly through the water, with the air blower off.

7. Correct pH

pH should be maintained at the correct level (7.2 to 7.6) to maximise the effect of chemicals and to minimise deterioration of metal fittings through corrosion.

8. Acylic Spas

These should be cleaned and polished at least twice yearly.

Some features of the Spas: 1. Recess for mosaic tiles. 2. Air blower manifold. 3. Provision for underwater light. 4. Efficient skimmer design. 5. Insulated with polyurethane foam.

9. Wooden Hot Tubs

If the interiors of wood hot tubs are not lined with some kind of waterproof material, they should be guaranteed against water leakage, and also against the leaching of tannin from the wood which can discolour the water for a considerable time. If tannin does leach out, this material has a high chlorine demand and is generally acidic. Higher doses of chlorine are required until:

The leaching process diminishes
The water remains clear; and
Chlorine test readings start to hold in the proper range.

SPA POOL ACCESSORIES

A large range of spa pool accessories are available

A compact weatherproof control box designed for spas and hot tubs, featuring a multi-function time clock fusing for the heater, 3 separate remote control air switches, separate fusing and switches for the pump, heater, super-charger and light plus a ripple control indicator.

(A) ELECTRIC CONTROL BOX

These control the pump, supercharger and underwater light safely and reliably without leaving the pool. Available as single or double units ready to install.

(B) REMOTE CONTROL AIR SWITCHES

This simple but effective hydro-therapy spa jet mixes water and air for the massaging action.

Flush fitting adjustable eyeball returns have a 25 mm opening to allow the spa jet to achieve the maximum effect.

(C) SPA HYPO-JETS

(D) EYEBALL RETURNS

The spa drain with a screw on safety cover makes it impossible to get feet or hands caught by the pump suction.

Supplied with 12 v bulbs and a breakdown transformer for safe use.

(E) SPA RETURN DRAINS

(F) UNDERWATER LIGHTS

An inexpensive vacuum made specially for the smaller area of the spa pool allows sunken dust and dirt to be vacuumed away.

Floating thermometers are a must in a spa.

(G) SPA VACUUM

(H) SPA THERMOMETERS

Spa chemical packs with all the chemicals for good spa pool management plus full instructions are available.

A special spa pool test kit to test chlorine or bromine, pH, total alkalinity and water hardness with full instructions is available.

(I) CHEMICAL PACKS

(J) SPA TEST KITS

INSULATING COVERS in 12 mm thick closed cell foam to keep heat loss to a minimum and the spa clean, are available for all stock spas. Special sizes are made to order. SAFETY COVERS in strong nylon mesh or reinforced strong nylon mesh or reinforced PVC that completely cover the spa and that are fastened to the surround, are supplied complete with stainless steel anchor pins.

LADDERS, GRAB RAILS AND HAND RAILS

Once, in the past, almost every swimming pool was fitted with w two or three-tread stainless steel pool ladder. In the 21st century, however, it is not common to find these items fitted to residential swimming pools. The more favoured item for entering and exiting the pool seems to be in-built formed steps. A change in the Building Code (The Building Act 2004) has re-defined the height of step risers, however, so many moulded pools may not pass approval (if the Authorities are made aware). Other pool companys simply rename the "pool entry" as a "pool seat" thus avoiding unnecessary bureaucratic red tape.

Ladders and Handrails play an important part towards ensuring pool safety which will be discussed in greater detail later on. In this PAPER we will look at some of the side range of shapes and modes of attachment available for these, enabling them to be installed at any stage during the life of the pool. They are normally manufactured from high quality 318 quality stainless steel 32mm or 40mm seamless tube.

General purpose ladder
Suitable for most home pools.

Specially designed for home pools
with narrow surrounds.

(A) STANDARD LADDER

For pools with vinyl lining.

(B) COPING MOUNTED LADDER

For fibreglass or vinyl lined pools where mounting is only available away from pool edge.

(C) DECK MOUNTED LADDER

Suitable for home pools.

(D) CANTILEVER LADDER

Suitable for home pools with narrow surrounds.

(A) FIGURE 4 STYLE

Suitable for most home pools.

(B) D STYLE

Moulded Plastic

(C) P STYLE

For pools with built-in entry steps.

(D) WALL STEP

For fibreglass or vinyl lined pools and spas with entry steps.

(A) STAIR HAND RAIL

Flange mounted

(B) DECK MOUNTED HAND RAIL

(C) MULTI-PURPOSE HAND RAIL

Specially designed as continuous safety or kick rail around perimeter of pool for learners and other pool users.

(D) MODULAR SAFETY HAND RAIL

Familiarise yourself with New Zealand Safety Standards and regulations: for example NZ Draft Standard 4441S considered banning handrails in school pools as being a possible entrapment danger. 4441S was not adopted into Law, but has been widely circulated to the Terriotorial Authorities as a "Recommended Practise". In other words it will probably become mandatory.

UNDERWATER POOL LIGHTING

INCANDESCENT: Servicing these older type of 100w or 150w 12 volt incandescent bulbs enclosed in a waterproof housing (Niche) can be problematical: they are usually installed in pairs during the construction of the pool and used for aesthetic and practical reasons. A big problem is the heat produced by the bulb pressurizing the (supposed) water-tigh Niche. This pressure escapes and creates a vacuum when the light is turned off. Suction by the vacuum then allows outside water to get into the nich – quite often damaging the system and "blowing" the light bulb. The best fix is to swap out to an LED lighting system that is designed to retro-fit these Niches.

If the customer wants to keep these old incandescent lights, point out that New Zealand Electrical Regulations do not allow 240v AC anywhere near a swimming pool, so all pool lights will be fed a low voltage direct current (DC) usually 12vDC. Each Pool Light must have its own step-down transformer. The transformer should be mounted in a convenient position well away from the edge of the water - at least in Zone 3 (3 metres), in a weatherproof enclosure if it is not supplied with same. The light assembly mounted in the wall of the pool is fully sealed, usually with one entry point only for the power cable trough a watertight CROX fitting.

L.E.D (Light Emitting Diodes): LED light devices are effectively miniature bulbs that do not use filaments to produce light. Therefore, the life of an LED is much longer than that of a regular incandescent bulb, because there is no filament to burn out. Incandescent bulbs also tend to be much larger in size due to the filament, which must be housed in a vacuum inside the bulb. LED light bulbs last as long as a standard transistor used in modern electronics and are lit purely by the movement of electrons.

As the power source for the L.E.D. is a data stream (rather then electricity) there is no "transformer" rather a control box that has data outlets that transmit the signal through a data cable or flexible light-conducting lead rather than electric wire, so there is no requirement for individual sources for multiple lights. Up to six outlets are common from one control box.

The simplicity and long life of the LED make its use very desirable for various technological applications. LED light bulbs are housed in a durable plastic rather than glass and perhaps most importantly, are much more efficient. In traditional incandescent bulbs heat is generated when activating the filament to produce light. This causes energy to be wasted on the production of heat rather than the production of light. In order to produce the same amount of light as an LED, an incandescent bulb would have to work even harder. LED light bulbs save electricity and lower electric bills. (Attribute: www.wisegeek.com)

If you have any doubts about the safety of your customer's pool electrical installation, you should consult an electrician without delay, as life is literally at stake when dealing with 240v electric power.

VALVES

There are many types of valves in use around the home pool and/or spa.

PUSH-PULL AND MULTIPORT FILTER VALVES (MPV)

When discussing filters earlier, we saw that backwashing was achieved by means of a value which directs water into the tank in the reverse direction to flush dirt from the filter medium and then to waste. This valve may be of either the push-pull or rotary type. Such a valve, if fitted, should turn or move easily from the 'filter' position to the 'backwash' position.

Some valves called multi-port valves or multi-purpose flow control valves fitted to filters have several positions to enable different operations to be performed. For example, in addition to the FILTER and BACKWASH positions, some have a by-pass position called RINSE and WASTE so that water can be pumped directly out of the pool to waste without going through the filter and sometimes RECIRCULATE so that water can pass through the system without going through the filter – i.e. to run a water feature etc. The WASTE setting provides a simple method of removing excess water from the pool after heavy rain, should the pool not be fitted with a self-levelling device.

All generally used positions which may be incorporated into the multi-purpose flow control valve are:

CLOSED - to isolate all inlets and outlets to the valve;
RECIRCULATE - to by-pass the filter tank and to circulate water in the pool
FILTER - to filter the pool water
BACKWASH - to backwash
RINSE - to rinse the valve seals after a backwash cycle

Less common is:
PUMP - to pump water from an external nearby source into the pool for topping-up;

There are automatic valves available which will turn the filter to backwash when the pressure inside the tank rises to a particular level, indicating that the filter is dirty and needs to be cleaned. After backwashing, it automatically turns itself back to the filter position. It is more expensive but is a quality valve which saves the operator considerable time and effort.

It is wise to pay extra for a good valve to avoid a valve breakdown and the resultant loss of filtering capability.

THREE-WAY VALVES

Some filters provide only a two-position valve, i.e., backwash and filter modes. To enable the pump to be used to remove excess water from the pool and divert it to waste without going through the filter tank, a three port valve may be installed between the pump outlet and the standard two position valve. A three-port valve is, in effect, a T piece whereby flow entering the vertical port is directed either to the left or right by a half turn of the rotary-type handle on which an arrow is cast to show the direction of flow. See Fig. 4.18. Valve positions should never be changed without first shutting off the pump to protect the pump against damage.

SIX-PORT VALVES

These are basically two three-port valves arranged either permanently coupled so that the one action controls both valves, or having separate flow control levers for each valve. They are mainly used where a spa is constructed integrally with a pool and uses the same filtering equipment as the pool. The six port valve directs water to and from the pump/filter/heater system to the pool only, to the spa only, or divides the flow between both.

NON-RETURN OR CHECK VALVES

These are used to ensure that flow in one direction only occurs, i.e., to prevent reverse flow. This type of valve should be installed on the suction line near the pump where the filtering equipment is installed at a higher elevation than the pool water surface, to prevent the suction line draining into the pool when the hair and lint strainer lid is removed. A non-return valve installed in this instance enables the hair and lint strainer pot to be filled for priming the pump, as water loss back into the pool is prevented.

A common type of non-return valve, called a spring check valve consists of a spring-loaded seat which requires a small amount of suction pressure to open it to allow flow. As soon as the pump stops, the spring forces the seat shut, thus preventing back-flow. A hand screw cap enables the spring and the seat to be removed for cleaning purposes. See Fig. 4.20(a)

(A) SPRING CHECK VALVE (B) SPA RETURN LINE SPRING CHECK VALVE

Non-return valves are also installed on raised spas integrated with pools, to hold the higher water level in the spa when the pump is not operating. Called a spa return line spring check valve, it is installed on the inside wall of the spa for ease of servicing. See Fig. 4.20(b).

STOP VALVES

As the name suggests, these valves prevent the flow of water completely in any direction. Either of two types are normally used around the home swimming pool, namely ball valves or gate valves. Such a valve should be installed before the pump where the filtering equipment is lower than the pool water surface, to prevent water draining from the pool when the lid of the hair and lint strainer is removed.

(A) PLASTIC BALL VALVE (B) METAL BALL VALVE

WHICH RESISTS CHEMICAL ATTACK

WITH SCREW-THREAD PIPING ADAPTER

(C) BRONZE GATE VALVE

(D) CROSS-SECTION OF GATE VALVE

4.9 POOL AND SPA HEATING

A choice of one of several means of heating a pool and/or spa is available, namely from oil-, LP gas-, town gas- or natural gas-fired boilers, electric heat pumps & heaters and various solar heating systems. We will look at the advantages and disadvantages of the main types of systems available to pool owners today.

A typical side-exhaust Heat Pump

The average sized pool of 9.2 m by 4.5 m contains about 60 000 litres of water with a surface area of 41.5 m^2. To heat such a body of water, a large energy input is required. The energy required is expressed in kilowatt hours.

Both the volume of water and the heat loss via the large surface area must be considered when attempting to raise the temperature of the pool. The heat losses are largely dependent on the surface area, ambient (surrounding) temperature, pool temperature and wind over the surface, and the effectiveness of the pool cover which should be installed.

The average daily heat loss for the pool mentioned above in maintaining the water at 24^{0}C in December, January and February, where the average ambient temperature is 24.6^{0}C, is obviously nil.

However, the average daily heat loss for the same pool and conditions in June, July and August, where the average ambient temperature is 15.4^{0}C, is approximately 175 kilowatt hours, provided a suitable pool cover is used.

The average heat loss throughout the year to maintain the water temperature at 24^{0}C for this pool with a suitable cover is approximately 27 550 kilowatt hours, quite a lot of energy. The energy required for spa heating is considerably less.

The selection of heating equipment capacity should be based upon local ambient temperatures, and should be of sufficient output to maintain the following water temperatures.

Spa pools	38^{0}C to 39^{0}C
Competition swimming	22^{0}C to 25^{0}C
Leisure Swimming	27.5^{0}C to 30^{0}C
Learner Pools	32^{0}C

The maximum temperature of any swimming pool should not exceed 32^{0}C or spa must not exceed 40^{0}C. Swimming Pool water above 25^{0}C will not cool down swimmer training in the pool and may result in heat exhaustion

Heating equipment must always be installed downstream of the pump and filter in the return line to the pool. It should be thoroughly checked at minimum twelve monthly intervals, to ensure the correct operation of all controls and safety devices.

Heating experts generally recommend that the pool heater be left on during the week during the swimming season. Contrary to popular belief, the pool owner pays more if the heater is turned on and off for weekend swimming only – especially low output heaters such as Heat Pumps. This is because more heat is needed to raise the temperature of a large body of water than it is to maintain it at comfort level during the week. Water, after all, is a great heat sink!

No pool heater should operate unless the water is being circulated through it by the filter pump. It is necessary to run the filter and heater continuously for 24 hours or more initially until the desired temperature is achieved. The daily running of the heater is dependent on prevailing weather conditions but generally the normal daily eight-hour operation of the filter is sufficient as the heater will be controlled by its own thermostat which the customer sets at his desired temperature.

Whenever there is more than 4^{0}C temperature differential between daytime and night-time temperatures, it will be more cost effective to have the Thermal Cover fitted if the pool is not in use, as the pool will lose heat during the night.

In summer, most people remove and store their Thermal Covers. In winter, the cover MUST NOT be left on the pool otherwise a green mass of algae will be encountered in spring when it is removed. Costly to bring back, there is no reason for a Thermal Cover to be on the pool when it is not being heated. It is, after all, a HEAT RETENTION cover.

OIL HEATING

Oil-fired boilers are an unpopular installation in home pools today due to the high cost of diesel oil and its uncertain availability at times.

GAS HEATING

Natural gas, town gas or bottled LP gas can be used for heating. Installation costs depend on the availability of gas mains and their distance from the site. Bottled LP gas used where mains gas is not available is more expensive. A high efficiency rate of about 70% can be obtained with gas heaters. The heaters usually automatically control the water temperature and have a constant flow valve to prevent scale build-up.

ELECTRIC HEATING

Electric element heaters, like gas heaters, are simple to install by plumbing directly into the circulation system but the provision of three-phase wiring to the unit if necessary, where most houses have only a two-phase connection, makes the installation cost high for heating a swimming pool in this method, which is why almost no-one does it these days.

A better option is the electrical Heat Pump for residential swimming pool heating. These units use from 2,400 watts to 6,500 watts, and are generally available in single and three phase inputs. There are a number of options on buying heat pumps, the most common being sourced from China, but others are manufactured in the Phillipines, Australia and New Zealand assembles Heat Pumps under the Hot Water Heat Pump brans using imported components.

The typical heat pump range could be:

Model	Designation	Phase	Input	Output Equivalent
Small	Small pools	single	2400 w	9000 w
Medium	Medium size pools	single	3000 w	11000 w
Larger	Larger pools	single	3600 w	13000 w
Very Big	Big pools	3 phase	6000 w	23000 w
All Year	12 month heating	3 phase	6500 w	25000 w

The above example is for general information only!
Some Spa pools are now being fitted with smaller size heat pumps

HEAT PUMP RUNNING COSTS:

Assuming an eight-month season (Upper North Island) – use your own data for your area:
2.2 Kw input – 14Kw output Filtermnaster FM14 – other types may vary
.19c Kw/Hour (x 2.2 = $0.41.8 center per running hour) Pool temperature requirement: 27.5°C

Air Temp (Alber Park, Auckland) Hi and Low

	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	
	15.0	16.0	17.0	18.0	20.0	22.5	24.0	25.0	25.0	20.0	17.5	15.5	
	7.0	8.0	10.0	12.0	12.5	15.0	16.5	17.0	16.0	14.0	11.0	8.5	
Sunlight		0	.5	1.0	1.5	2.0	4.5	8.0	7.0	6.0	5.0	4.0	0
Required boost.	-	-	13.0	11.0	9.3	4.3	-	-	1.8	5.5	-	-	
Running Hours	-	-	10.0	9.0	7.0	6.0	-	-	2.0	4.0	-	-	
Monthly Cost =	-	-	$132	$119	$92	$80	-	-	$26	$92.5			

Total for 8 month season = $542.00 (Running hours = 38 hours, times 41.8 cents per Kw hour)

THIS ASSUMES A THERMAL HEAT RETENTION COVER IS INSTALLED SEPT-DEC AND MAR-MAY

NOTE: Increasing the pool temperature requirement will dramatically increase the running costs of any heater!

All electric heaters must be installed by a qualified electrician.
Electricity is most efficient in terms of heating but has a high operating cost in some areas.

The advantages of heaters which operate on oil or gas is that the water can be heated when you want it, day or night, and that the desired temperature can be maintained regardless of the weather. The downside is the additional cost.

MINIMUM REQUIREMENTS FOR OIL, GAS OR ELECTRIC POOL HEATING SYSTEMS

Automatic chemical dosing equipment must be installed downstream of the heater, at least 2 metres from the heater outlet connection, preferably in the plastic pipeline section.

The heating equipment, its installation and maintenance, must meet the requirements of local statutory bodies, and the heater manufacturer's instructions. Particular attention should be given to the local requirements for gas, electricity, water and ventilation.

All heating equipment must be fitted with a high temperature limit control to prevent the water temperature exceeding 60^{0}C.

Heaters must be fitted with a flow switch, or pressure switch, or device to ensure that the heater will not operate without water flow. This is particularly important where valves are installed in the filtration system to enable the heater to be isolated from the pool water circulation system during heavy chemical dosing periods.

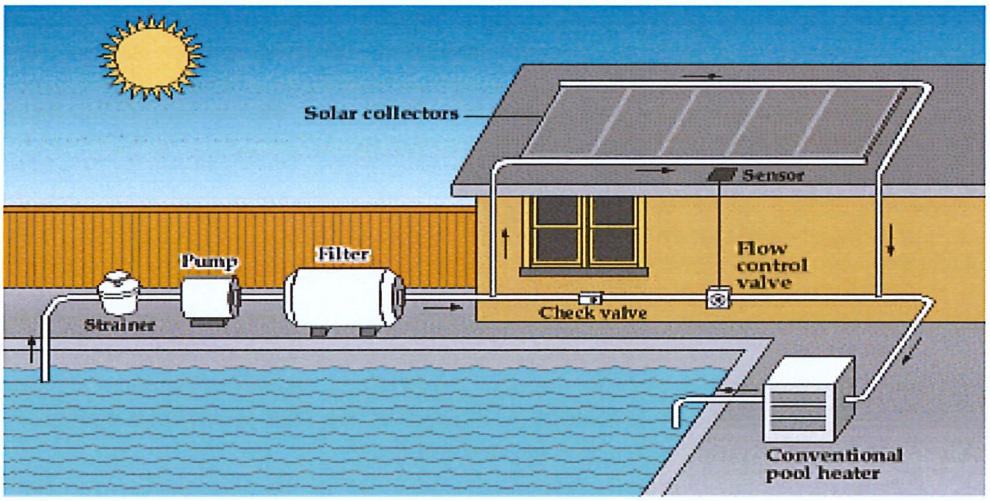
Heaters must not be installed in enclosed areas where they may be subjected to pool chemical fumes or fume-laden air.

Pool heaters should be located as close as possible to the filtration equipment to keep pipework length and resultant pressure drop to a minimum.

A GOOD IDEA IS TO INCLUDE PIPE INSULATION (Source: Forman Insulation Auck.)

SOLAR HEATING

One of the most effective uses of solar energy is in the heating of water for swimming pools. It is also used for spa heating although booster heat source is required to replace heat losses between sundown and spa use at night, and also during the operation of the spa.



Although the use of solar energy in heating domestic pools is not effective for the entire year, it should work well in the height of summer, but has limited ability to extend the swimming season. They are most effective in mid-summer.

Compared to the current cost of running an oil, gas or electrically heated pool for four months during the year, it would take approximately five years to recoup the cost of installation of a solar heating system, although this is no more than that for a conventional heating system. The big difference is in the running costs.

New Zealand, by comparison with other countries, has a reasonable amount of annual sunshine, relatively free from filtering agents caused by heavy pollution. The onset of the energy crisis in 1973 was responsible for the growing attention now being given to solar energy which – is clean and efficient.

To be effective, a solar pool heating system should be sized from 75% to 100% of the pool area, but is fair to say that the more area of solar panels, the warmer the pool will become. The system should be capable of turning over all the water in the pool in not more than two days. More efficient heating of the water is obtained if there is a fast flow-rate through the solar panels, so it is recommended that a separate pump and temperature comparison system is used: if the water in the solar system is warmer than the pool, it switches on: if the water is cooler, it does NOT switch on. This will prevent the pool cooling down if a cold snap passes overhead.

Buyers of any type of solar pool heating should seek written guarantees from suppliers regarding the anticipated life of the product, as ultra violet rays can damage any PVC item left out in the sun for years, and to repace them is 90% of the initial cost all over again!

A pool blanket should always be used at night to decrease heat loss.

There are two systems of solar pool heating in popular use today.
These are as follows:

1. The Gravity System

Water is drawn from the deepest end of the pool and pumped using a separate pump, up on to the roof of the house into solar collector panels exposed to the sun (either under a glass cover, or in the case of the PVC collectors, simply laid onto the roof) where it is heated to the desired temperature.

The cycle is completed by the return of the heated water to the shallow end of the pool. The process is fully automatic and completely separate from the filtration system.

A sensor turns the pump on to supply pool water to the collector plates whenever it senses sufficient solar energy output is available to heat the water. There is also an over-temperature cut-off switch which turns the pump off on hot days when the water temperature would become too warm if it continued to be pumped to the solar system. The thermostat is pre-set to the desired water temperature.

The separate pump and .750 watt motor are fitted to the system since the pool water should be pumped to the solar collectors when the sun is available and at its hottest period of the day. Systems connected to the filter pump of the pool will not necessarily operate at the best times, so a "filtration plant" fed solar system is to be avoided.

One advantage of the gravity system is that because water flows freely over the panels and not through small pipes, there is no risk of blockages from debris of chemicals.

The size of the solar panels should not be less than 100% of the pool area and should be facing north. The angle of the panels can be a compromise between summer and winter angles of the sun. Any shade from trees must be considered for this will alter the temperature dramatically. The size of the pipe to the panels is usually 40 mm.

2. The Closed Circuit System

This usually consists of a thin plastic panel into which are moulded hollow tubes through which the water runs. In some cases, the water is pumped to the panels located on the roof by the filter pump via a pipe connected to the pool return line, but this is not the preferred method. Use a separate pump..

It is best to have the system equipped with an automatic switch designed to shut off the distribution of water to the panels when the weather is overcast or rainy, preventing heat loss.

The black plastic panels marketed today are made from either polypropylene or polyethylene. Both products use petrochemicals for manufacture, and should be stabilised to stand up to the strong ultraviolet rays in New Zealand, to give a life expectancy of at least 8 - 10 years.

Some panels are designed to allow maximum contact with the roofing material of the house and absorb heat energy via conduction from the roof as well as radiation from the sun.

Moulded fibreglass closed circuit panels are also available. These are strong non-corroding and self-supporting so they can be used on pergola structures as well as on house roofs, and have wide waterways covering more than 90 per cent of the panel. In areas with an extreme temperature range, a relief valve is fitted which drains the panels to prevent the water freezing or boiling. Fibreglass, like PVC plastic, is affected by the sun.

When discussing the relative costs of pool heat with your clients, be aware that an electronically controlled solar system running a 750 or 1000 watt pump might operate for up to 8 hours a day in spring and autumn.

Power usage will be 8 x (say) 1000 watts – or 8000 watts for the day.
8kw @ 20c per Kw = $1.60 per day

You must compare this to the heat pump, which – although drawing 2400 watts – might only operate for three to four hours – (say) 4 x 2400 = 9600 watts.
9.6Kw @ 20c per Kw = $1.92

A Heat Pump will cost 32c a day more than Solar under these conditions.

The marginal extra power use of the heat pump might not justify using solar, and you cannot describe the solar as "free heat" under these circumstances.

Be cautious what claims you make for Solar Heating.

MINIMUM REQUIREMENTS FOR SOLAR POOL HEATING SYSTEMS

Most importantly, a suitable roof facing North/NorthWest, ideally at 15^0 pitch, although this changes as the intended heating times vary: i.e. for early and late season use, the panels should be more vertical so as to catch the low declination of the sun. Equally for mid-summer heating, the panels should be flatter, so to catch the higher declination of the sun.

All systems must be equipped with devices that allow air to be expelled from the system and the vacuum to be broken when the system drains. This can involve quite complicated plumbing (to avoid the filtration system from depriming every time the system shuts down, if you are using the pool pump to power the solar system) An automatic draining facility must be provided to ensure that collection devices do not contain water in a stagnant situation.

Although it's cheaper (and helps sell the system) ***DON'T use the pool filtration pump to feed the Solar Panels***. The main danger in doing this is the undersupply of the panels when the filter reached its highest pressure levels (i.e. needs a backwash) which could to the water in the panels boiling and destroying them. But it's a bad idea anyway to deprive the essential functioning of the tuned filtration system by asking it to do "double duty" and feed the Solar system as well as filter the pool. Use a separate suction line and return line, a separate self-priming pump (500w or 850w will suffice) hooked up to a temperature differential sensor. If yopu are going to do Solar, do it properly!

If a common (non pool or non-self priming) pump is used, care should be taken to ensure that the circulation is of sufficient capacity to provide adequate flow through the solar collectors, and any ancillary equipment simultaneously. Where a separate pump is provided for the solar heating system, the pump need have capacity only for this purpose.

Solar systems incorporating metal components must have provision for isolation of these components during heavy chemical dosing periods.

The installation and maintenance of the solar system must meet the requirements of local statutory bodies and the manufacturer of the solar system.

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