

# INDEX

1.	SPECIFICATIONS	1
2.	SYMBOLS & WARNINGS	2
3.	EQUIPMENT CONTENTS	4
4.	INSTALLATION	4
	4.1 Installation Space Requirement	4
	4.2 Installation Base for the Heat Pump	5
	4.3 Installation of the Pipeline	5
	4.4 Installation of Water Pump & Flow Switch	7
	4.5 Installation of Electric Components	8
	4.6 Appearance and Button Functions of Controller	10
	4.7 Protection Specifications	12
5.	OPERATION AND MAINTENANCE	14
	5.1 Routine Maintenance	14
	5.2 Refrigerant Filling	14
	5.3 Lack Detection & Air Tightness Examination	14
	5.4 Remove Compressor	14
	5.5 Routine Maintenance	15
6.		16
7.	TERMS OF WARRANTY	19

Congratulations on selecting a Dayliff Heat Pump. They are manufactured to the highest standards and if installed and operated correctly will give many years of efficient and trouble free service. Careful reading of this Installation Manual is therefore important, though should there be any queries they should be referred to the equipment supplier.

# **1. SPECIFICATIONS**



A cold swimming pool is an unused swimming pool and in many upcountry areas swimming pools are too cold to use throughout the year and heating is required. There are a number of options available, but a particularly effective solution is the Dayliff Heat Pump. Heat Pumps utilise energy from two sources, heat from the ambient air and electrical power to run a compressor in a reverse refrigeration cycle, the compression process extracting heat from the ambient air for transfer to the pool water. The heaters are highly efficient operating at a Coefficient of Performance (COP), which is the ratio of energy output to direct energy input, of up to 6 times depending upon the environmental conditions. They are therefore very economical to run compared with fossil fuel alternatives though a pool cover must be used to ensure maximum heat retention. Heat Pumps are simply installed in-line on the filter return to pool pipe and include an integral controller and a durable housing suitable for outdoor installation. Particular features include:-

- Low energy consumption for low running cost and low emissions for heating and cooling applications.
- SPS-190 fitted with a plastic casing, larger sizes with a powder coated galvanised steel casing for long life
- High efficiency compressor that uses environmentally friendly R410A refrigerant.
- Advanced dual coil titanium heat exchanger for long corrosion free life
- Built-in protection for the compressor, low water flow, high/low pressure and electrical overload
- Fully automatic and simple to install with minimal plumbing and electric connections.

- Remote controller to set temperature up to  $40^\circ\text{C}$  with digital system setting and fault indicators.

Dayliff Heat Pumps are robust and efficient units that are the ideal solution for cost effective pool heating in a variety of conditions.

#### **OPERATING CONDITIONS Ambient Temperature:** 10-60°C

**Humidity:** 0-95%



#### **PUMP DATA AND DIMENSIONS**

# 2. SYMBOLS & WARNINGS



The installation shall be done by professional person, to prevent leaking, electric shock, or fire disaster.



Electrical installation must comply with the relevant local technical standards.



Ensure ground connection is properly done, else may cause electric shock.



When installed in a small room, ensure there is sufficient ventilation.



Avoid installations in such locations with mineral oil, air containing salty or corrosive gases, flammable compounds, strong electromagnetic waves or harsh environmental conditions.



Ensure there is enough space for installation and maintenance.



Make sure the air inlet and outlet are unobstructed for ease of maintenance.



Recheck the model, number, name etc, to avoid incorrect installation.



The installation base must be strong enough to support the weight else may damage the equipment.



Avoid installation in an unstable place, such as car or cabin



Don't put finger or sticker into the air inlet or air outlet. As the internal rotor high-speed operation may cause injury.



When a burning smell is detected, turn off the manual power switch immediately, stop operating, and contact Dayliff retailer.



When the unit needs to be removed, re-installed or repaired, contact Dayliff retailer or have a qualified person to do it. If the installation is not well done, it may cause failure, electric shock, fire, leaking, etc.



The heat pump must not be modified for other uses as it may cause electric shock or fire.



Before cleaning the unit, the operation should be stopped, and power switch turned off.

# **3. EQUIPMENT CONTENTS**

Item No.	Description	Quantity	Use
1	Installation manual	1	Guidance on proper installation
2	Controller with connecting line	1	To automate control of the heat pump
3	Water flow switch	]	To protect heat pump against running under flow condition
4	Certificate of approval	1	Proof of product quality
5	Warranty Card	1	Warranty Certificate



Water pump is purchased separately and must be properly sized.

# 4. INSTALLATION

# 4.1 Installation Space Requirement



#### 4.2 Installation base for the heat pump



- 1. When moving use four or more soft lifting belts to move the equipment.
- 2. Use protective plate on the surface of the unit to avoid scratching and deformation.
- 3. Recheck whether the foundation is level before hoisting the unit.
- 4. The heat pump will produce condensation water, provide a drainage channel in the installation base during construction.
- 5. Include shock absorbers on the base surface to prevent vibration.

# 4.3 Installation of the Pipeline

- 1. Prevent air, dust and other debris from going into the water pipes and fix the whole system before installing the water pipe.
- 2. Water inlet and outlet pipes should be insulated to prevent heat loss.
- 3. Stable water flow should be maintained at all times.
- 4. When moving the equipment water inlet and outlet pipe should not be used for carrying else will damage the equipment. Instead use holes provided on the base of the equipment.
- 5. When connecting the water inlet and outlet pipes, two pipe wrenches shall be used to ensure the pipes do not turn around unnecessarily.

5







- The non-return valve is recommended for each unit to prevent the water back flow.
- The system can be combined with multiple units, but should be controlled independently.
- Regarding the installation of backup pump, maintenance valve and temperature measuring point, a separate design may be considered if necessary.

6

• All pipes and valves of the unit must have heat insulation.



The swimming pool heat pump uses titanium heat ex-changer and may be connected to the swimming pool directly. A water filtration unit must be installed before water goes into the heat pump, minimum size about 40mic.

- The non-return valve is recommended for each unit to prevent the water back flow.
- The system can be combined with multiple units, but should be controlled independently.
- Regarding the installation of backup pump, maintenance valve and temperature measuring point, a separate design may be considered if necessary.
- All pipes and valves of the unit must have heat insulation.

# The demand quality of water

• Poor quality water will produce more scale and sand, this kind should be filtered before putting through the heat pumps.



The water quality should be analyzed before system running, to measure the pH value, conductivity, Chloride ion concentration and sulphate ion concentration.

• The acceptable water quality standard is shown in below table.

pH Value	Total Hardness	Conductivity	Chlorine Ion	Ammonia Ion
7~8.5	<50ppm	<200V/cm(25°C)	<50ppm	None
Sulphate Ion	Silicon	Iron Content	Ca	
<50ppm	<50ppm	<0.3ppm	<50ppm	

## 4.4 Installation of Water Pump and Flow Switch

#### Selection of the water pump

• The circulation pump should be correctly sized to pump water through the pool circulation and filtration system.



# When the heat pumps are connected in multiples pump head is subjected to the worst working condition loop.

## Flow switch

The flow switch is provided together with the heat pump and meets the following criteria;

- The temperature of fluid should be between 0 and 120  $^\circ \rm C$  , max working pressure of 13.5 bar.
- The flow switch can be installed on the horizontal pipeline or the vertical pipeline with the water flow direction upward, it should not be installed on the vertical pipeline which the water flow is downward.

• The flow switch must be installed on a straight pipeline and there must be more than five times the length of the pipe diameter at its two sides. The direction of flow must follow the arrow on the switch. The terminal block should be easily accessed for maintenance.



Do not use a spanner to fix the flow switch, else may cause damage.



## 4.5 Installation of Electric Components

# **Electrical Wiring**

- The unit should use a dedicated power supply with correctly rated voltage.
- Power line and signal line layout should be neat, reasonable and synchronized. Avoid contact with water pipe and the valve body.
- After all wiring is completed, check it carefully before switching on the power supply.
- Power cable must be properly selected based on the power requirement on the nameplate.





# **Special Requirement**

- 1. For 1pH circulation pump connect live line with one output port of the three phase lines KM2 and connect the pump null line with the null port XT1.
- 2. The circulation pump must be installed in the water flow pipe line system between the heat pump and the pool outlet line. Install the water flow switch and water pressure gauge in the outlet pipe line of the water pump.



#### The screen filter must be installed before the input of the water pump and the dirt cleaned out whenever pressure drop gauge noted.

The electric auxiliary heat start and stop signal does not connect to the electrical heating load. It only switches AC contactor coil which in turn controls the heating cord.



The pump must be installed with the correct wire and grounding must be effective. Do not connect the earth wire with water pipe and lightning conductor as this may cause electric shock.

#### 4.6 Appearance and button functions of controller



#### **Keyboard lock and unlock**

If there is no operation within 60 seconds, the keyboard will be locked automatically. To unlock press the "O" key for five seconds until buzer sounds are heard.

#### Display backlight turn on or off

If there is no operation within 60 seconds, the display backlight will go off, press any key to turn on the light.

#### **Power On/Off**

If on standby mode, press "O" key to turn on the controller If on power on mode, press "O" key to turn off the controller.

#### **Mode Change**

If under the power on mode , press"M" key to change the mode and choose between heating, cooling and constant temperature.

10

#### Water Temperature Setting

Under the condition of power on, press "▲ " or " ▼ " key to set the water temperature.

Heating Mode: water temperature (L3):  $20^{\circ}C \sim 40^{\circ}C$ , default:  $28^{\circ}C$ .

Cooling Mode: water temperature (L4):  $7^{\circ}C \sim 20^{\circ}C$ , default:  $12^{\circ}C$ .

Constant Temperature Mode: temperature (L1):  $7^{\circ}C \sim 40^{\circ}C$ , default:  $28^{\circ}C$ .

# Time Setting

- 1. Long press "O" key for about 5 seconds to enter time setting.
- Press "O" key once to enter hour setting, press "▲" key or "▼" key to set the correct number.
- 3. Then press "⊙" key to enter minute setting, press "▲" key or "▼" key to set the correct number.
- 4. Once setting is finished, press "O" key once finish the process.

# **Timer Setting**

- 1. The system can be set automatically for power on and power off for two time periods.
- 2. Press "O" key to start the timer setting.
- 3. In the bottom right corner of the screen, "1" will be displayed, which means the first time period setting has started.
- 3. Press "O" again, to enter the power setting required.
- 4. Press " ▲ " or " ▼ " to set hour parameter.
- 5. Then press " 🕑 " to accept and set minute parameter in the same way.
- 6. Press "O" another time to end the automatic power one setting and start the automatic power off setting.
- 7. Press "▲" or "▼" to set hour parameter, then press"⊙" to set minute parameter in the same way.
- 8. After the first time period setting is done, press "▲" to enter the second time period setting,
- 9. in the bottom right corner of the screen "2" will be showed, which means the second time period setting has started.
- 10. Repeat operation as above.
- 11. Press "O" key, to end the timer setting.

# **Cancel Timer Setting**

- 1. To cancel the timer setting, press "O" once, then press "O" again for 5 seconds, the first time period setting will be canceled.
- 2. To cancel the second time period setting, press "O" once, press "O", then long press "O" again for 5 seconds.

#### **Operating Parameters**

Code	Meaning	
A1	Coil temperature	
A2	Discharge air temperature	
A3	Exhaust temperature	
A4	Ambient temperature	
A5	Input water temperature	
A6	Return water temperature	
A7	Unused	
A8	Compressor Current	
A9	Unused	
AA	Expansion Valve	

#### **Fault Codes**

Fault Code	Meaning	
01E	Default phase	
02E	Loss of phase	
03E	Water switch	
04E	Anti freezing	
05E	High pressure	
06E	Low pressure	
09E	Communication	
11E	Time limited	
12E	High exhaust temperature	
15E	Input water sensor fault	
16E	Coil sensor fault	
18E	Exhaust sensor fault	
21E	Ambient sensor fault	
22E	Return water sensor fault	
23E	Supercooling protection	
27E	Outlet water sensor fault	
29E	Return air sensor fault	
35E	Compressor overflow	

#### **4.7 Protection Specifications**

3 minutes after the compressor has stopped, it can start again.

#### Water Flow Switch Protection (for water cycling system)

Start the system and run the circulating water pump, if water flow switch is disconnected the compressor and outer blower will stop working until the water flow switch is reconnected for more than three minutes.

#### **Exhaust Temperature Protection**

If the temperature is beyond 115°C and lasts for 30 seconds, it will be interpreted as system is over heated. The output will stop and fault code will be displayed.

## **High Pressure Protection**

- 1. If the high pressure switch is disconnected less than three times per hour, display panel will show fault code with alarm.
- 2. The compressor, fan and water pump will stop working and restart again after the high pressure switch is reconnected.
- 3. If the high pressure switch is disconnected more than three times per hour, the controller will lock up this fault, and stop all the output no matter whether the high pressure switch is reconnected or not.

#### **Low Pressure Protection**

- 1. If the low pressure switch is disconnected less than three times per hour, display panel will show fault code with alarm.
- 2. The compressor, fan and water pump will stop working and restart again after the low pressure switch is reconnected.
- 3. If the low pressure switch is disconnected more than three times per hour, the controller will lock up this fault, and stop all the output no matter whether the low pressure switch is reconnected or not.

## **Sensor Failure Protection**

If there is something wrong with the sensor, all the output will be stopped and fault code will be showed.

#### **Three Phase Protection**

Rotate switch 1 to number side, and connect mains power, the system will detect the three phase electricity working condition. If there is anything wrong, the protection pattern will start, output will be stopped, fault code will be shown.

# **Adjusting and Initial Operation**

- Within 12 hours after operation, connect the circuit breaker and energise the heater.
- Open the main value of water system and the second value of assistant tank, fill with water and bleeding air.
- Perform necessary adjustment if need be.
- After the power is switched on, start the test running of heat pump to see if it functions well.
- Forced operation is not allowed, as it is dangerous to work without protection.

## Checklist Before Making Adjustments;

- The system must be installed correctly
- Tubes and lines must be put in the right place
- Accessories are correctly installed
- Ensure proper drainage
- Ensure perfect insulation
- Ensure correct earthing of the heat pump
- Ensure correct supply voltage to meet the requirement of rated voltage
- Air inlet and outlet functions
- Electrical leakage protector works well

# 5. OPERATION & MAINTENANCE

#### **5.1 Routine Maintenance**

- Control and protect the equipment.
- Pay close attention to whether all the operation parameters are normal during system working.
- Regularly examine whether the electrical connection is loose, if not tighten.
- Regularly examine the reliability of electrical components and change failed or unreliable components.
- There will be calcium oxidized or other mineral substance deposition on the surface of water heat ex-changer copper coil after long period of operation. This will impact the heat exchange performance and lead to high electrical consumption, high discharge pressure drop in air suction pressure and resulting in lower hot water production. To clean, use formic acid, citric acid, acetic acid or other organic acid.
- The dirt retention on the surface of evaporator fin may be cleaned using 6bar compressor blower, brushed by fine copper wire, or flushed by high pressurized water, usually once per month. If there is too much dirt, a paintbrush dipped gasoline may used to clean.
- After long downtime, the following should be done before restart examine and clean the equipment carefully, clean the water pipeline system, examine the water pump, and fasten all the wire connections.

# **5.2 Refrigerant Filling**



# Use genuine replacement parts to ensure proper repairs

Examine the refrigerant level from the display screen. Also check the air suction and exhaust pressure. If there is leakage in the refrigeration circulation system, examin air tightness and adjust if necessary.

## 5.3 Leak Detection and Air Tightness Examination

During leak detection and air tightness examination do not fill the refrigeration system with oxygen, ethane or other flammable harmful gas. Use compressed air, fluoride or refrigerant for such trials.

#### 5.4 To Remove the Compressor

- Turn off the power supply
- Drain the refrigerant from the low pressure end, paying attention to reduce the exhaust speed.
- Remove the compressor air suction and exhaust pipe.
- Remove the compressor power cables, fixing screws and eventually the compressor.

#### 5.5 Routine Maintenance

Conduct regular maintenance to make sure the unit is running in good condition.

- In the event of a fire turn off the power switch immediately and put out the fire with fire extinguisher.
- To prevent flammable gas from exploding: the unit working environment should be kept free from gasoline, ethyl alcohol and other flammable materials.
- If malfunction occurs, it should be attended by a qualified person who will find cause and eliminate it before restarting unit. Never boot the unit forcibly if the malfunction has not been eliminated. If there is refrigerant leakage turn off the power switch, if the unit can not stop by controlling switch, turn off the power.
- Do not bypass the protection required for the unit, or else may damage the unit. and cause personal injury.

6. TROUBLE SHOOTING			
PROBLEM	POSSIBLE CAUSE	SOLUTION	
	Presence of air or other non condensable gases in the system	Vent the air from the system	
Discharge pressure too high	Water heat exchanger is scaled or fouled	Wash and clean the heat exchanger	
	The circulation water volume is not sufficient	Examine the water system pipeline and pump	
	Too much refrigerant in the system	Drain part of the refrigerant	
Discharge pressure too	Liquid refrigerant flowing through evaporator to compressor, making foam for the frozen oil	Examine and adjust the expansion valve making sure temperature sensor is close connected with the air suction pipe and well insulated	
	low Refrigerant charging is too low, the refrigerant air goes into liquid pipeline	Refer to Section 4.2 on refrigerant filling	
	Discharge pressure is too high	Examine and adjust the expansion valve	
Suction pressure is high	Refrigerant charging is high	Drain part of the refrigerant	
	Liquid refrigerant flowing through evaporator to compressor	Temperature sensor is closely connected with the air suction pipe and absolutely insulated against the ambient temperature	

PROBLEM	

Suction pressure is low

Compressor stopped because of high

Compressor stopped

because of motor

overloading

pressure protection

## POSSIBLE CAUSE

#### SOLUTION

Ambient temperature is too low

The evaporator liquid inlet or compressor suction pipe is blocked

Expansion valve faulty

The refrigerant is not enough in the system

The water inlet temperature is too high

Circulation water is not enough

The high pressure stop setting is not correct

The air suction overheat greatly

Fluorine filling is too much

The voltage is too high or too low

Discharge pressure is abnormal

Device loading failure

Ambient temperature is too high

Motor or connecting terminal is in short circuit

Adjust overheat temperature, examine whether there is flourine leakage from the expansion valve

Clear blocked inlet/suction pipe

Examine flourine leakage

Repair expansion joint

Examine the installation condition

Examine water flow and temperature

Examine and rectify the high pressure setting

Examine the fluorine filling volume and drain part of refrigerant

The voltage should be controlled within more or less 20V than rated voltage and phase difference within± 30%

Examine the compressor current, compare with the full loading current indicated in the nameplate

Improve air ventilation

PROBLEM	POSSIBLE CAUSE	SOLUTION
	The voltage is too high or too low	Examine the voltage and ensure it is within the recommended range
Compressor stopped because of built in thermostat	Discharge pressure is too high	Examine the discharge pressure and correct
	The refrigerant in the system is not enough	Examine whether there is fluorine leakage and repair
	Filter clogging	Examine and change dry filter
Compressor stopped because of low	Expansion valve failure Adjust or change expansion valve	
voltage production	The refrigerant is not enough	Fill in refrigerant
High noise from the compressor	There is liquid hammer for liquid refrigerant flowing through evaporator to compressor	Adjust liquid supply, examine whether normal for the expansion valve and air suction.
	Over current relay is tripped	Set the control circuit in manual mode and restart the compressor
	The control circuit is not connected	Examine control system
Compressor can not	No current flow	
start	The pressure is too low, which can not conduct the pressure switch	Examine power supply
	The contactor coil is burnt out	Examine whether the refrigerant is less and refill
	Water system failure, relay is tripped	Reconnect and adjust the wiring

# I) General Liability

- In lieu of any warranty, condition or liability implied by law, the liability of Davis & Shirtliff (hereafter called the Company) in respect of any defect or failure of equipment supplied is limited to making good by replacement or repair (at the Company's discretion) defects which under proper use appear therein and arise solely from faulty design, materials or workmanship within a specified period. This period commences immediately after the equipment has been delivered to the customer and at its termination all liability ceases. Also the warranty period will be assessed on the basis of the date that the Company is informed of the failure.
- This warranty applies solely to equipment supplied and **no claim for consequential damages**, however arising, will be entertained. Also the warranty specifically excludes defects caused by fair wear and tear, the effects of careless handling, lack of maintenance, faulty installation, incompetence on the part of the equipment user, Acts of God or any other cause beyond the Company's reasonable control. Also, any repair or attempt at repair carried out by any other party **invalidates all warranties**.

# ii) Standard Warranty

#### **General Terms**

If equipment failure occurs in the normal course of service having been competently installed and when operating within its specified duty limits warranty will be provided as follows:-

- Up to one year The item will be replaced or repaired at no charge.
- Over 1 year, less than two years The item will be replaced or repaired at a cost to the customer of 50% of the Davis & Shirtliff market price.

The warranty on equipment supplied or installed by others is conditional upon the defective unit **being promptly returned free to a Davis & Shirtliff office** and collected thereafter when repaired. No element of site repair is included in the warranty and any site attendance costs will be payable in full at standard chargeout rates. Also proof of purchase including the purchase invoice must be provided for a warranty claim to be considered.

# DAYLIFF is a brand of Davis & Shirtliff

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