Orange Solar Pump HD50

36 volt DC brushless step motor
Loss of prime protection - Automatic tank filling

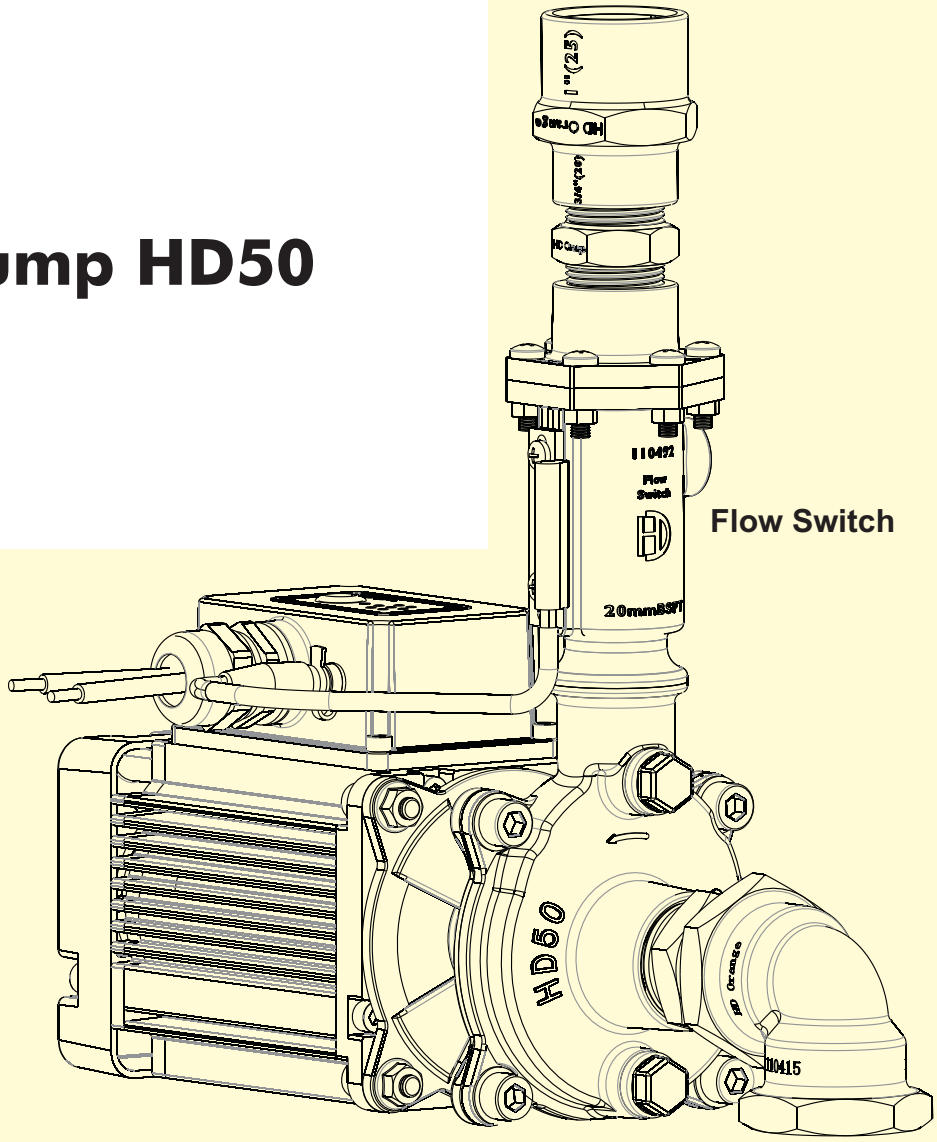
How the pump works
The HD50 centrifugal solar pump is made of stainless steel with a plastic impeller. Centrifugal pumps are good when pumping clean water or water with a little fine sand. The pump rotates at a variable speed so that all the power available from the solar panels is used. It is equipped with a flow switch, pipe fittings, and foot or check valve. The motor is a high tech DC step motor which has no brushes, no wireless interference, a permanent magnet rotor and a built-in control circuit. It should be housed under cover from the weather and ventilated. It operates on 36 volts DC and uses about 10-15 amps. Top speed is limited. Step motors are very efficient and normally supply more water from the solar panels than other motors. The HD50 pump is a shallow well pump which means it's maximum suction at sea level is about 6 metres.

Solar pumps only work when there is good sunlight. Not at night, not when the sun is week and not in cloud. This means that in most applications they are used to pump into tanks so that water is available all the time.

The HD50 pump will lift water vertically 37 metres (121 feet) or less of which 6 metres (20 feet) can be used for suction and 6 metres (20 feet) used to lift water into a tank, leaving 25 metres (82 feet) for actually lifting water vertically up a hill. It will keep the tank full automatically without having to connect the pump to the tank with wires.

The tank must have a good quality ball valve installed. We recommend all suction and discharge pipe be 25 mm for normal pipe lengths (up to 100 metres). A foot valve is recommended if the pump is sucking, and a check valve if the water flows by gravity into the pump. It is important that the foot valve seals perfectly as it will be left static for about 18 hours overnight and must keep the pump primed. It is good practice before installation to fill the valve with water and let it sit for one hour or longer to check there are no leaks. If the foot valve is used in conditions where nuts or leaves etc can cause a blockage then some fibre glass fly wire should be put around the valve. If dealing with long pipes, calculate pipe friction; this must be added to the vertical lift. Use of larger pipes may be necessary. The pump should be installed under cover so that it is protected from the weather and well vented to keep motor temperature low.

Solar Pump HD50



Flow Switch

Pump Assembly

Pump Operation

The pump has an 'on' and 'off' switch for manual operation, if the switch is off the pump is off.

If the switch is on the small red light in the center will light up and the green lights will rotate showing the pump is running automatically. It will fill tanks and keep them full (provided the pump and panels have enough capacity and sun light).

It will stop when there is insufficient sunlight and start again when the sun returns. This may happen during the day when a cloud passes overhead or when the sun goes down at night.

If it runs out of water the pump will stop and the circular green lights will flash. If the pump stops for any reason it will try to start again in 30 minutes and run for 1 minute. This cycle will go on continuously or it will run normally if the fault has been cleared.

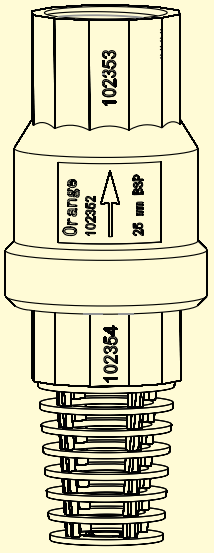
If the pump stops and you want to start it immediately not waiting the 30 minutes then press the reset button.

The pump also has inbuilt protection. When the small red light blinks it indicates that the motor is over temperature.

When in operation the pump will change speed so as to use the maximum electricity available from the solar panels. In this way maximum water is pumped.

If you do not want automatic tank filling the flow switch can be unplugged and not used. The pump will run as a solar pump without loss of prime protection (LOP).

If pump pressure is low due to low volts, lack of sun, or any reason the flow switch will turn off protecting the pump and the green lights will flash.



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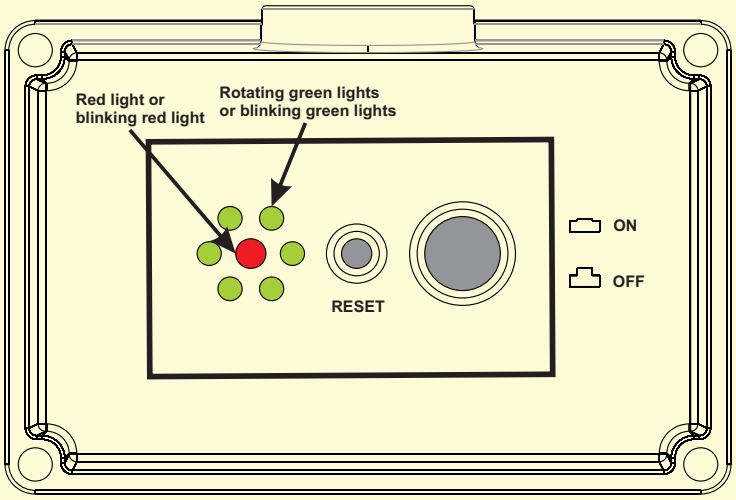
Control Panel



SolarPanel Installation

Installation of solar panels is not complicated.
In Australia they should be installed in a position where they get uninterrupted sun, face true north, and have an angle to the horizontal the same as the earth's latitude for that installation. Small variations to the tilt angle make very little difference to performance.

In practice things may change a little. If the installation is fixed, the panels angles are not changed through the year, on an existing roof with some undesigned angle, then the panels may not face north, and the angle may not be correct, panels mounted this way may improve the aesthetics but the performance drops. This can be compensated for by installing more panels.

To increase the panel output they can be mounted on a sun tracker which automatically turns to face the sun during the day. This can increase the solar output by about as much as 28%, but on small installations it is probably not worth while. Fixed panels can also have their angle changed twice a year [September 29 and March 14 in the southern hemisphere]. This will increase the solar output by about 25%, but involves the effort of changing the angle every 6 months.

For small pump installations and simplicity we recommend a fixed panel installation.

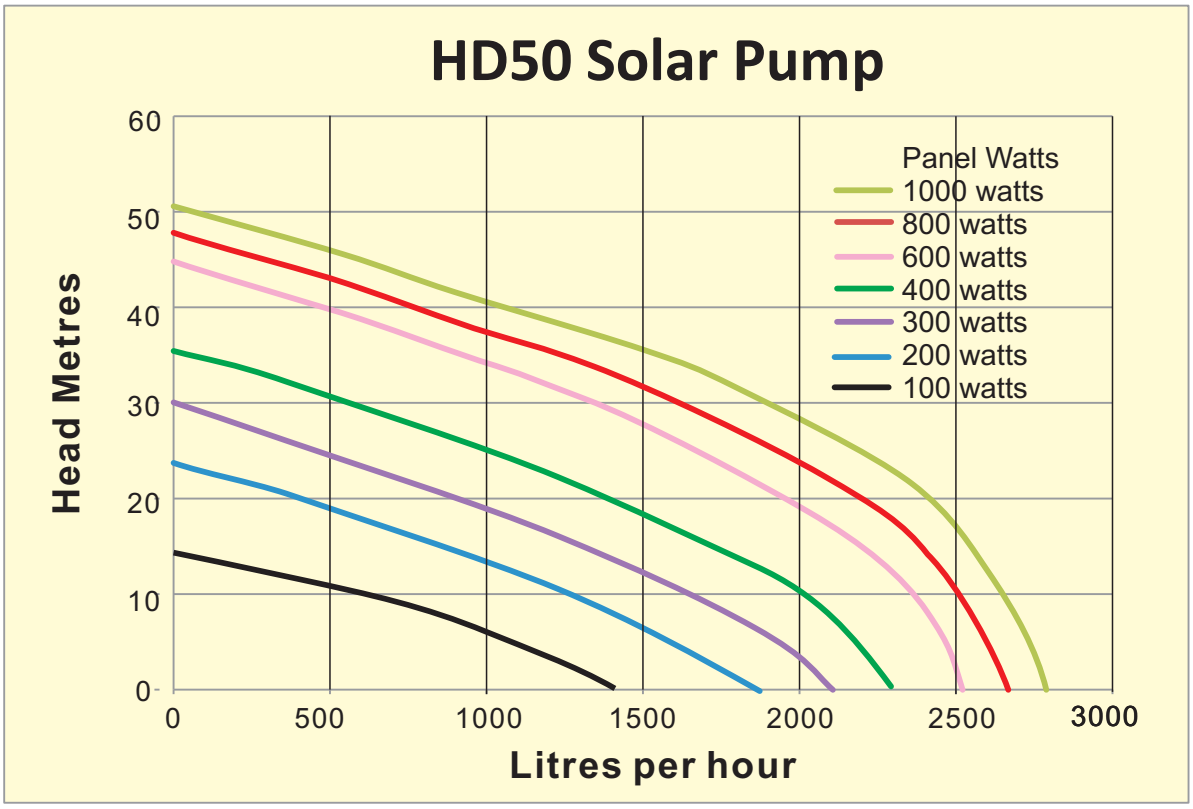
InstallationVariations

Many installers vary the angle of the solar panels to hopefully increase the power output. In the case of seasonal loads like summer airconditioning, winter heating, or watering cattle etc, you need maximum power when you want it. In this case the panels could be fixed at a different angle to suit the load. The actual angle can be calculated thus:

Minimum tilt angle to the horizontal is 10° for practical considerations so dirt and snow can run off.
For all year round good performance the panel angle is same as the Latitude.
Summer angle : Latitude x 0.9 minus 23 deg.
Winter angle : Latitude x 0.9 add 29 deg.
Remember that the angle is not very critical. If you do not use the correct angle or direction you may have to add some more or larger solar panels to compensate.

Guide to solar panel calculation

This test used panels with open circuit volts of about 45 to 47. This test was made at about 1PM daylight saving time on 20 February 2017 on a latitude of 38 degrees.



To compensate for practical variations add 20% to watts when using this graph

Calculating the panels and wattage required

If the latitude is less than 38 the panels will produce more watts, more water will be pumped, and the pumping time will be longer.

Look at page 7 and use the summer time column to calculate the pumping hours per day. If pumping in the winter use the winter column.

If the temperature is over 40 deg C the panels will produce less watts and the pump will pump less.

Calculation of pump head: Suction = maximum vertical distance of water to the pump + Discharge = vertical distance from the pump to the top of the tank [If pumping to a tank]

Use the above table to calculate water pumped.

HD50 model pump uses 36 volts solar panels and is wired with standard 10 or 15 amp cable or Solar cable. The panels used can be any wattage but it is best for them all to be the same. The above graph is drawn showing various panel watts. In-between readings can be found by interpreting between the lines. Connected panels of over 1000 watts or under 100 watts should not be used. The pump is 350 watt but to compensate for low sun, panel angle, winter sun, clouds, temperature, humidity, the earth's latitude etc, up to 1000 watts panels are required.

If more panels are used always more water will be pumped for longer, but the increased capacity may not the worth the cost of the extra panels. However, more panels may have to be used to achieve water requirements in winter, to compensate for panel shading or bad weather conditions etc.

The pump can be used for applications that do not involve tank filling, but be careful, no sun - no water. This may not suit the application.

Example : To calculate water pumped

This is tricky as it is dependant on the hours of pump operation, the panel angle, winter sun, clouds, temperature, humidity, and the installation latitude. As an approximation we use 6 hours pumping per day in the summer but be it could be less.
See table on Page 7 we recommend 20% to be added to the wattage to compensate.

Looking at the pump curves the pump will deliver about 2400 litres per hour at low head but at it's operating head is probably about 1200 litres per hour. This means a pumped capacity in 6 hours of 7,200 litres or 1,600 imperial gallons. This assumes near perfect sun conditions and a good installation. This with suitable storage should suit a house which uses about 400 liters per day + garden + watering animals.

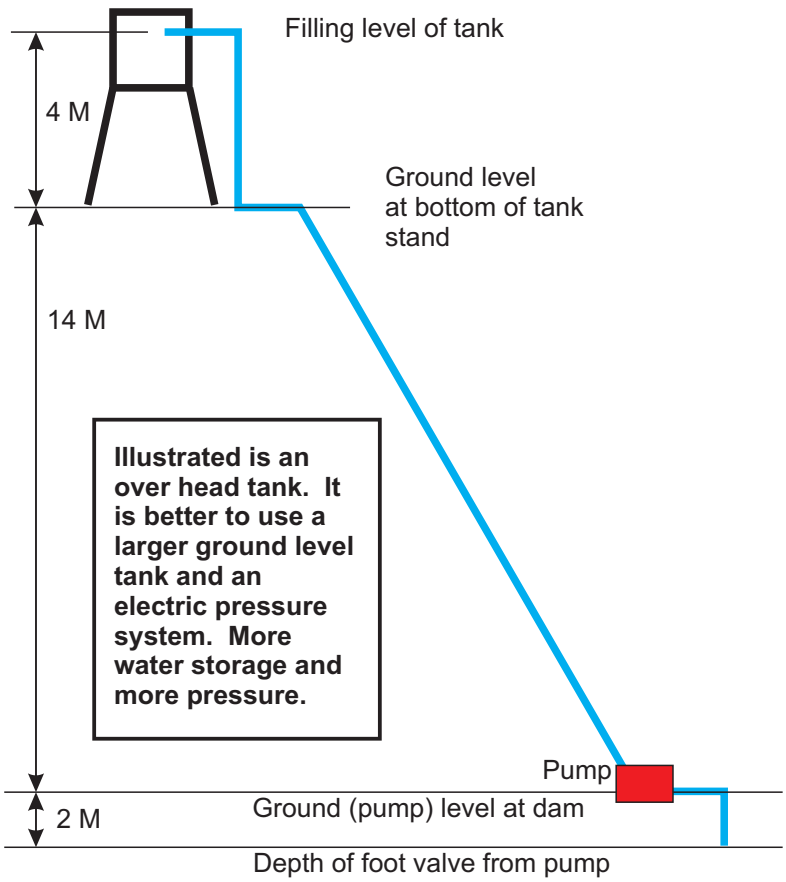
Look at our panel tables.
More water can be pumped by simply adding more panels. Try the pump and add panels as required at any time. The motor is internally limited to a maximum of about 15 amps so it cannot be overloaded by adding more panels..

When using solar there are times when no water will be pumped due to bad weather conditions. Water stored should compensate for this so that when the weather nominalises the solar pump can fill the tank and be ready for the next low.

Practical variations that need to be compensated for.

Seasonal changes in sun light between summer and winter see page 7
Daily variations of sun light between 9 AM and 10 mid day
Daily variations of cloud cover reducing the watts available
Water usage for summer and winter
A normal house uses about 400 litres per day for 4 people + garden + 100 litres per person
If using a storage tank it must be large enough to store water required to bridge bad weather when the pump is not operating and emergencies.
Temperature of the panels over 40 Deg C reduces the wattage output of the panels.
High humidity will effect the panel output.
Mounting to solar panels. They should face North and have the same angle to the horizontal as the Latitude, with a minimum angle of 10 deg. Small variations to this will not make much difference. There must be no shading.
Failure to comply will result in requiring more panels; we would add 20% to the opposite graph to compensate.

Example



Summer Melbourne

Pumping height
Tank height = 4 M
Lift from dam to tank stand = 14 M
Suction from dam = 2 M

Total height = 20 M

Water requirements per day
House 4 people = 400 litres
Garden = 500 litres
10 cows per day = 1350 litres
Total water used = 2250 litres
+ 25% to fill tank in bad weather = 2813 Litres

Size tank required to cater for bad weather conditions of 4 days

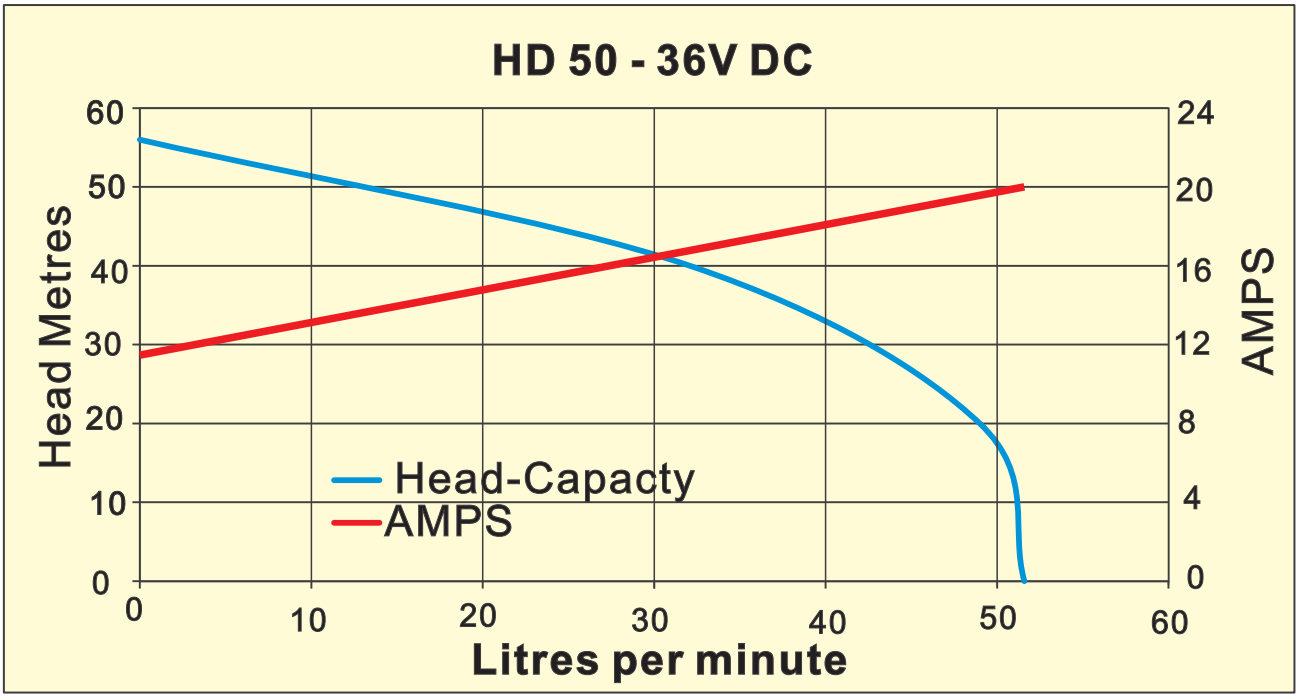
2250 x 4 = 9000 litres or 3500 Imp Gallons

Watts needed for head of 20 M and flow of 2813 divided by summer hours pumped in Melbourne (see page 7) = 2813 divided by 4.8 = 586 litres per hour
See graph page 4 - 20 M at 600 litres = 230 watts + 20% for variations = 276 watts
So we would install 1 x 300 watt panel.

The HD50 pump can work as a DC Pump

How the Pump Works
The HD50 centrifugal pump can operate from batteries. It is made of stainless steel with a plastic impeller, the shaft and seal is Stainless steel. Centrifugal pumps are good when pumping clean water or water with a little fine sand. The pump rotates at a variable speed so that maximum efficiency is obtained. The motor is a high tech DC step motor which has no brushes, a permanent magnet rotor and a built-in control circuit. It should be housed under cover from the weather and ventilated. It operates on 36 volts DC and uses about 10-15 amps. Step motors are very efficient and normally supply more water than conventional motors. The HD50 pump is a shallow well pump which means it's maximum suction at sea level is 6 metres.

The pump should be installed under cover so that it is protected from the weather and vented to keep motor temperature cool.



Pumps can be made in 12 and 24 volt DC and to give different performances.
Enquiries welcome.

Solar radiation for Australian towns
The table shows average yearly peak hours
If your town is not listed use the one closest as a good guide

Location	Latitude and Tilt Angle	Best average Peak Sun Hours per day		
		Best Month	Worst Month	6 months of Summer
Darwin NT	12	Aug 7.2	Jan 5.0	6.1
Cairns QLD	17	Oct 6.1	May 4.4	5.3
Halls Creek WA	18	Sep 7.3	Dec 6.0	6.7
Townsville QLD	19	Sep 6.5	Jun 5.6	6.1
Tennant Creek NT	20	Sep 7.0	Jan 5.6	6.3
Port Hedland WA	20	Oct 7.6	Jun 5.7	6.7
Rockhampton QLD	23	Oct 6.3	Jun 5.4	5.9
Longreach QLD	23	Sep 7.3	Jun 6.2	6.8
Allice Springs NT	24	Mar 7.4	Jun 6.2	6.8
Brisbane QLD	27	Jan 6.2	May 4.5	5.4
Oodnadatta NT	28	Mar 7.5	Jun 5.4	6.5
Geraldton WA	29	Dec 7.6	Jun 4.8	6.2
Kalgoorlie WA	31	Dec 7.2	Jul 3.6	5.4
Forrest WA	31	Jan 7.5	Jun 4.8	6.2
Perth WA	32	Jan 7.6	Jun 3.9	5.8
Williamtown NSW	33	Jan 6.0	Jun 4.0	5.0
Sydney NSW	34	Dec 6.3	Jul 3.8	5.1
Mildura Vic	34	Dec 7.4	Jun 4.1	5.8
Albany WA	35	Jan 6.7	Jun 3.6	5.2
Adelaide SA	35	Jan 7.9	Jul 3.2	5.6
Wagga Wagga NSW	35	Dec 7.1	Jun 3.6	5.4
Canberra ACT	35	Jan 7.2	Jul 3.6	5.4
Mt Gambia SA	38	Jan 6.7	Jun 2.9	4.8
Melbourne Vic	38	Jan 6.5	July 3.1	4.8
Laverton Vic	38	Jan 7.0	Jun 3.0	5.0
East Sale Vic	38	Jan 6.2	Jun 2.8	4.5
Launceston Tas	42	Feb 6.6	Jun 2.7	4.7
Hobart Tas	43	Jan 6.2	Jun 2.7	4.5

Example
Water pumped see graph
See “6 months of summer” column in table to find hours pumped per day
To calculate litres pumped per day:
Litres pumped per hour x Hours per day = Litres pumped per day.

Address from 1 November 2017

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Australia

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Web www.orangepumps.com

Phone
Use 61 3 9426 3400 temporally

July 2017

Address to 31 October 2017

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