CONSOL
NEW ZEALAND LTD

DS SERIES
SOLAR SYSTEM

INSTALLATION & INSTRUCTION MANUAL

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Contents

Introduction

Thank you for purchasing the Consol DS Solar Collector.

This manual provides information for installation and operation of the Consol DS Solar System. The system consists of the following components:

- Collector
- Hot water storage tank
- Supplementary heating equipment
- Pump and pump controller
- Ancillary temperature and pressure protection equipment

This manual includes part of the operation instructions for the system. After installation, this manual is to be given to the owner.

For safe and efficient operation, please read the manual carefully before you operate the system and observe instructions for all the other components of the system which has been installed.

Building consents

New Zealand local councils require that all installations obtain a building consent.

Warranty

To ensure warranty provisions all installations are to be carried out by Consol-approved installers. Installation by anyone other than a Consol-approved installer may void the warranty.

Installation

Installations are to be carried out within the terms of the New Zealand Building Code Clause G12.

Producer statement

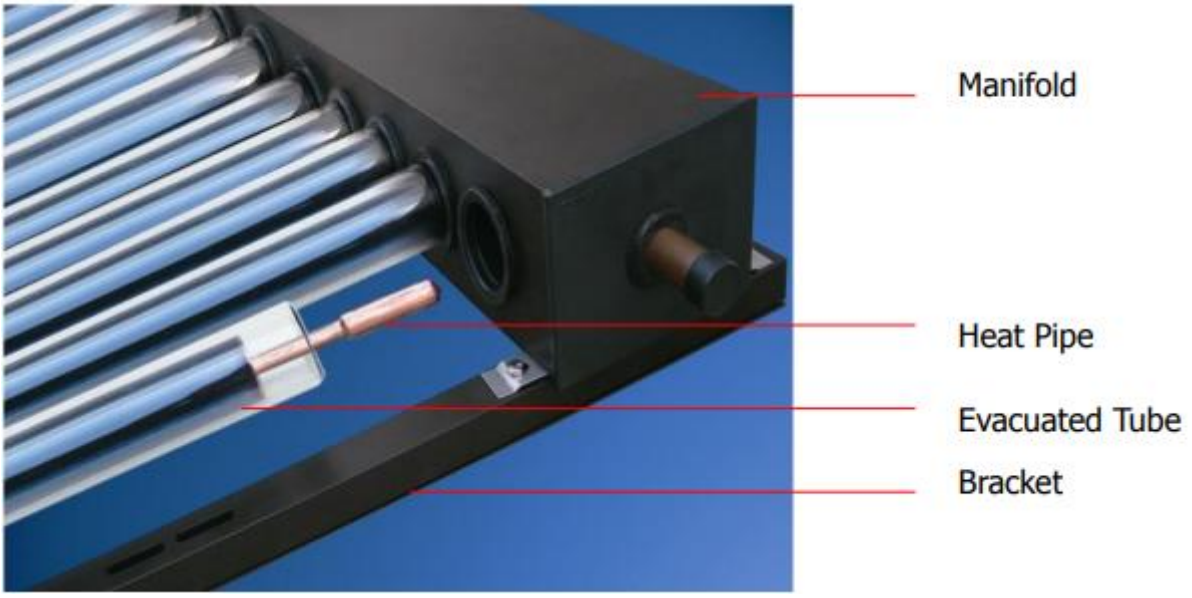
The producer statement is to be completed by the installer and given to Consol New Zealand upon commissioning of the system.

The producer statement will be forwarded on to the customer by Consol NZ to enable code compliance to be issued by the local authority.

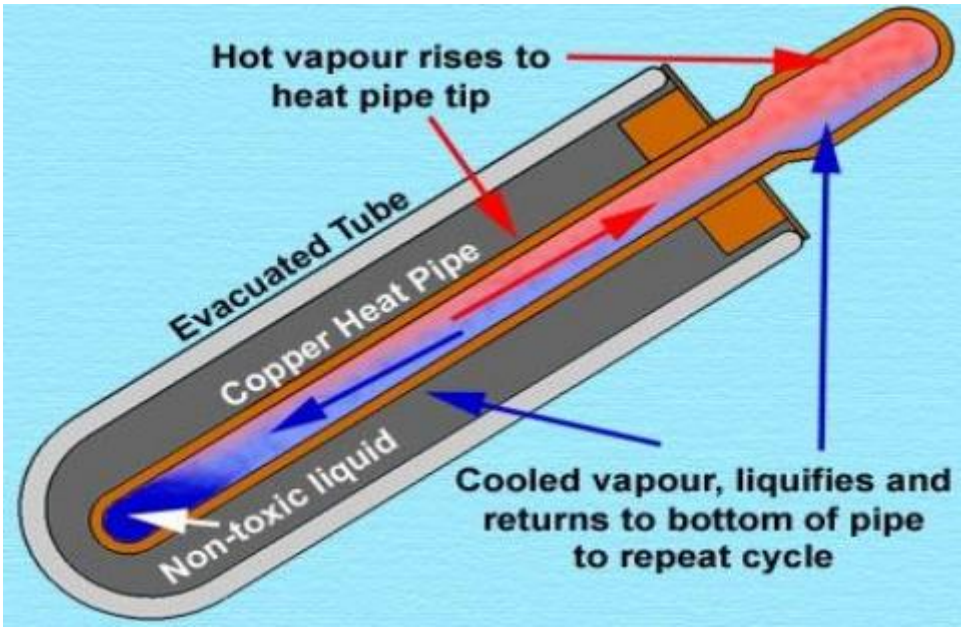
Description of Consol DS Solar Collector

Characteristics of the product:

- The Consol evacuated tube system is an open loop system that directly heats the potable water in the cylinder.
- It can be installed with high or low pressure, large or low flow rate.
- The borosilicate glass vacuum tubes have excellent insulation properties to reduce the loss of solar energy.
- Inside the vacuum of the tube is the selective coating Al Ni which greatly increases the absorption to make the collector more efficient.
- Ability to produce very high temperatures and still produce heat with low irradiance.
- Light weight construction reducing roof loads.
- Pumped system allowing greater circulation.



Working Principle



Collector

The sun radiates solar energy onto the evacuated tubes. The tube has a selected coating that absorbs the energy and traps it inside the tube.

The heat is concentrated onto the copper heat pipe which contains a small quantity of fluid that is also in a vacuum. The top end of the copper heat pipe is inserted into a manifold where the heat exchange takes place.

The fluid in the copper tube boils at a low temperature and the steam travels rapidly to the top of the tube where it releases the latent heat through the heat exchanger to the fluid in the manifold. The cooled fluid then travels down the tube to be heated again.

Pump Controller

The controller runs the system and measures temperatures at the cylinder and manifold via temperature probes. This enables the controller to decide the optimal time to start the pump to transfer the heated fluid from the manifold to the cylinder. Power supply to the controller and pump are not to be on a circuit that is controlled by the electricity supplier.

The pump controller protects the system against freezing and overheating. The operation instructions for the controller clearly outline the functions and settings of the system and need to be used in conjunction with the set up and future operation of the system.

The controller for this system requires three probes for accurate operation. Probe location is outlined in the controller operation and installation manual. Probe pockets are to be dry before being inserted.

A separate instruction manual for the controller is supplied.

Supplementary Heating Controller

The controller manual also outlines the programming of the timing heating parameters necessary for efficient operation and should be followed.

This is critical as the cylinder temperature must reach 60°C once a day to control the growth of legionella which is a human health hazard.

Pump

The pump is the means of transferring the heated fluid from the manifold to the cylinder and the cooler fluid from the cylinder to the manifold to be heated. The pump is operated by the controller and needs a continuous supply of power to allow frost protection of the system. This should be prominently displayed. The pump should draw the coldest water from the bottom of the tank and return it at a higher point using the connection points recommended by the manufacturer.

The pump when mounted securely must be above the cylinder safe tray in case of leakage. An isolation valve is to be located either side of the pump to enable ease of removal for servicing.

The pump has three settings and a flow meter is to be used to enable the correct flow rate (30 litres/hr/m² of collector area). The controller manual outlines the settings for the pump and controller operation and changing these settings will affect the performance of the system.

Valves

The valves associated with the solar system are necessary for protection, operation, and maintenance of the system. The necessary valves are outlined in the schematic drawings of the plumbing diagrams. If draining the cylinder for valve maintenance, disconnect all electrical to the cylinder.

Pressure created by the system will be relieved through the cold-water expansion and temperature pressure relief on the cylinder. Easing of valves is to be carried out by a registered craftsman plumber. Tempering valve is necessary to reduce the water to a safe temperature.

The air relief valve is located at the highest point of the pipework. Use only CALEFFI SOLAR AIR RELIEF 250031, rated to 180°C and 10 bar.

There is also a non-return valve on the inlet line and outlet line of the collector, to and from the cylinder, and two shutoff valves either side of the pump.

Pipeline and Insulation

- Consol NZ recommends copper pipeline no less than 15mm.
- Use long radius bends to reduce resistance to flow rates. Pipework is to be flushed of foreign material.
- Pipework to be pressure tested to 1.5 times the maximum working pressure prior to insulating.
- Insulation of the solar pipework to be Centurylon or similar quality.
- External insulation to be foil covered to reduce degradation from the elements.
- Length of pipework should be kept to a minimum to reduce the time for completing fluid transfer.
- Long pipe runs should incorporate expansion loops, horizontally formed to avoid air locks.
- Insulation material, insulation thickness, and operation method should comply with regional regulations.

Water Tank

The Cooper solar ready cylinder is constructed of Duplex stainless steel and is an integral part of the solar package.

The cylinder comes with the temperature and pressure relief valve that must be installed. Cylinders will be placed on a safe waste tray with a minimum 40mm diameter if it is to be installed in a location that leakage could cause damage to property.

Technical Parameters

Water heater model number: Consol DS 30-58-1800 with the MP 300 cylinder

Date of AS/NZS 2712 compliance approval: 2007

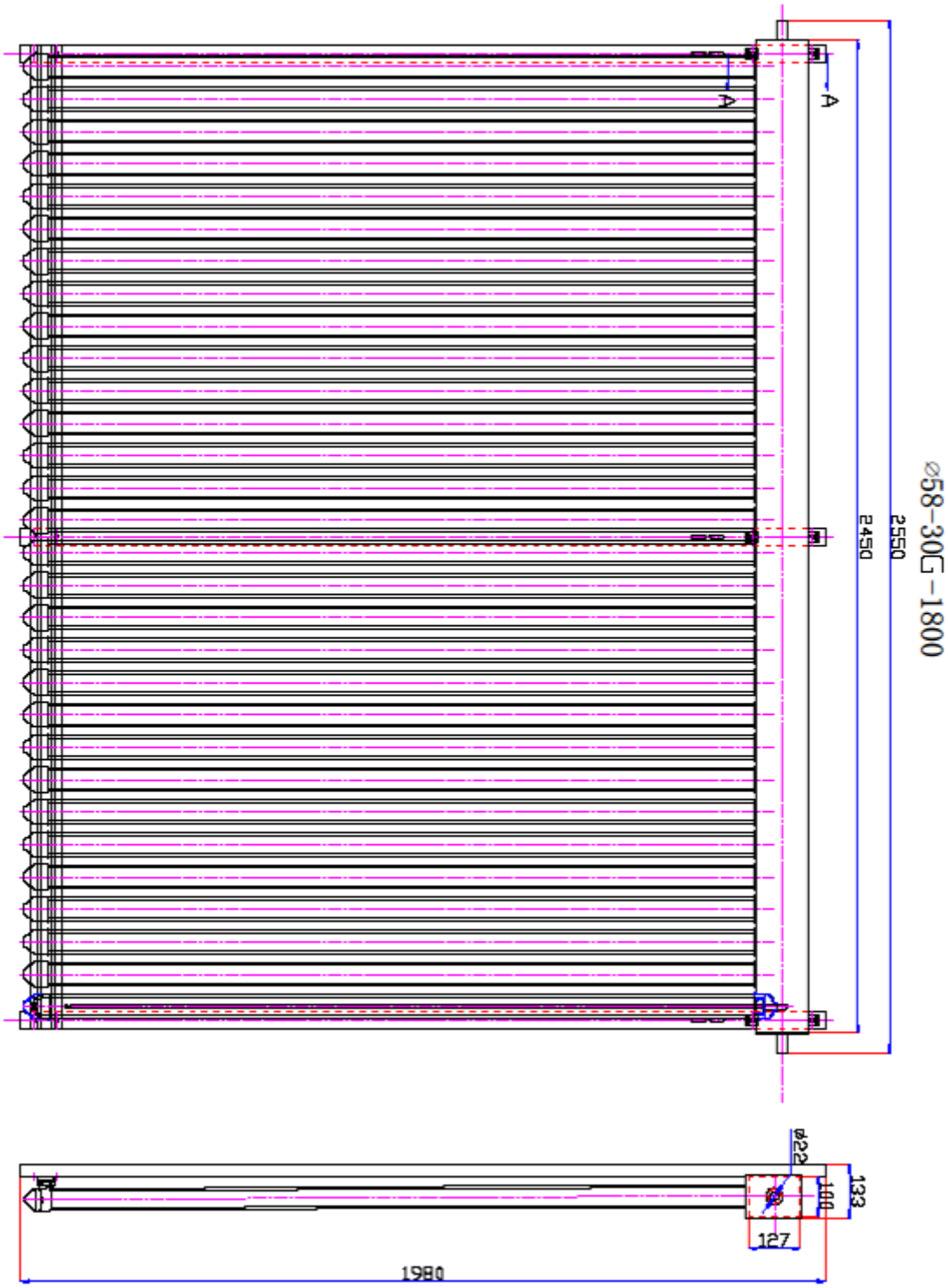
Manifold: unitary aluminium alloy manifold Thickness: 1.9mm
Material of bracket: aluminium alloy 1.9mm
Material of heater pipe: T2 copper
Insulation material: rock wool Thickness of rock wool: 96mm
Density of rock wool: 80kg/m³
Seal: silicon rubber
Hydraulic connections: copper pipe
Max. operation pressure: 8 bar
Test pressure: 10 bar
Max. working temperature: 220°
Min. working temperature: -40°
Max. tilt angle: 45°
Min. tilt angle: 15°
Thickness of water carrying tube: 0.8mm
Surface finish: powder coated
Permissible wind: 45m/s
Snow load: <0.6kpa

Information about the cylinder used			
Cylinder manufacturer	H J Cooper Ltd		
Cylinder model number	MP180	MP250	MP300
Cylinder physical (total) volume)	180L	250L	300L
Cylinder rated volume (if known)	180	250	300
Cylinder MEPS rated	Yes		
Cylinder standing heat loss kWh/day at (T_{cyl}-T_{amb}) = 55ºC	180L: 1.13	250L:1.59	300?:1.76
Test lab for standing heat loss date of test	23/07/2005	10/08/2005	23/07/2005
Cylinder inner diameter	448mm		
Cylinder wall overall thickness (include all wall components, e.g. glass lining if applicable, inner metal shell, insulation, outer metal shell)	1.0mm #2304 Duplex stainless steel		
Cylinder wall components' materials and individual thicknesses (here should be given the individual thicknesses of the wall components mentioned above)	N/A		
Thickness of insulation and type of foam	50mm nominal, exp poly		
Number of elements in cylinder	1 standard with 2nd optional		
Element power rating (in kW)	3kW		
Height of element 1 from bottom of cylinder	Element dips down to 100mm from the bottom of the cylinder		

Electricity tariff element 1 is connected to	Night rate
Height of thermostat 1 above the bottom of the cylinder	1076mm
Electricity tariff element 2 is connected to	Day/night rate
Height of thermostat 1 above the bottom of the cylinder	335mm
Height of thermostat 2 above the bottom of the cylinder	1076mm
Thermostat temperature difference between ON/OFF (temp dead band)	+/- 5°C
Thermostat set point (1)	65°C
Thermostat set point (2)	65°C
Height of cold sensor above the bottom of the cylinder	340mm
Does the cylinder have an internal enamel layer?	No
If yes, what is the thickness of enamel layer?	N/A
Height of hot water draw-off port on side of cylinder from bottom of cylinder	1726mm
Height of inlet of dip tube connected to hot water draw-off port if there is one	n/1
Height of cold water (mains) entry into the cylinder (from the bottom of cylinder)	5mm
Information about the auxiliary boost controller	
Controller temperature difference between ON/OFF (dead band) (if electronic thermostat used)	Range 2° - 15° Default valve is set at 8°C
Timer settings (if timer used) for each element	3 timer settings, morning/noon/night
Hold-off timer settings (if used)	Controller timer based hold off
Frost protection settings (if used)	Frost protection range 2° - 10°C
Other controller functions (if used)	High temperature protection, temperature difference circulation, timer controlled circulation, temperature controlled circulation, temperature controlled auxiliary heating settings
Information about the solar collector	
Solar collector model no.	
Type of collector	Evacuated tube system
Tested to the AS 2535. This test gives the panel efficiency used in the Australian REC scheme	SPF Test Report
Collector gross area	4.725m²
Collector aperture area	2.833m²
Collector absorber area	2.429m²
Weight of collector loaded with fluid	98kg
Collector glass type	Borosilicate
Absorber type, and material bonded on to (e.g. black paint on copper)	Al ni Al
Collector inlet pipe inner diameter	20mm
Collector outlet pipe inner diameter	20mm
Information specific to evacuated tube collectors	

Heat pipe length (for evacuated tube systems)	1723
Header length	2450mm
Header inner diameter (for evacuated tube systems)	33mm
Insulation material used for the header	Rock wool
How is heat transferred from the glass tube to the header/cylinder?	Via a copper endothermic tube that insets into socket in the manifold
Shape of fin (if used): either describe or sketch	Hamburger bun shaped aluminium fins
Reflectors	Individual stainless reflectors that inset between lower side of the tubes. The reflectors cover 80% of the collector area
Information about the differential controller and pump used	
Differential controller model	SR868C6
Pump supplier and model no.	WILO RS25/6
Pump flow rate	3 settings optimal 90-110 L/hr
Flow meter used on installation	No
Placement of panel sensor	Placed into socket welded to the insulated manifold
Placement of cylinder sensor 1 (cold) – height above bottom of cylinder	335mm
Placement of cylinder sensor 2 (if used) – height above bottom of cylinder	1397mm
Open or closed circuit	Open
Information about the pipework between cylinder and panel	
Collector inlet pipe insulation material	Centurylon
Collector inlet pipe insulation thickness	25mm
Collector outlet pipe insulation material	Centurylon
Collector outlet pipe insulation thickness	25mm
Diameter of piping used (ID)	15mm
Height of hot water draw-off port on side of cylinder from bottom of cylinder	310
Height of inlet of dip tube connected to hot water draw-off port if there is one	5mm from bottom of cylinder
General	
How does the system control stagnation events?	Controller is fitted with a high temperature protection feature. When temperature reaches a set point the controller opens a valve on the inlet pipe and shuts off the pump. When the tank temperature lowers to a set parameter temperature the function is deactivated
How does the system control freezing events?	Frost protection via insulation and programme in the controller to avoid freezing
What is the maximum temperature the cylinder can withstand? How do you control over-temperature within the cylinder?	Cylinder max. temperature is 90°C. the controller has a function to stop the cylinder heating at set temperature.

Collector Schematic

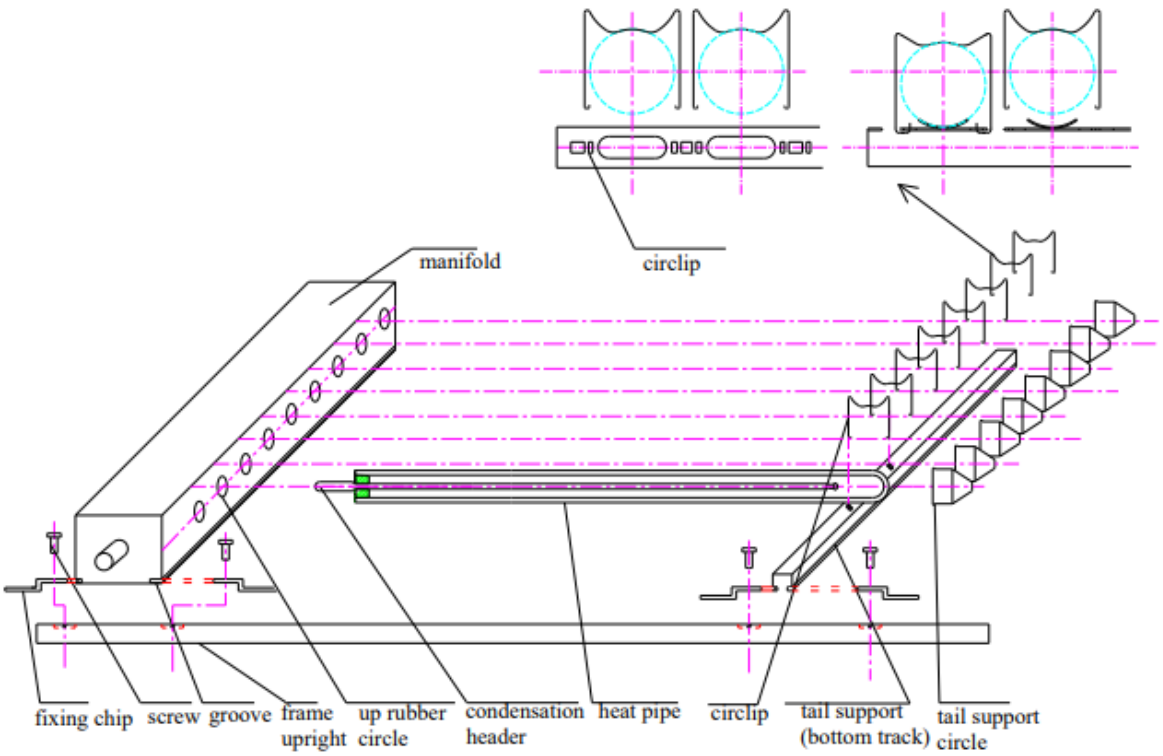


Transportation and Safety Precautions

- The evacuated tubes with heat pipes should be protected with packers and precautions should be taken against damage.
- Boxes to be labelled as fragile.
- Glass tubes and reflectors are to be handled with gloves.
- When working at height you must comply with occupational health and safety requirements. The installer of the roof panel should use fall protection.
- All electrical components are to be kept free of moisture.
- All electrical work is to be carried out be a registered electrician.
- Plumbing work to be carried out by a craftsman plumber.

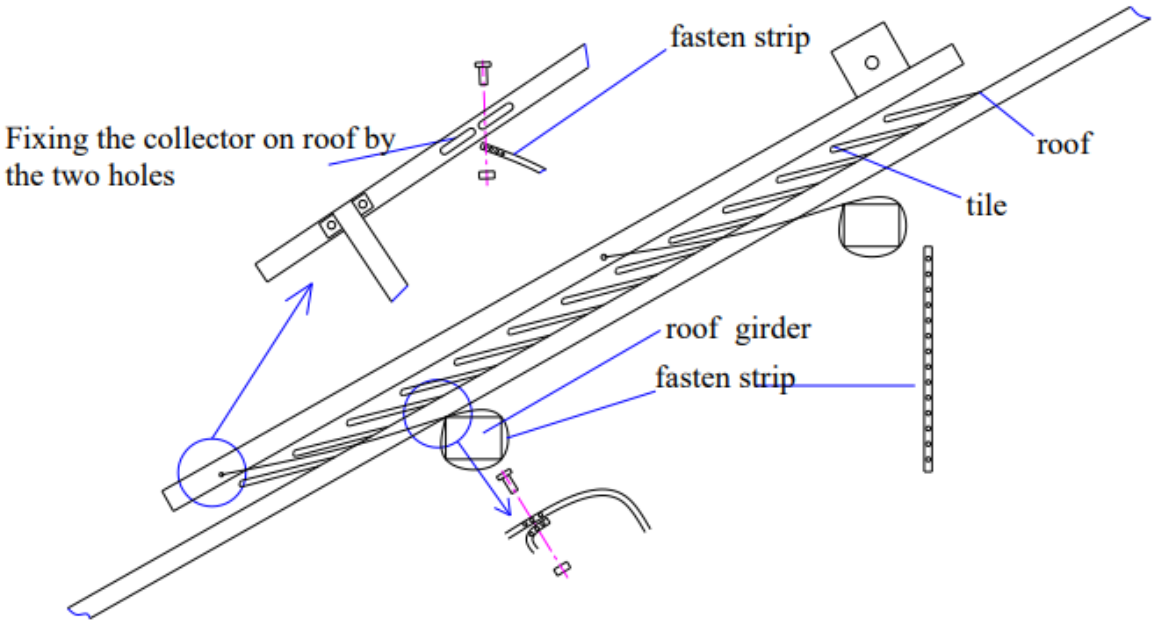
Installation Diagrams

General

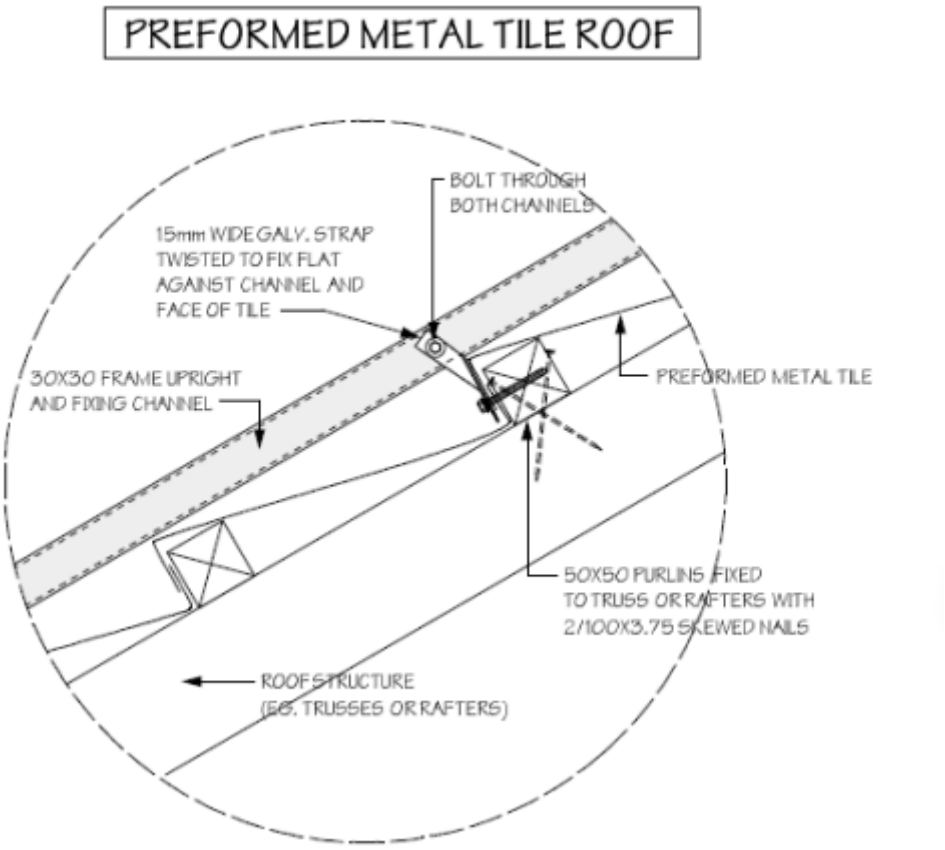


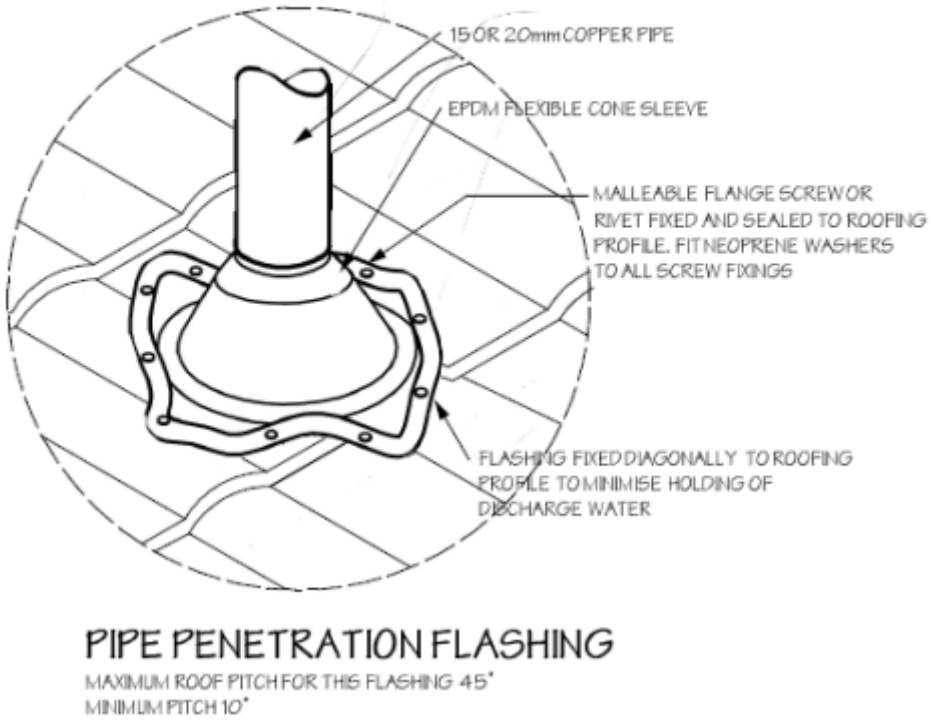
Concrete tiled roof

The following diagram is for fixing to a tiled roof. Precautions must be taken to avoid damage to the tiles. A 25mm cavity between the frame and the roof is required.

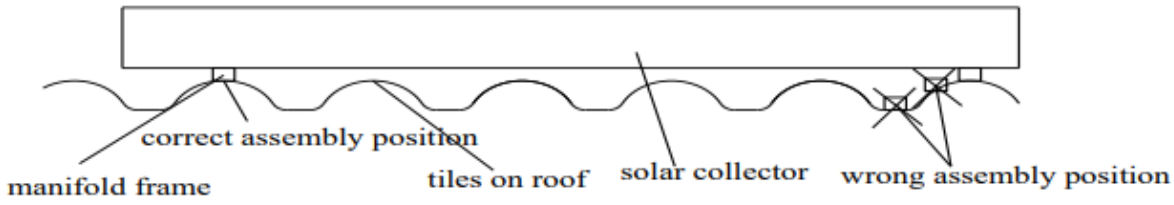


Metal tile roof



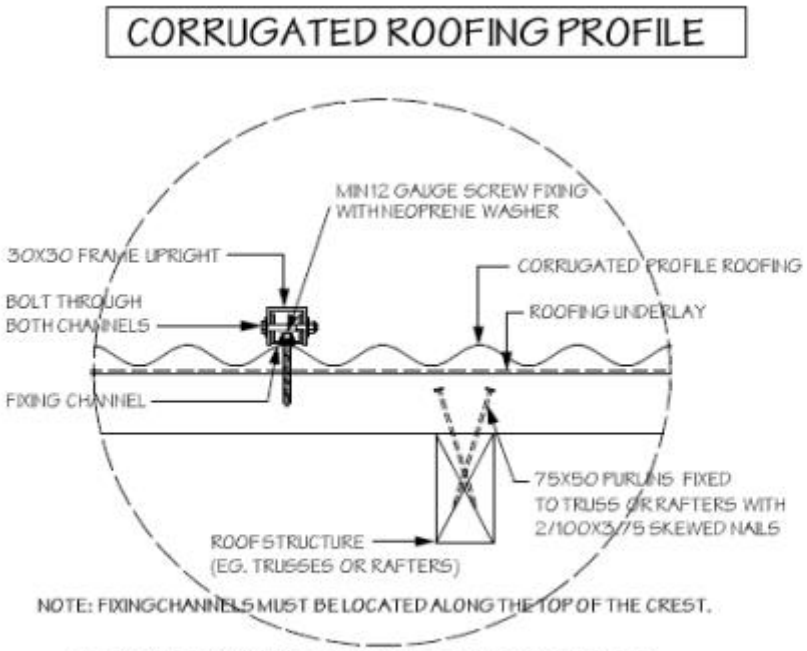


Fixings are to be fastened through the top of the corrugations. The frame is to be set 25mm off the roof by way of rubber packers at the fixing points. Fixings are to be galvanised and securely fixed through the purlin into the roof truss.

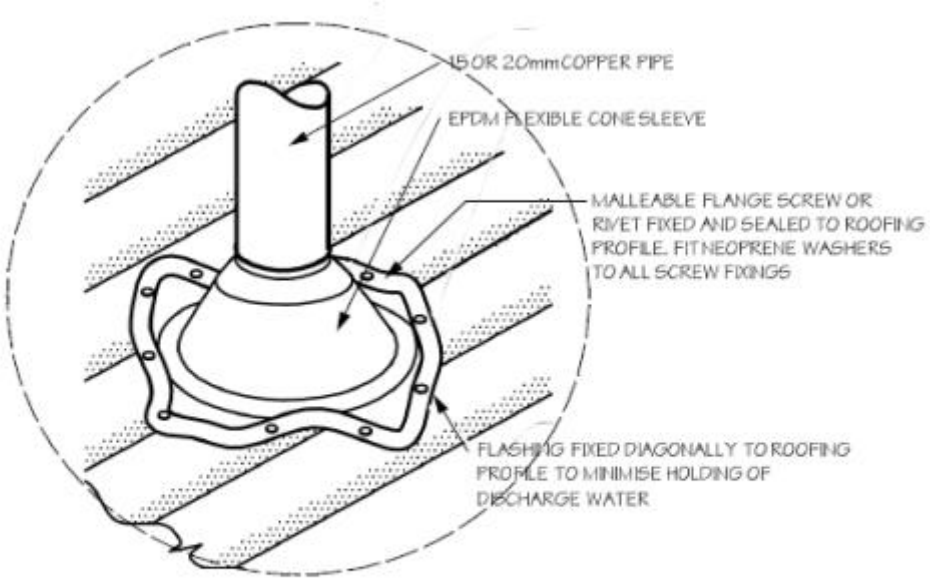


Frame upright can be adjusted by related situation about the roof.

Corrugated roof



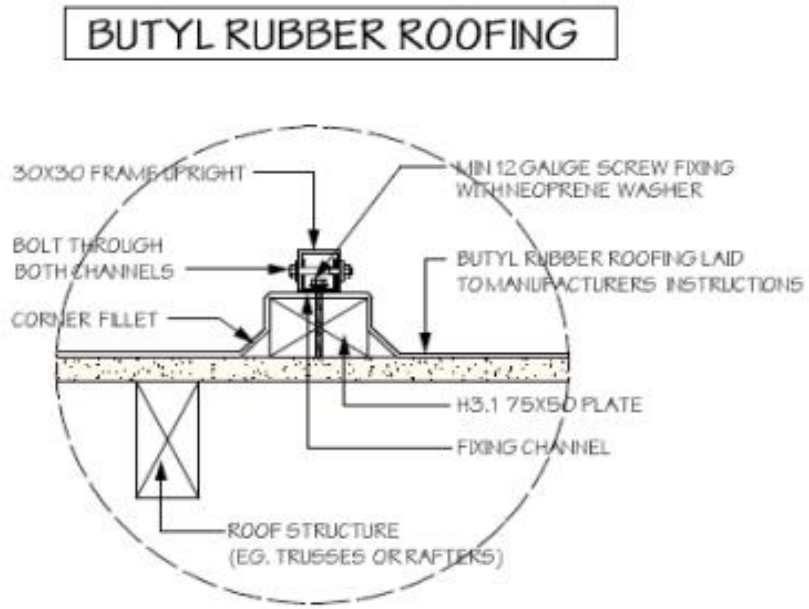
CORRUGATED PROFILE ROOFING



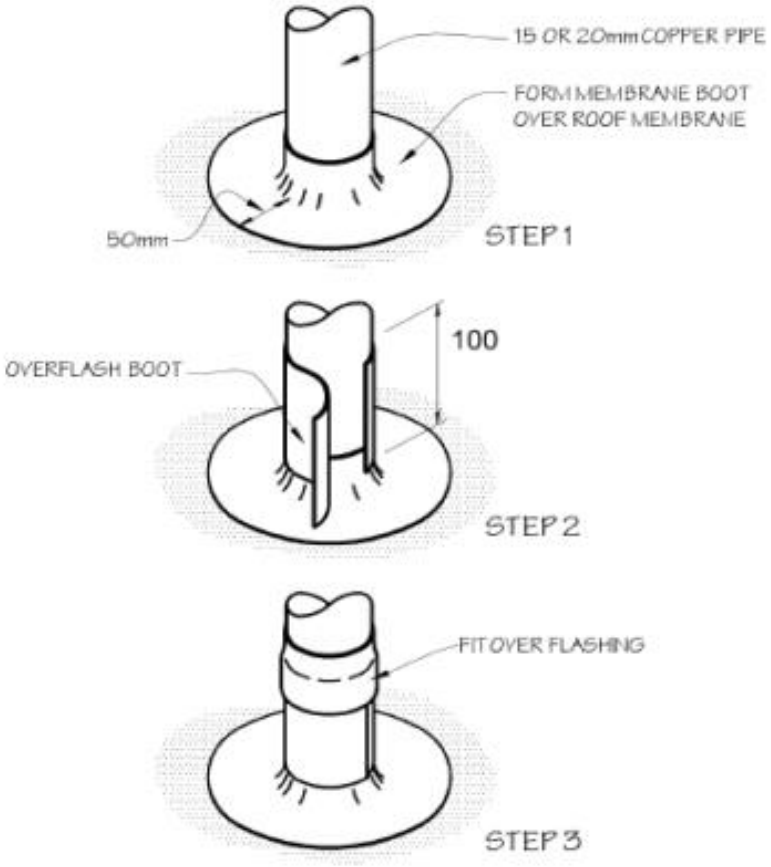
PIPE PENETRATION FLASHING

MAXIMUM ROOF PITCH FOR THIS FLASHING 45°
MINIMUM PITCH 10°

Flat roof/butynol/fibreglass



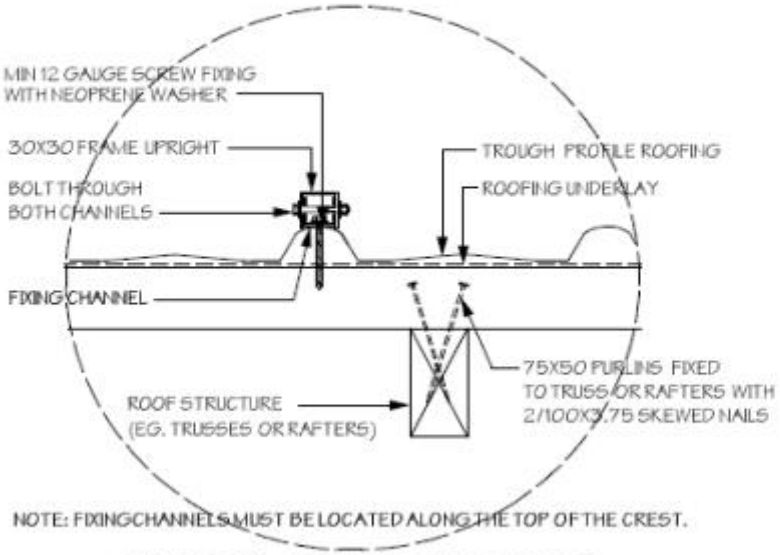
BUTYL RUBBER ROOFING



PIPE PENETRATION FLASHING

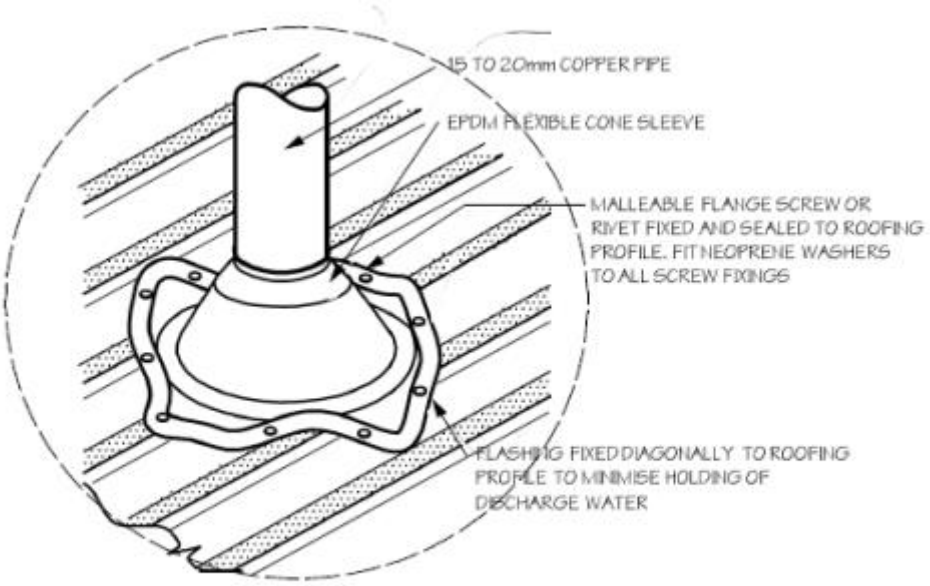
Trough roof

TROUGH ROOFING PROFILE



NOTE: FIXING CHANNELS MUST BE LOCATED ALONG THE TOP OF THE CREST.

TROUGH PROFILE ROOFING



PIPE PENETRATION FLASHING

MAXIMUM ROOF PITCH FOR THIS FLASHING 45°
MINIMUM PITCH 10°

Frame/collector installation

1. Place the two brackets upright on roof in parallel.

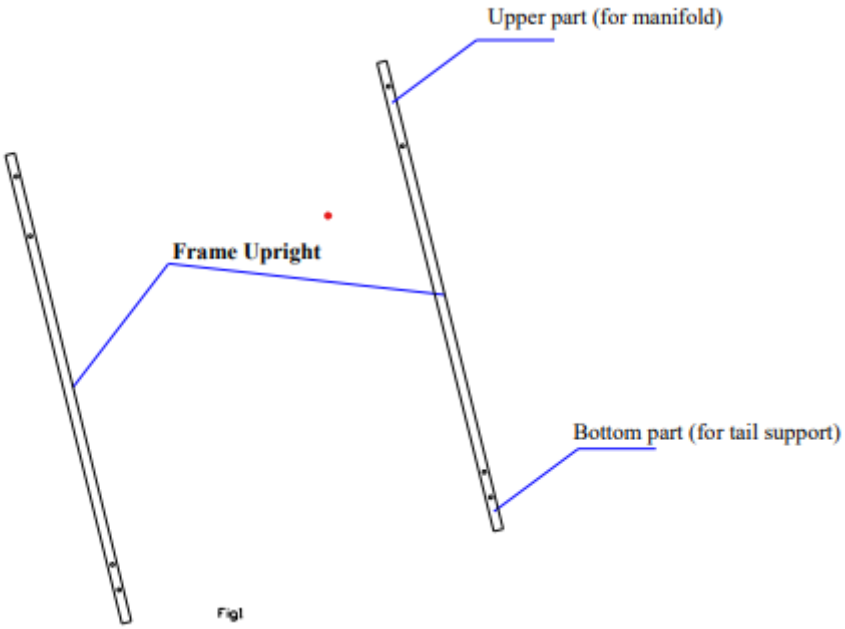
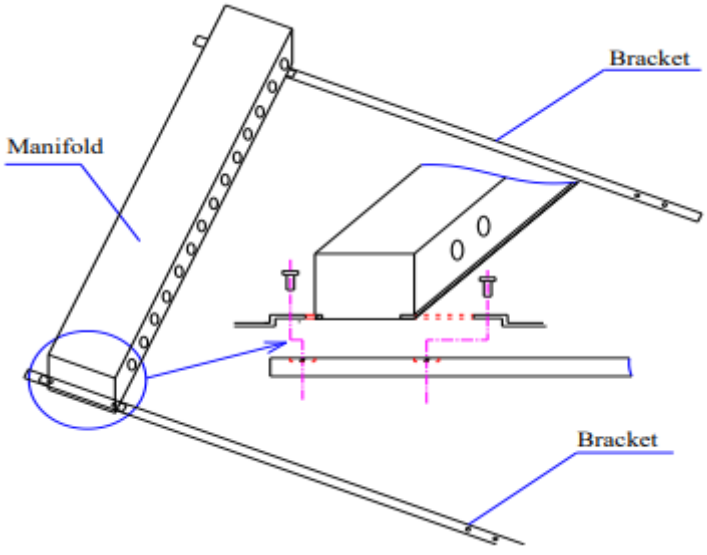
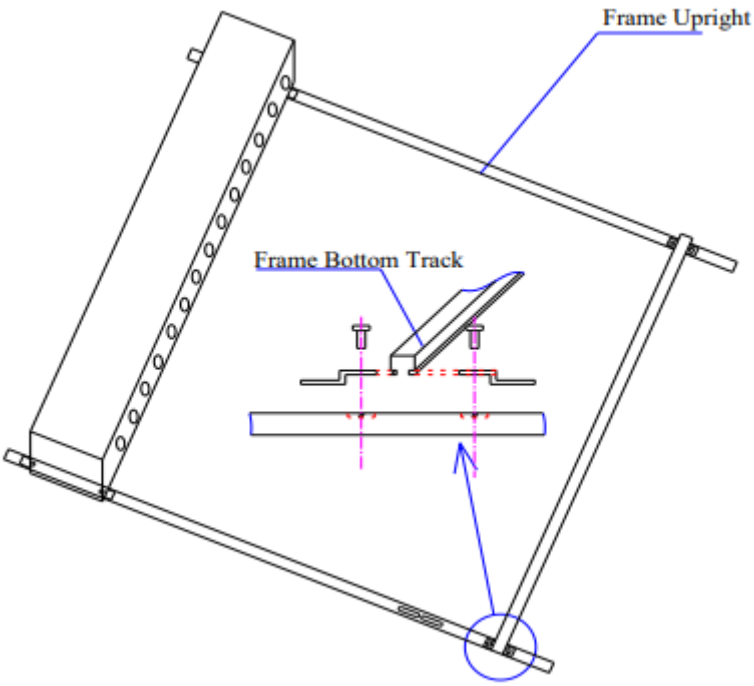


Fig1

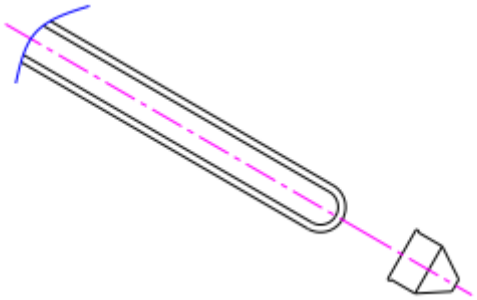
2. Place the manifold on the upper part of frame upright. Fix the clips into the grooves under the manifold with the stainless-steel screws.



3. Place the bottom track on the two frames. Connect them by the stainless-steel screws.



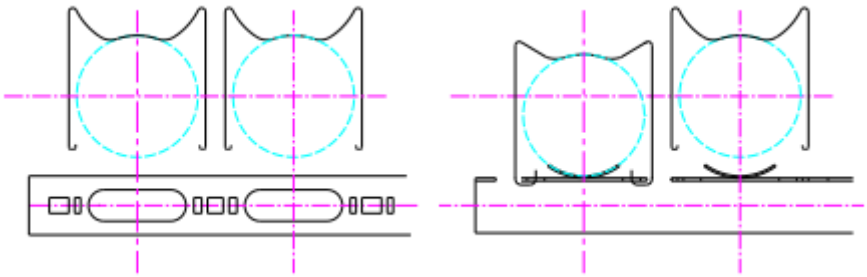
4. Cover the lower end of the tubes with the rubber boot.



5. Brush silicon grease on condensation header of heat pipe. Pull copper heat pipe 100mm out of the glass tube and brush silicon grease onto the heat pipe top end. Insert the heat pipe into the manifold, ensuring that it fully inserts. Follow with the glass evacuated tube. This will avoid breakage. Detergent and water can be used to lubricate the glass end to help insertion.

   Care is to be taken, as the heat pipe will be hot if exposed to the solar radiation. Always wear protective gloves.

   Fasten the end of heat pipe to the bottom track with stainless steel clips over the rubber boot.

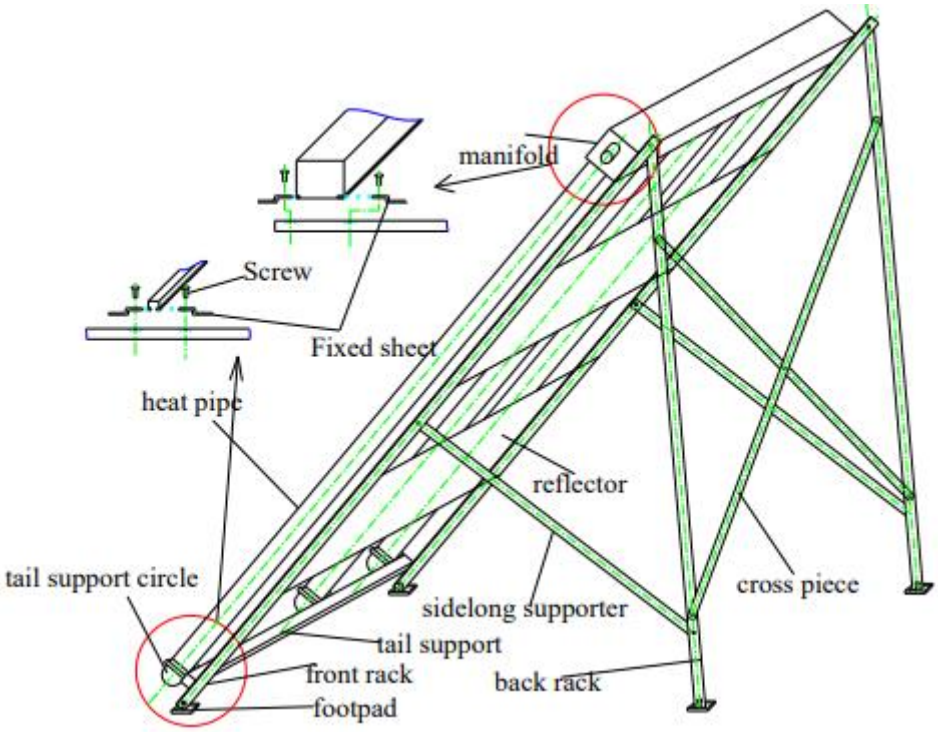


6. Check that all fixings have been tightened and all penetrations are secure and sealed. Care is to be taken of the roof structure. Ensure that the installation does not affect the structural integrity of the building.

   All penetrations are to be professionally sealed.

   Ensure there are no areas for water ponding or debris buildup.

Stand mounting

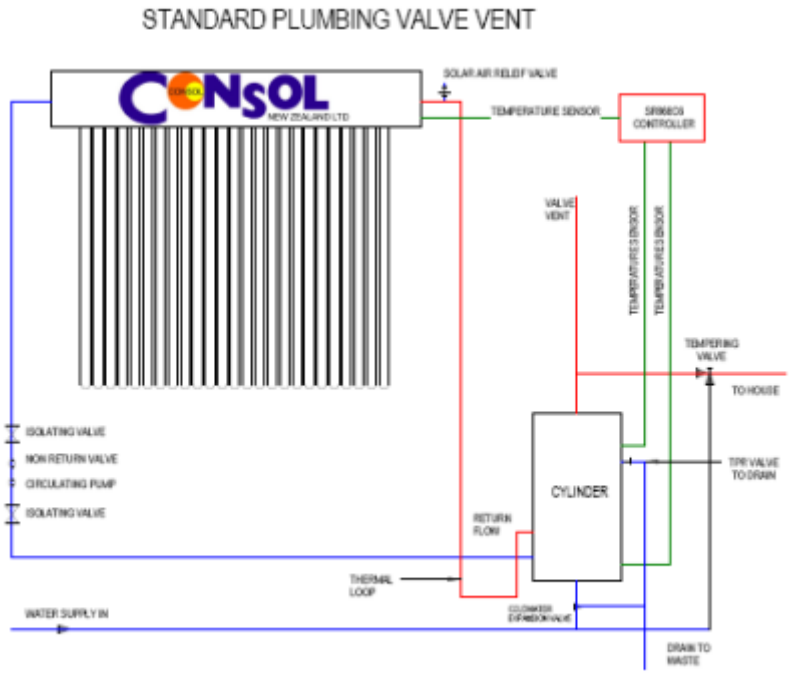


A stand mounted collector may be necessary where the roof is not at the correct inclination.

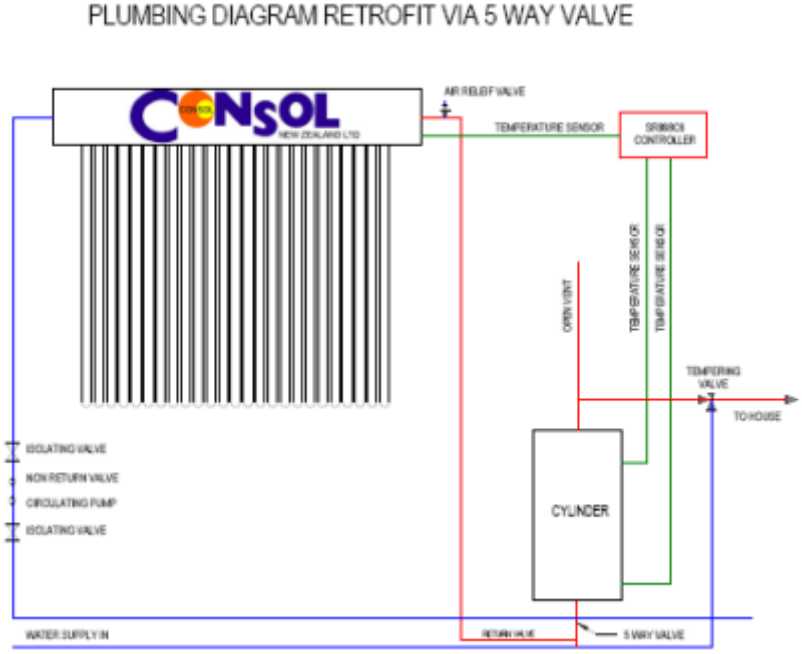
The customer should be advised that performance is reduced if the panel is not mounted at the correct inclination. The performance can be increased by adding extra tubes as an alternative to mounting on a stand.

Plumbing Diagrams

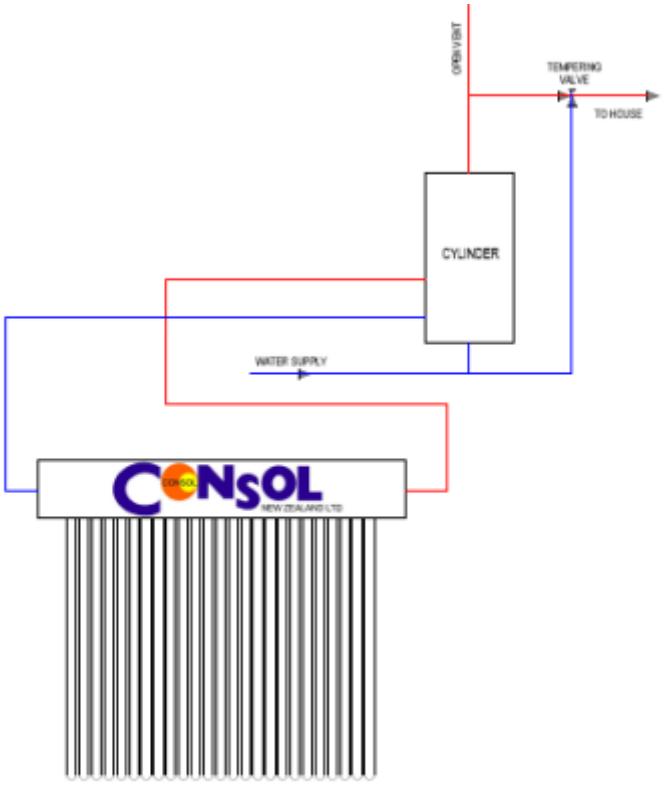
Standard valve vent



Retrofit



Thermosyphon



PLUMBING DIAGRAM THERMOSYPHON

Controller Connection

The installation and commissioning of the controller must be carried out by a registered electrician and must be carried out in accordance with the operation and instruction manual. Care should be taken when wiring in the controller auxiliary heating where ripple control could disturb the operation of the system. The adjustment of controllers may adversely affect solar performance.

The controller controls the system components. It will operate the switching time of the cylinder and pump. There needs to be a continuous power supply to the controller as the freeze protection function is operated by the controller. This system operates with three temperature probes that are wired to the collector, cylinder, and controller. Placement of the sensors according to the wiring diagrams is important. Sensor cables are to be protected from degradation by weather and animals.

The controller is to be installed in a position that is accessible for servicing. Connection to the mains is via a plug and is not to be hard wired.

Functions of the controller include:

- Temperature difference controlling
- Temperature controlled auxiliary heating
- Time controlled auxiliary heating
- Temperature controlled hot water circulation
- Anti freezing protection
- High temperature protection

Pump Connection

The pump in this direct system will draw the water from the low point of the cylinder, circulate it through the collector(s) and return the heated water at a point higher than the draw off point.

The pump used in this system is the WILO RS25/6.

The pump will be installed with isolation fittings either side that will allow for removal for maintenance or replacement.

This pump is designed to produce the hydrostatic head that may not be suitable for every application.

The pump is wired into and operated by the system controller.

The pump is to be mounted according to the manufacturer's instructions and according to the system layout diagrams.

The pump is fitted to the system by the installer and the wiring is carried out by the electrician.

Cylinder Connection

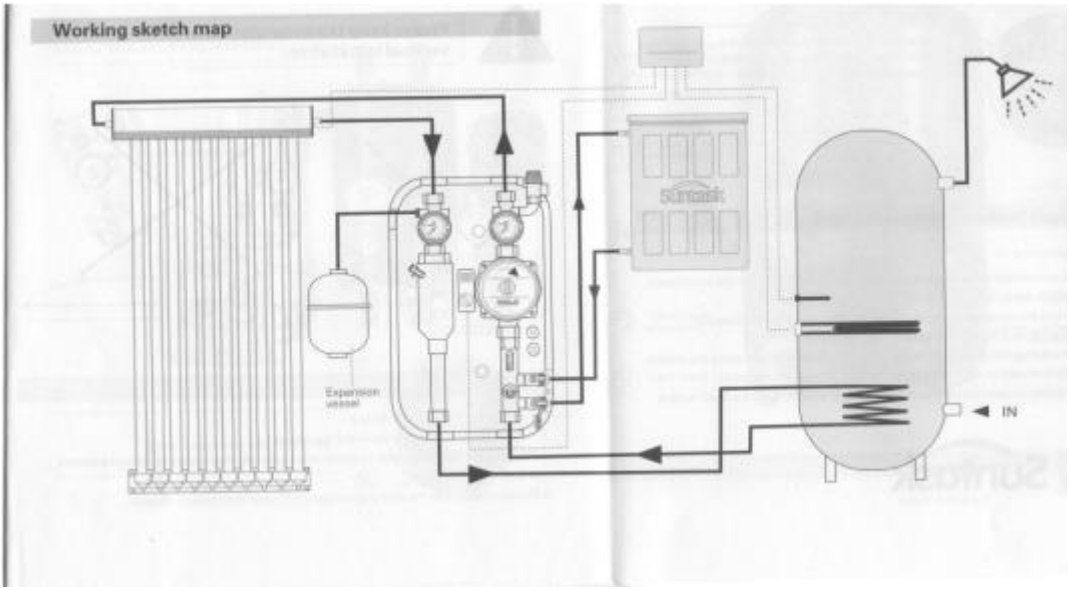
The chosen cylinder for the Consol system is the Cooper Mains Pressure Stainless Steel Solar Ready MP series.

The cylinder comes standard with element and thermostat and temperature/pressure relief valve set to 850kpa and 90°C (the cylinder has a manual resettable cut out button set at 85°).

Cylinders are to be restrained as per the Building Code. The thermostat should be set to 55° or 45° for elderly and child-care facilities. The cylinder is to be filled and vented prior to being energised by power or solar.

The cylinder is the storage for the water heated via solar gain and is to be correctly sized according to the water usage and the size of the collector. The cylinder has an electrical element to back up the solar. The electrical element is wired to an is controlled by the controller.

Closed Loop System



For installations in areas where there are extremely cold temperatures and where there can be interruptions to the power supply and system frost protection features, high temperature functions are to be set as in the controller manual to protect the tank from overheating.

All pipework must be copper.

A shut valve will be located on the pipework so the pump station can be removed for maintenance. The solar panel must be covered to prevent overheating and excess pressure if the valve is to be shut.

Fluid

A fluid concentration of 30% food grade propylene glycol and 70% clean water will be used as the transfer medium. This is a nontoxic food-grade glycol and will withstand the high temperatures that will be reached by the system without degradation or becoming toxic. It will be coloured with Hansells food-grade red colouring for leak detection. Colour should be visible in concentrations of 1:1000 for a period of 90 days. The system will be filled by the fill

valve in the filling station and the system pressurised to 1.5-2.0 bar and equalised with the pressure in the expansion vessel. See the Suntask pump station instructions for filling method.

The drain cock will be installed at the lowest part of the system loop for draining the system.

The pump station provides draining instructions and the fluid must be disposed into the fowl water drain only.

If leakage occurs red dye will be present in the potable water. If this occurs, turn off all taps and immediately call your Consol agent.

Relief valve

A pressure relief valve is located in the pump station and is the system safety device designed to open at 6 bar should the system pressure rise to that level. The relief valve should vent onto the copper relief of the cylinder with no obstruction of flow. Drain for the relief must be no smaller than 20mm and be able to withstand temperatures of 110°C.

Remove the safety valve and shut off the expansion tank when pressure testing the system to 1.5 times the maximum working pressure for pipework leakage.

Pump

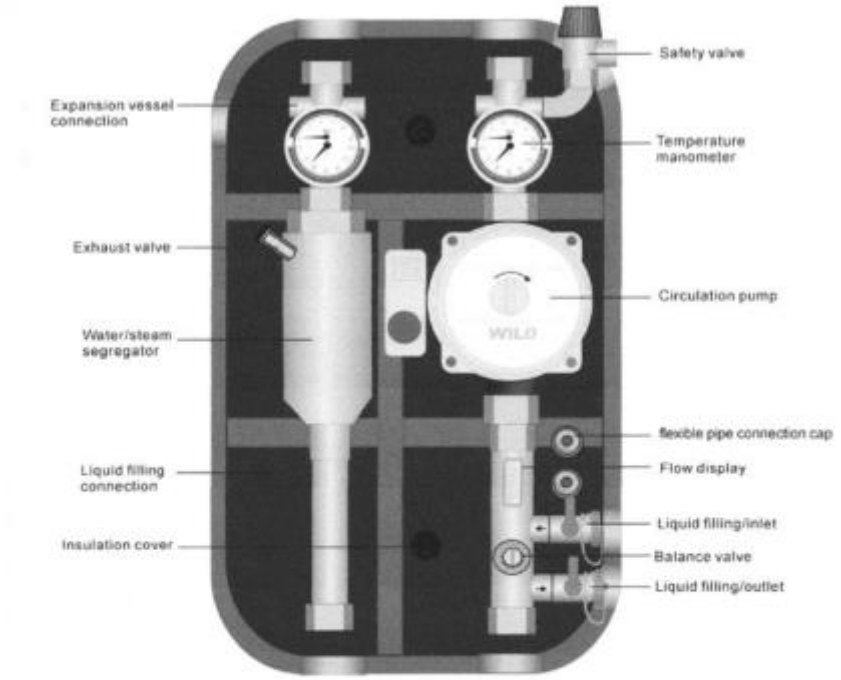
The pump located in the pump station is a WILO RS16/6 with a maximum head of 6m, maximum pressure of 10 bar and working temperatures of -25°-110°C. The pump station needs to be installed vertically as in the pump station instruction manual.

Expansion tank

The expansion tank will take up the expansion of the heat transfer fluid as it heats preventing excess pressure that will cause the relief valve to vent. For a standard installation a 12-litre tank is recommended. The tank should be sized depending on the volume of transfer fluid and temperatures.

Pressure gauge

The pressure gauge located in the pump station should be visible at all times to make sure that the system has maintained fluid level and pressure.



technical parameters

application range：Combined self-fill circulation unit for solar thermal applications
Body Dimensions (HxWxD)：476x285x158mm
Max pressure :10 Bar
Max working temperature： 100°C
Max surrounding temperature： 45°C
connection size: G3/4" female

For the Heat Transfer Fluid

The heat transfer fluid for the open loop system is the potable water that is pumped from the cylinder.

If there is a problem with continuous power supply in a region where freezing temperatures can happen, then the transfer fluid can be changed to a glycol-type antifreeze fluid, which is in a closed loop situation. Please consult your Consol dealer for instruction if this is necessary. The system has been designed for frost protection level 2 (-15°).

Water quality in different regions can vary, so consult the local council if unsure. If water quality is poor then a more frequent maintenance schedule may be necessary.

Solar Collector Location

Preliminary site inspection

Check that the roof will have adequate area for the proposed collector.

Check that the collector can be oriented in the correct direction and at an appropriate inclination.

Check for shading by objects at all times of the day allowing for the low sun angles in the winter.

Orientation

For optimal solar gain the collector should be facing the geographic north and be tilted to the same angle as the latitude location of the installation. Some examples are present in the table below:

Auckland	37°
Wellington	41°
Christchurch	44°
Invercargill	46°

Care should be taken to avoid situations where significant shading can occur.

Maintenance and Service

Operation and maintenance instructions are to be left with the customer or in a convenient location.

Consol New Zealand Ltd offer a full maintenance and servicing programme. Please contact Consol for further information.

Relief valves, protective devices, thermostats, pumps, and controllers all need to be accessible for removal and servicing.

Periodically ensure that the collector is free of leaves and is cleaned with fresh water.

Check that drains are free from obstructions.

Ensure that the system is correctly programmed. See controller manual.

Collector glazing must only be replaced by an authorised agent.

Closed loop glycol will need to be checked for quality on an annual basis. Consult your Consol dealer for instruction.

Sizing of Collector

The cylinder and collector size are very important. Consol will size the system for each individual situation. Water quality can affect the components so if there is any doubt contact Consol.

Generally, the cylinder should contain 1.5 times the daily usage of hot water.

The system will be sized to achieve approximately 70 percent of the normal annual hot water energy requirement of the household.

System Handover

Prior to handing over the system, the installer must ensure that the requirements have been met and that the full installation has been tested and commissioned. This includes the solar collector and electrical systems.

The owner will be provided with a copy of the following:

- System operation and installation manual
- Controller operation manual
- Maintenance instructions
- Manufacturers and installers contact information
- Guarantees

Relevant Standards

AS/NZS 3500.4:2015	Plumbing and drainage – heated water services
NZS 4606 and 4607	Storage water heaters/installation
NZS 4608	Control valves for hot water systems
AS/NZS 4613/4614 1986	Domestic solar water heaters installation
AS/NZS 2712:2007	Solar and heat pump water heaters

Warranty Details

Warranty

Consol New Zealand Ltd is committed to supplying a top-quality product to the water heating industry.

The solar collector system complies with AS/NZS 2712 and is designed to be very low maintenance.

Consol's manufacturer's guarantee includes the following when the Consol-scheduled annual maintenance programme is applied:

Solar manifold	7 years
Solar tubes	15 years
Solar controller	1 year
Solar pump	1 year
Coopers' manufacturer warranty	20 years

Installation Guarantee

All installations are to be carried out by Consol-approved installers. Installs will carry an installation workmanship guarantee for a minimum of five years. Install records will be maintained by Consol.

Follow-up Service

Consol will database all customers, recording details of:

- Installer
- Installation date
- Address of install
- Name of purchaser
- Collector serial number

This allows Consol to attend to any warranty issues immediately and supply details for our quality control systems.

Contact details for technical help will be given to each customer.

Quality control

Consol will contact customers within three months after commissioning of the collector to assess satisfaction and attend to any technical difficulties.

Consol offers a maintenance programme to protect your investment and insure efficiency of the system.

Contact Details

 info@consol.nz

 www.consol.nz