

hrrsfunke
HEAT TRANSFER



SOLARCHOICE

SOLAR SOLUTIONS FOR HOT WATER

- FPC SERIES
- ETC SERIES



WHY SOLAR?

The benefits of choosing to install a solar powered hot water system are significant when viewed through a long-term lens. It is a great investment with the eventual return being risk free (unlike stocks and shares). This return will also increase in-line with the increase in gas and electricity prices in the future, giving you more incentive to make the initial investment.

HRSFUNKE SOLAR CHOICE offers cost effective solutions for the hot water system for residential, commercial buildings using renewable energy. HRSFUNKE can offer two types of solar collections - Flat Plate collectors and evacuated tube collectors.

WHY CHOOSE HRSFUNKE SOLAR CHOICE?

HRSFUNKE Solar Choice offers efficient, cost effective design as per the project requirement and can guarantee long time efficient performance. Solar Choice offers the best quality products and extremely attractive prices with the latest design, you can guarantee you will be using one of the best solar panels on the market offering a high efficiency in solar collection.

The Solar Choice storage tanks supplied are manufactured from the best materials and are extremely reliable. Fitted with the latest safety equipment and the best of finishes, our customers can be assured their hot water is heated using a safe and economical process.

HRSFUNKE SOLAR CHOICE - FLAT COLLECTORS

HRSFUNKE Solar Flat plate solar thermal collector consists of a copper riser tube structure, fitted to a flat absorber plate. The absorber plates are highly efficient, and are made of specially designed Tinox Selectice or Black Chrome based on the requirement. The absorber plate on standard Flat plate solar thermal collectors are generally painted black or black in colour. The black surface is most efficient at absorbing solar radiation and converting it to heat, it is also highly efficient at reradiating long wave infrared heat back out. The collector structure is manufactured from stainless steel or anodized aluminum and the collector base is manufactured from weather resistant aluminium or galvanized sheet with 35mm glass wool rear insulation. The glass cover is highly transparent, made from lowiron, tempered glass.

The Solar collector captures the solar energy by employing the 'green-house' effect. The glass cover of the collector permits up to 90% of the visible sunlight to enter the collector. When this light passes through the glass cover, the frequency of the light is decreased to a lower energy level.

When the light hits the absorber plate, the light is absorbed as heat. The combination of the frequency change and the absorber surface on the plate captures the maximum amount of energy. As the absorber plate heats up, it begins to radiate energy as infrared or heat radiation. The glass cover traps the heat in the collector as the glass is essentially opaque to infrared waves, thus increasing the temperature and heating the water in the copper tube assembly. The heated water is then pumped to a coil (heat exchanger) within the storage vessel. When the solar-heated water drops below a certain temperature the solar pump stops circulating the water. The control system switches to the Back up heater to heat the water, in the conventional system which heats the stored water by a separate coil in the vessel or by direct heating using electrical heater.

A Solar Choice Package Consists of

- The required number of solar panels
- A suitably sized storage vessel with Coil HEX and Back up heater
- A pump & valve set
- A solar accumulator/ expansion vessel
- A digital temperature controller
- Panel connection kits (to suit the panels)
- A solar specification automatic air vent
- Fixing kit



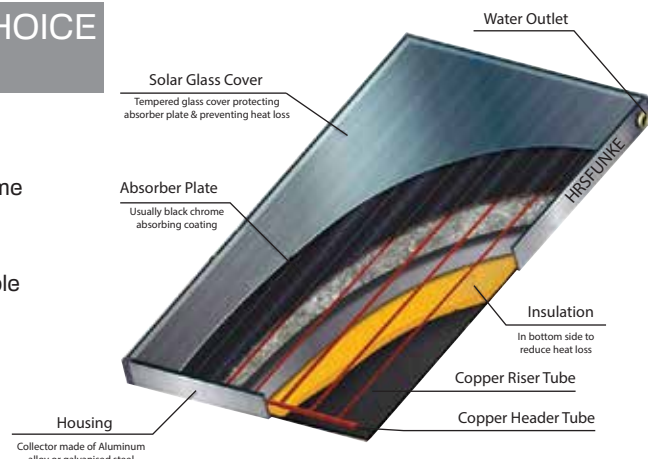
HRSFUNKE STANDARD FLAT PLATE COLLECTORS - (FPC Series)

TECHNICAL DETAILS

MODEL	FPC2.0 - Vertical	FPC2.4 - Vertical	FPC 3.0
Dimension (h) x (w) x (d)	2000 x 1000 x 80mm	2000 x 1200 x 80mm	2000 x 1500 x 80mm
Gross Area (m ²)	2	2.4	3.0
Aperture Area (m ²)	1.86	2.39	2.39
Cover material	Frosted Low Iron Tempered glass		-
Cover thickness	-	3.5mm	-
Weight	35kg	40kg	50kg
Fulid Volume of Absorber	1.6 Litre	1.6 Litre	1.6 Litre
FEATURES			
Sensor pocket	Built in sensor pocket	Built in sensor pocket	Built in sensor pocket
Panel orientation	Vertical	Vertical	Vertical
ABSORBER			
Material	Copper-Aluminum fin	Copper-Aluminum fin	Copper-Aluminum fin
Surface treatment	Black Chrome	Black Chrome	Black Chrome
Absorption Factor	85 ± 5%	85 ± 5%	85 ± 5%
Emissions	5 ± 2%	5 ± 2%	5 ± 2%
Header material	Copper	Copper	Copper
Header tube size	22mm x 0.75mm	22mm x 0.75mm	22mm x 0.75mm
Riser tube size	Copper	Copper	Copper
Design Welding	Ultrasonic Welding	Ultrasonic Welding	Ultrasonic Welding
Maximum Pressure	10 Bar	10 Bar	10 Bar
THERMAL INSULATION			
Insulation Material	Polyester fiber	Polyester fiber	Polyester fiber
Insulation thickness	35mm	35mm	35mm
CASING			
Frame	6063 Aluminum alloy	6063 Aluminum alloy	6063 Aluminum alloy
Frame color	Antique bronze	Antique bronze	Antique bronze
Fram thickness	1mm	1mm	1mm
Back plate	chromodek	chromodek	chromodek
Max operating temperature	< 200 °C (153 °C)	< 200 °C (153 °C)	< 200 °C (153 °C)
Transfer coefficient	> 95 ± 2%	> 95 ± 2%	> 95 ± 2%
Sealing gasket	EPDM	EPDM	EPDM

FEATURES OF HRSFUNKE SOLAR CHOICE FLATE PLATE COLLECTORS

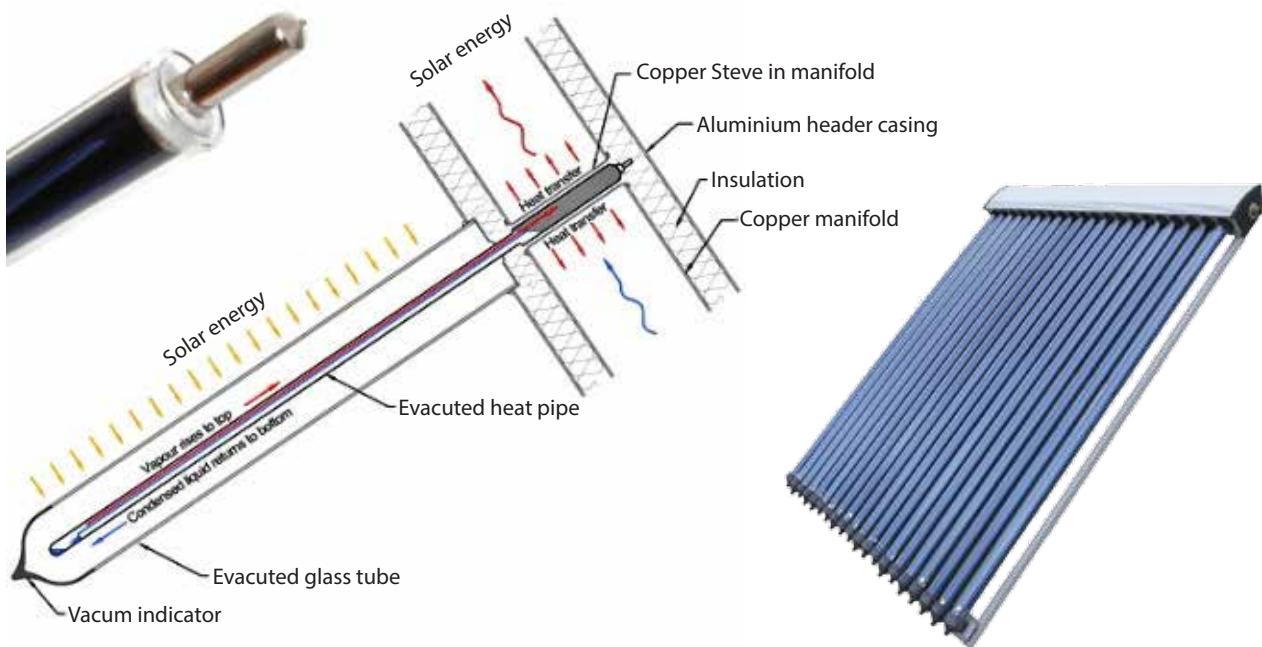
- Highly efficient absorber plate
- Copper Riser Tubes
- Durable & weather resistant stainless steel or aluminum frame
- Tempered glass with optimal light transmission
- Full complement of custom mounting hardware is available
- Long lasting, easy to assemble & install and also disassemble without cutting or unsoldering



HRSFUNKE STANDARD EVACUATED COLLECTORS - (ETC Series)

HRSFUNKE tube collectors are made of high performance evacuated tubes with tincoated. Different types of panels are available with 10, 15, 20, 30 tubes to suit requirements. The heat pipes offers high efficiency, low maintenance.

Tubes	W1 mm	W2 mm	W3 mm	Wet Weight kg	Aperture Area m ²	Annual Output kWh
10	860	780	950	40.0	0.93	792
15	1250	1170	1340	58.0	1.4	1188
20	1640	1560	1730	62.0	1.87	1590
25	2030	1950	2120	96.0	2.33	1980
30	2420	2340	2510	114.1	2.79	2376



FEATURES OF HRSFUNKE SOLAR CHOICE - EVACUATED TUBE COLLECTORS

- High performance evacuated tube collectors
- Available in 10, 15, 20, 25 & 30 tube panels
- Can be mounted on a flat or on a pitched roof
- Solar keymarked and EN 12975-2 certified
- Heat pipes - offering low maintenance
- Easy to install, simple roof fixings
- 10 year warranty, 20+ year lifespan
- Market leading efficiency $\eta_0=73.4\%$

SOLAR CHOICE - STORAGE CALORIFIER

Calorifier Material Selection

Material selection of a Calorifier is generally carried out to suit site requirements and specification, the pressure of the Calorifier and also the physical dimensions of the cylinder. Due to the high quality of materials used, longevity is extended much beyond that of interior materials such as enamelled or glass-lined cylinders which are susceptible to corrosion and decay. Our standard materials used include:

Copper

Solid copper is a proven reliable product by being virtually impervious to attack by aggressive water, used throughout the world with its' long life making it a popular material selection. Shells manufactured from copper gain a coating of copper oxides on the surface which protects it from attack. Where water is aggressive, an aluminium anode can be fitted in the shell which also deposits an aluminium film on the surface which permanently protects the shell from corrosion. The anode does not need replacing throughout the life of the Calorifier. Due to low material design strengths, solid copper may become uneconomical to use on cylinders with larger diameters and high pressures and thus, we would offer a copper-lined steel option as below. It is to be noted that copper shells should not be used in conjunction with galvanised steel pipe work or fittings due to incompatibility of the 2 materials.

Copper-Lined Steel

Solid copper shell is impractical due to high pressures, so we would offer a copperlined steel shell Calorifier. This type of manufacture combines the high strength of carbon steel with the corrosion resistant copper layer. The process involves manufacturing a carbon steel outer shell and then lining internally with copper sheets which is welded together to form a waterproof surface with all wetted parts within the Calorifier being manufactured from copper.

Anti-vacuum valves are fitted as standard to copper-lined cylinders to avoid the vessel collapsing under vacuum conditions when draining down without a suitable vent.



Galvanised Steel

Galvanised steel shells are also available. The shells are manufactured from carbon steel and then hot-dipped in a galvanising tank. This deposits a layer of zinc on the surface. Galvanised shells offer excellent corrosion protection in hard water areas. Galvanised Calorifiers should not be used on soft water areas as soft water prevents formation of a protective layer on the surface of the shell. Magnesium anodes should be fitted to galvanised cylinders which gives the shell its' protective coating. Anodes should be replaced annually to ensure long life of the Calorifier. Copper pipe work or fitting should not be used in conjunction with galvanised shells

Stainless Steel

Stainless steel Calorifiers are becoming more common for domestic hot water heating due to high material strengths and potable water compatibility. Calorifiers with stainless steel shells installed in systems with high chloride content may be unsuitable as the chlorides can attack the welds.

Glass-Lined Steel

The shell is manufactured from Carbon Steel and then internally lined with glass or enamel. The lining is hygienic and resistant to corrosion and scale formation. These are supplied with Magnesium anode which can provide additional Cathodic protection and can easily be checked and replaced.

SELECTION & SIZING OF CALORIFIER

Storage Size & Heating Load

We cannot make an exact calculation of hot water consumption in a public area; the demand will fluctuate throughout the day. So it is better to collect the possible data available to calculate the peak load demand, otherwise we can make general calculation based on hot water requirement per person and the recovery required for different applications, as discussed above.

In general the calculations are made based on heating water from 20°C to 65°C. If the required temperature is below 65°C either hot water demand has to increase or heating load should go down.

Flow rate

Flow rate will depend on the demand for hot water. It will be maximum during peak demand. Heating load should be calculated to satisfy the maximum flow rate.

Sample Heating Load calculation

Considering Hotel:
Normal recovery time is 2hours

General hot water demand = 45 Litres/Person

Maximum demand = 125 x 45
= 5625

Acceptable peak Demand = 0.7 x 5625
= 3940

Max. Flow rate required = 3940L / 2hrs
= 0.55 L/S

Heating Duty Required = 0.55 x 4.2 x 45
= 104 kW

So a Calorifier of capacity 4000 L with a heater of duty 105 kW will be sufficient for the application. The specified system can supply the maximum flow rate based on the peak demand.

Capacity Litres	Dia mm	H.O/E mm	Max Ht.	Access size	Connections							
					C	D	E	F	G	H		
230	500	1300	1525	DN 250	1.1/2" B SP	3/4" B SP	1.1/2" B SP	1/2" B SP	3/8" B SP	3/4" B SP	3/4" B SP	
300	600	1180	1405	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
400	700	1155	1380	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
500	700	1450	1675	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
600	700	1740	1965	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
700	800	1775	2000	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
800	800	1780	2005	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
900	800	1990	2215	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
1000	900	1765	1990	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
1200	900	2120	2345	DN 250	2" B SP	1" B SP	2" B SP	1/2" B SP	3/8" B SP	1" B SP	1" B SP	
1500	1000	2125	2350	DN 450	DN 65 PN 16	1.1/2" B SP	DN 65 PN 16	1/2" B SP	3/8" B SP	1.1/2" B SP	1.1/2" B SP	
1750	1000	2480	2705	DN 450	DN 65 PN 16	1.1/2" B SP	DN 65 PN 16	1/2" B SP	3/8" B SP	1.1/2" B SP	1.1/2" B SP	
2000	1100	2350	2575	DN 450	DN 80 PN 16	2" B SP	DN 80 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
2250	1200	2220	2445	DN 450	DN 80 PN 16	2" B SP	DN 80 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
2500	1200	2460	2685	DN 450	DN 100P N 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
3000	1200	2950	3175	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
4000	1450	2700	2925	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
5000	1600	2775	3000	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
6000	1800	2640	2865	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
7000	1800	3040	3265	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
8000	2000	2860	3085	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
9000	2200	2710	2935	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
10000	2400	2580	2805	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
20000	3200	2940	3165	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
30000	3800	3190	3415	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
40000	4300	3365	3590	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	
50000	4600	3660	3885	DN 450	DN 100 PN 16	2" B SP	DN 100 PN 16	1/2" B SP	3/8" B SP	2" B SP	2" B SP	

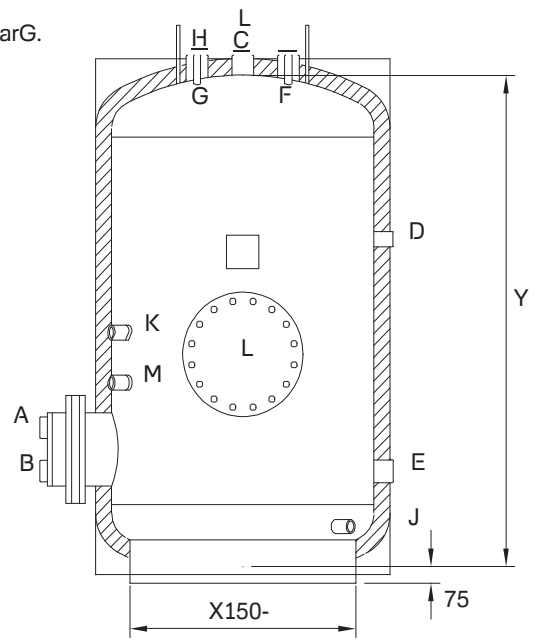
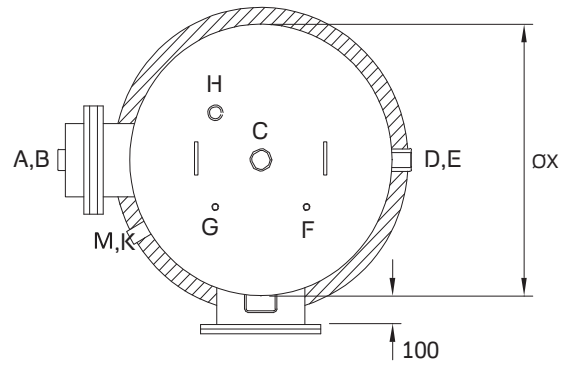
- HRSFUNKE standard models. custom models are also available

Key

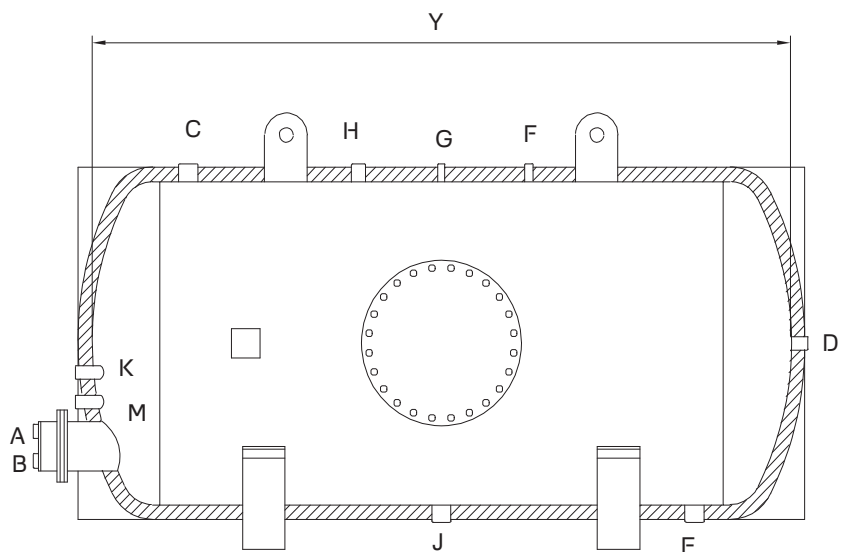
- A. Primary Inlet
- B. Primary Outlet
- C. Hot Water Outlet
- D. Secondary Return
- E. Cold Feed
- F. Thermometer
- G. Pressure Gauge
- H. Safety Valve
- J. Drain
- K. Thermostats (1" BSP)
- L. Inspection Opening
- M. Immersion Heater
- N. Anti-Vacuum Valve



The Standard HRSFUNKE range Calorifiers have working pressure of 6 BarG and 10 BarG. Higher pressures are also available.



Vertical Models



Heater Battery

U-tube is the most common heat exchanger used in Calorifier manufacturing. U-tubes are made with high efficiency tubes unaffected by thermal expansion provide high level of reliability. The tubes in the heater batteries are available in plain copper, making them suitable for both hard and soft water areas. Standard batteries are manufactured using copper integron tubes. The heater battery is also available in stainless steel AISI 316L offering a hygienic, reliable long life. The heater is withdrawable for cleaning and inspection purposes. So space must be allotted for withdrawal of the batteries. If withdrawal distance is not known, assume the distance being equal to the vessel diameter. The standard range of 'battery duties are based on a 1-hour recovery period raising water from 10°C to 60°C with a primary medium of water at 82°C to 71°C. Bespoke Calorifier designs are available along with other duties, working pressures and primary mediums. Please contact our sales department for further details.

Instead of U-tube, Spiral tube heat exchanger designs are also available to meet cost effective solutions.



Primary Side Flow rate Requirement:

Considering the heating load 100 kW.
As per standard Primary side Temperatures:

Inlet	=	82°C
Outlet	=	71°C
Heating Duty	=	100 kW
Flow rate	=	100/(4.2 x 11)

The selected U-tube will be capable to produce 100 kW heating duty if there is a primary flow of 2.17 L/s

Heading Duty	Heat Transfer Area	Inlet Size	Outlet Size	Flange Size	Length
kW	m ²	mm	mm	mm	mm
20	1.20	20	20	125	410
30	1.80	25	25	150	565
40	2.40	25	25	150	715
50	3.00	32	32	150	870
60	3.60	32	32	200	725
70	4.20	40	40	200	825
80	4.80	40	40	200	925
90	5.40	40	40	250	695
100	6.00	40	40	250	760
125	7.50	50	50	250	910
150	9.00	50	50	250	1060
200	12.00	65	65	300	1065
250	15.00	65	65	300	1290
300	18.00	80	80	350	1185
400	24.00	80	80	400	1125
500	30.00	100	100	400	1350

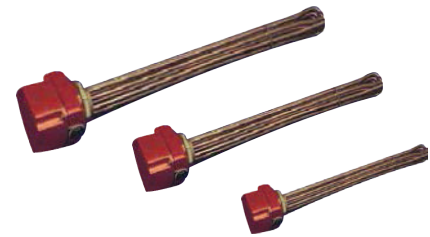
- Based on HRSFUNKE standard, subject to change

Immersion Heaters

Fixed Rod Elements

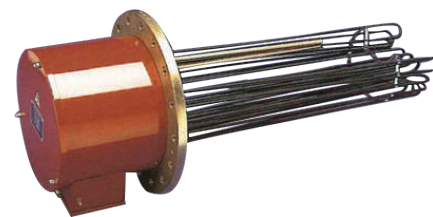
The rod element comprises of a resistance heating coil surrounded by compacted magnesium oxide powder enclosed in a tubular metal sheath. The element is brazed to the heater boss or flange. If an element fails the entire heater must be replaced. These heaters are generically screwed BSP.

Our standard element material on is Nicalloy 825. This is a high alloy stainless steel and has excellent corrosion resisting properties. Generally this material can be used in hard and aggressive waters and a range of chemical solutions.



Glanded Rod Elements

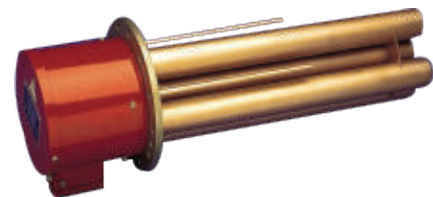
The rod element comprises of a resistance heating coil surrounded by compacted magnesium oxide powder enclosed in a tubular metal sheath. The element is brazed to glands that are bolted to the element flange. If an element fails the individual element can be replaced, however, the vessel must be drained and the heater removed from the vessel.



Removable Core Elements

A removable core element comprises of resistance wire wound inside ceramic formers. Removable core elements are inserted into element tubes which are expanded, brazed or welded into the heater flange. If an element fails the individual element can be replaced without draining or removing the heater from the vessel. Because removable core elements operate at much lower watts densities compared to rod elements and have much heavier wall thicknesses the range of conditions that they can operate in is far wider.

Our standard sheath material on is copper, generally suitable for use in hard and aggressive water conditions, particularly waters with high chlorine concentrations such as desalinated water.



Element Watts Density

Element watts density is defined as the amount of watts given out per unit surface area of element. High element watts density reduces the life of an element and increases significantly the effect of corrosion on the element sheath. High element watts density causes water to boil around the element and produces a noise similar to that of a boiling kettle. Where an immersion heater has been fitted close to sleeping accommodation it has been known for this noise to keep people awake at night.

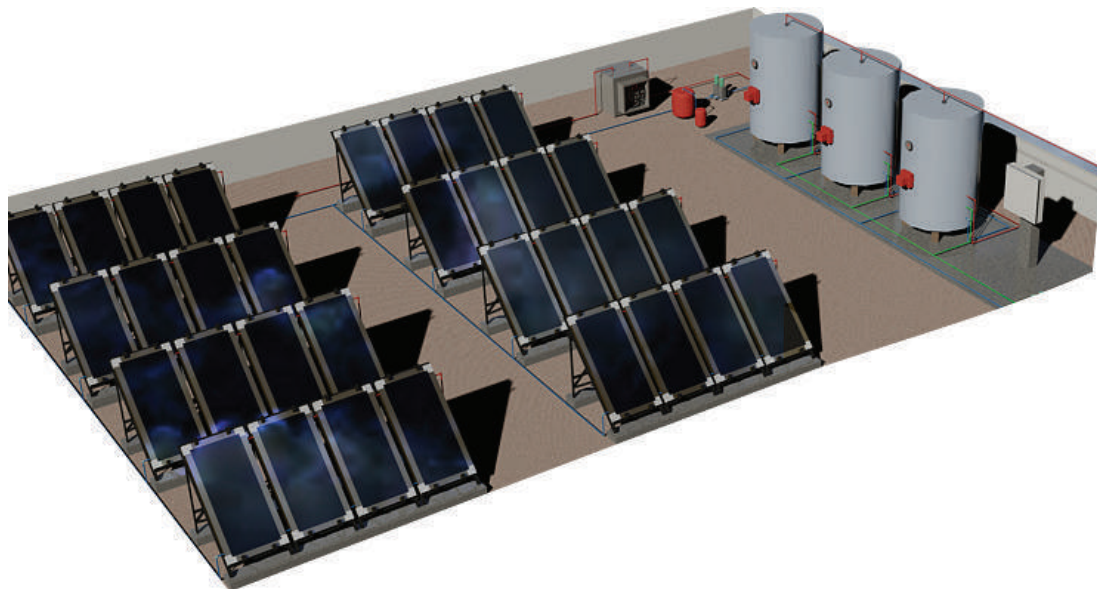
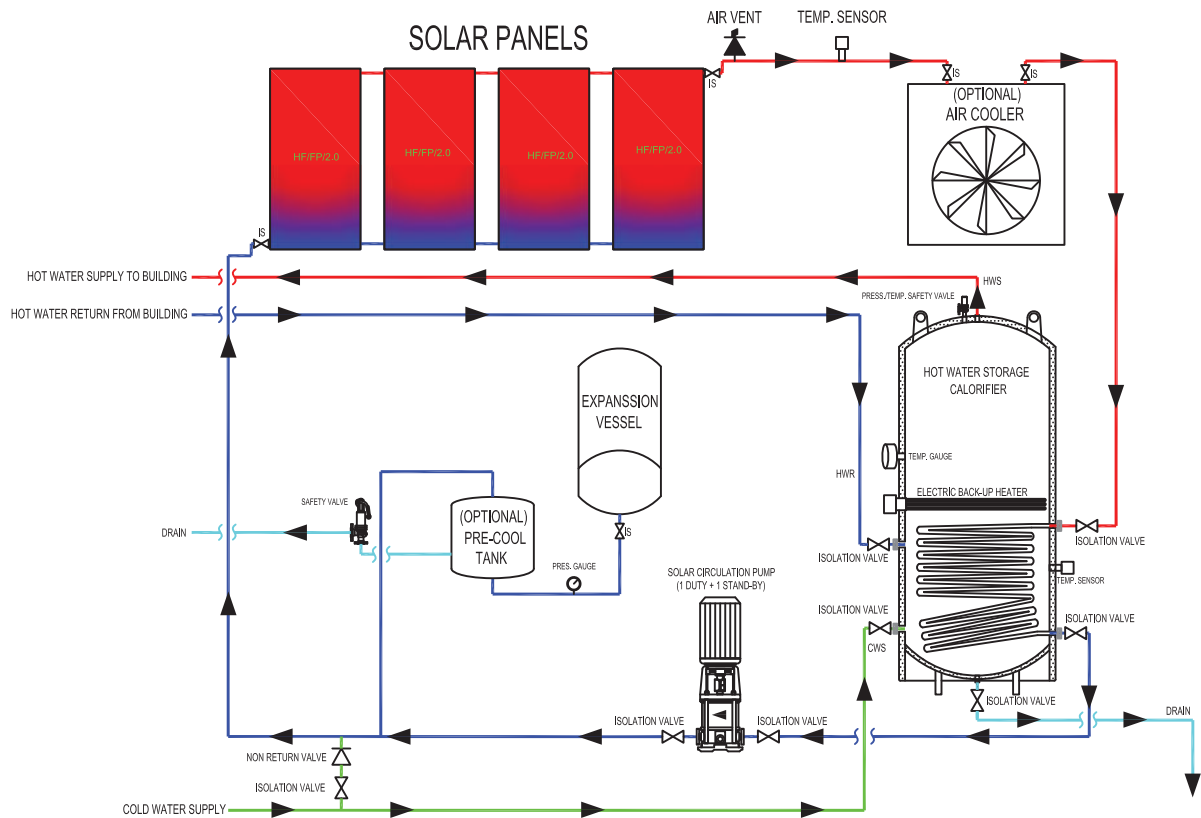
Due to their design, removable core elements operate at low watts-densities, which generally allow them to operate with

significantly less corrosion problems compared with rod elements. Generally removable core element watt densities are below $3.1\text{W}/\text{cm}^2$ ($20\text{ W}/\text{in}^2$)

With the exception of domestic heaters and some light industrial heaters the standard watts density for rod element heaters is $9.3\text{W}/\text{cm}^2$ ($60\text{W}/\text{in}^2$) with a standard watts density on our flanged heaters being $7.4\text{ W}/\text{cm}^2$. This is suitable for heating most types of water. Where water conditions are very hard or aggressive particularly in respect of desalinated water or where chemical solutions are being heated, please contact our technical department to obtain the correct element specification.

TYPICAL INSTALLATIONS

The Schematic diagram below represents an example of an advanced solution for domestic water & central heating production. Hot water is produced by the solar system which is integrated with the Electrical heater for non sunny periods. Our Solar System are supplied with a Standard controller which will run the Solar side circulation pump based on temperature difference and will operate the Back up Electrical heater if the solar heating is not adequate.



HRSFUNKE Solar Choice packages are pre-sized solar packaged units supplied complete with all necessary accessories. They are specially designed to offer maximum flexibility and meet any requirement for domestic and commercial use of solar energy.

FEATURES AND ADVANTAGES

Complete. Each package is supplied with the accessories shown tabulated below as standard.

Flexible. A wide variety of combinations








available (varying the number of collectors, cylinder size etc)

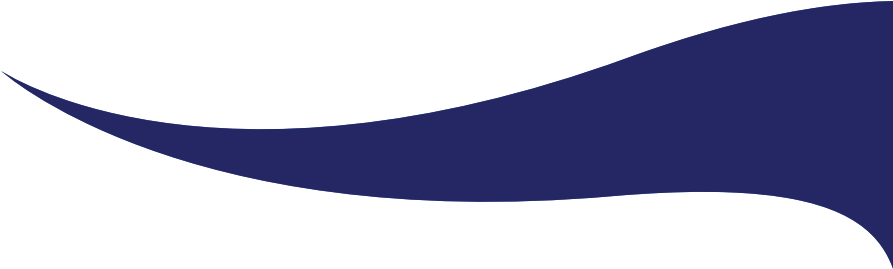
Pre-Sized. The packages are pre-sized for your benefit, offering the easiest solutions in selection.

Quality Product. HRSFUNKE Package solar systems are manufactured using the highest quality materials and are in accordance with all relevant laws and standards.

As a result of the 30 years of experience in exploiting solar energy, HRSFUNKE package systems can guarantee environmental protection and customer satisfaction for efficient and reliable solar systems.

STANDARD ACCESSORIES SUPPLIED WITH EACH HRSFUNKE PACKAGED SOLAR SYSTEM

<p>Circulation Pump is available in various standards twin type head or duty stand by assembly of cast iron or stainless steel depends on requirement</p>	
<p>Expansion Vessel Solar choice expansion vessel in different capacities as per the system design.</p>	
<p>HRSFUNKE Solar controller Differential controller with duty / stand by mode control for the solar pump.</p>	
<p>Air Cooler Air/Water heating cooler is available upon requirement for the over heating protection</p>	
<p>Solar Flow Control Valve, Air vent Standard flow control valve & air vent depends on requirement.</p>	
<p>Safety Valves- Security Valve, Pressure/Temperature Safety Valve Security value to protect system from high pressure and normally set at 6 bar. High pressure setting is also available depends on requirement</p>	
<p>Panel connector fittings Pressure/Temperature safety valve set at design pressure & 95 °C Protection from over heating & high pressure</p>	



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