

Views of the Factory

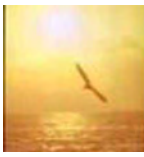
A look inside the main factory where solar heaters are manufactured, plus a sampling of various solar heaters produced.



Figure 1: Workers testing quality in solar water heater factory

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Seabird Solar
Solar Water
Heater Panels

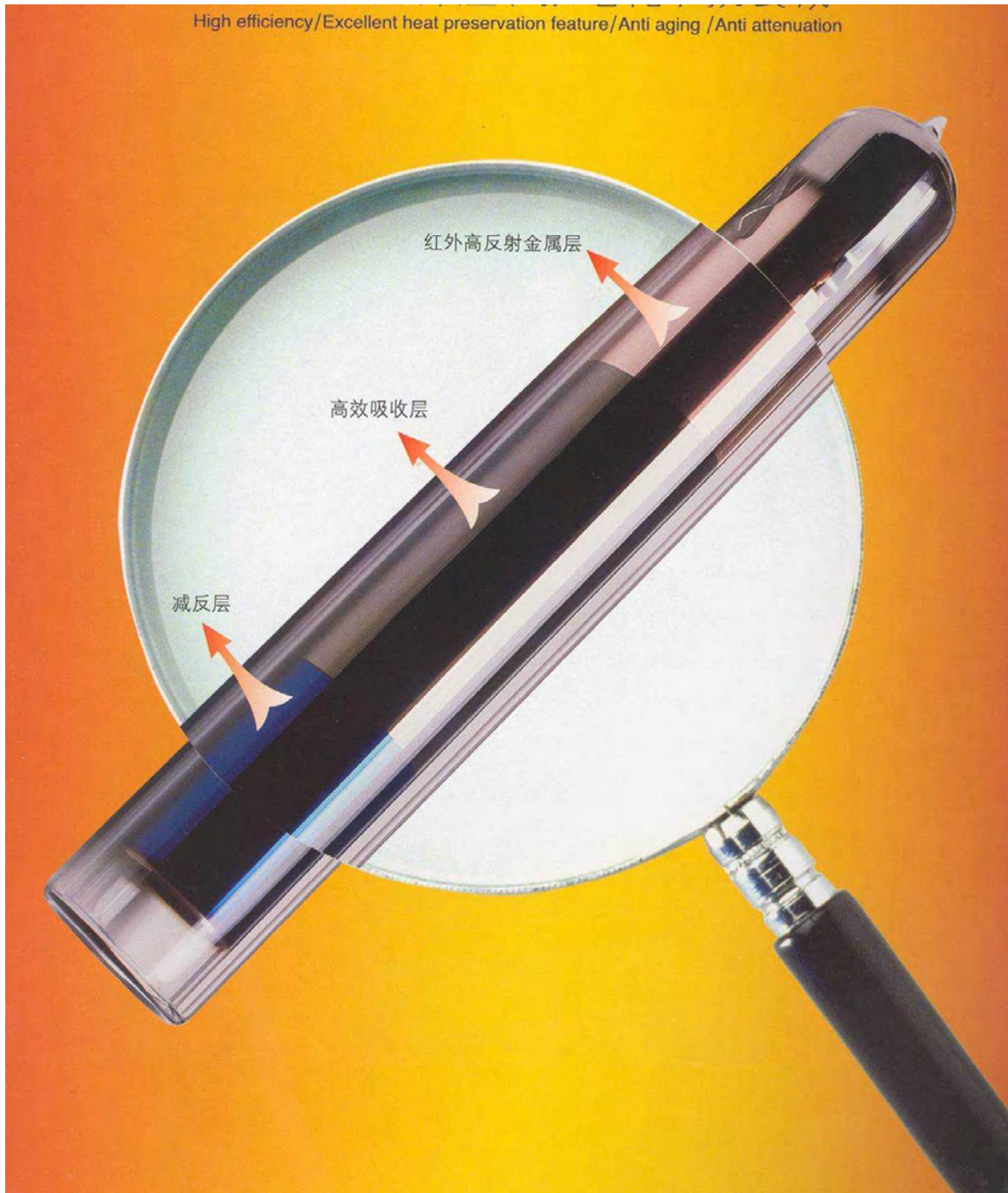
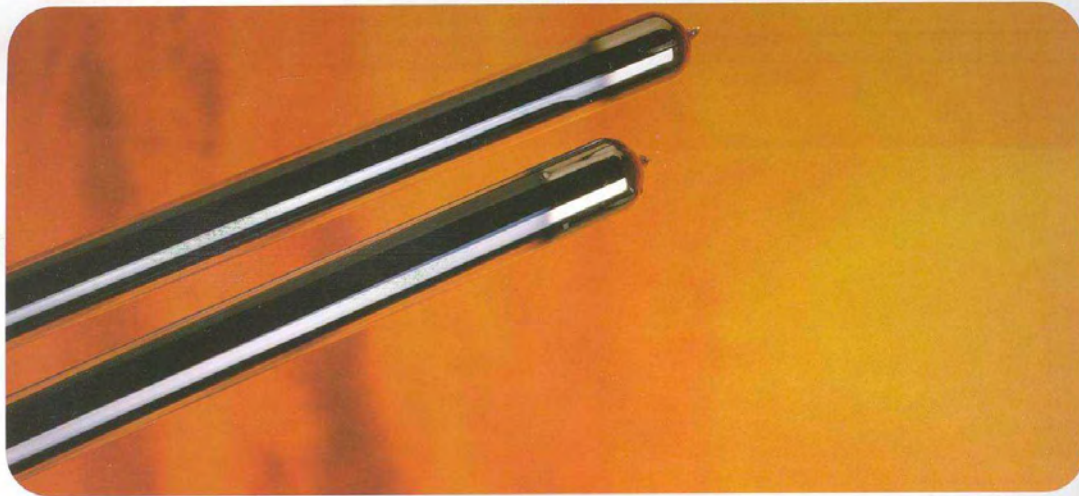


Figure 2: Expanded view of evacuated tube, showing outer tube, absorber, inner tube.

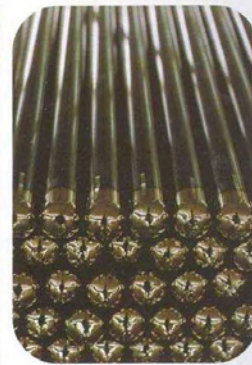


**Seabird Solar
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◆规格型号

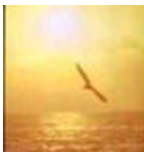
| 型号 | 外径/内径 (mm) | 长度 (mm) | 包装 |
|----|------------|---------|----|
| 1 | 58/47 | 2000 | 纸箱 |
| 2 | 58/47 | 1800 | 纸箱 |
| 3 | 58/47 | 1500 | 纸箱 |
| 4 | 47/37 | 1200 | 纸箱 |
| 5 | 47/37 | 1500 | 纸箱 |
| 6 | 47/37 | 1800 | 纸箱 |
| 7 | 47/37 | 1900 | 纸箱 |



◆Specification of all-glass evacuated solar collector tubes

| Model | Outer diameter/inner diameter (mm) | Length (mm) | Package |
|-------|------------------------------------|-------------|---------|
| 1 | 58/47 | 2000 | Carton |
| 2 | 58/47 | 1800 | Carton |
| 3 | 58/47 | 1500 | Carton |
| 4 | 47/37 | 1200 | Carton |
| 5 | 47/37 | 1500 | Carton |
| 6 | 47/37 | 1800 | Carton |
| 7 | 47/37 | 1900 | Carton |

Figure 3: Various kinds of evacuated tubes produced.



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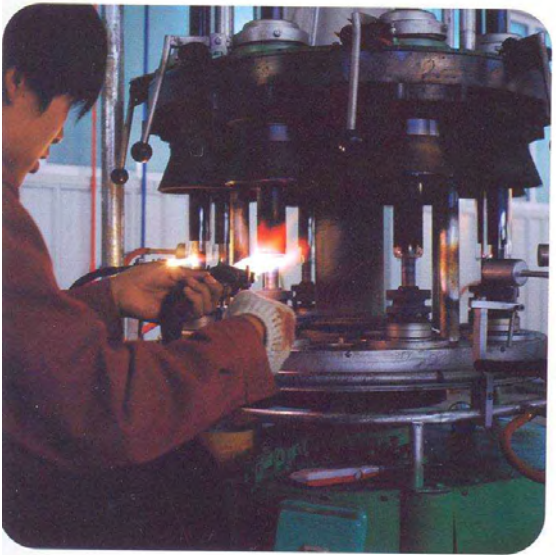
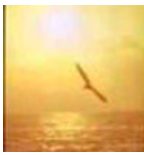


Figure 4: Workers and machines on the evacuated tube factory floor.



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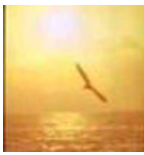
◆性能参数

| 名称 | 性能参数 |
|--------|------------------|
| 导热效率 | >99% |
| 轴向热通量 | 0.93-2.49千瓦/平方厘米 |
| 导热速度 | >200毫米/秒 (铜的千倍) |
| 轴向温差 | 1-2℃/米 |
| 启动温度 | 20℃ |
| 启动速度 | 2分钟 |
| 工作温度范围 | 30℃至300℃ |
| 寿命 | >10年 |

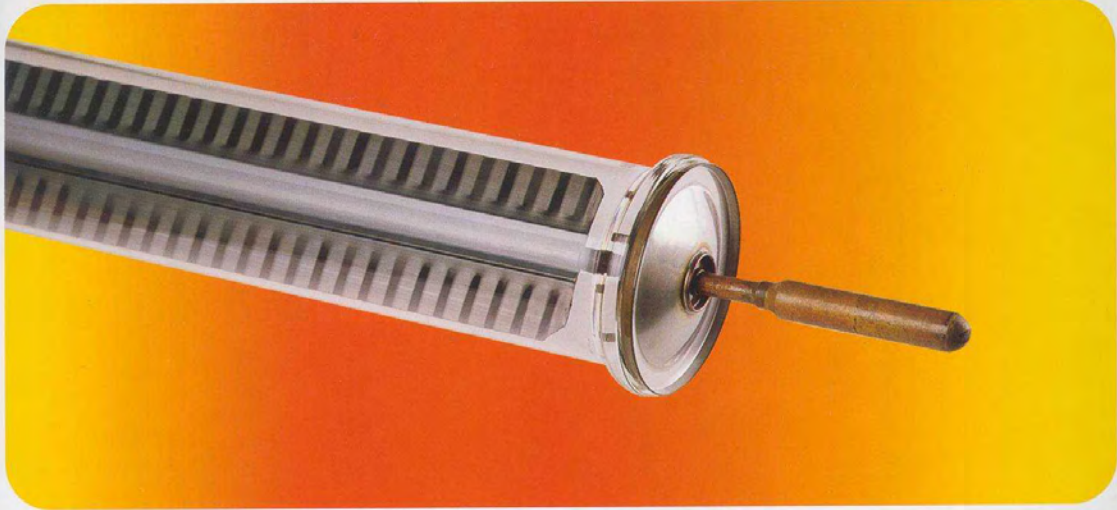
◆Performance parameter

| Item | Measured value |
|--------------------------------|-----------------------------|
| Heat conduction coefficient | >99% |
| Axial heat transition quantity | 0.93-2.49KW/CM ² |
| Heat conduction speed | 200mm/s |
| Axial temperature difference | 1-2℃/m |
| Starting temperature | 20℃ |
| Starting speed | 2 minutes |
| Working temperature range | 30℃-300℃ |
| Life | >10 year |

Figure 5: Various kinds of heat pipes produced.



**Seabird Solar
Solar Water
Heater Panels**



| 热管 | 重力超导热管 | 涂层吸收比 | $\alpha > 0.93$ |
|------|---------------------------|-------|--------------------------|
| 真空度 | 不低于 5×10^{-3} Pa | 发射比 | $\epsilon < 0.08$ |
| 抗风 | 30m/s (11级) | 耐冻性 | -50℃ |
| 寿命 | >10年 | 单管尺寸 | $\Phi 70 \times 1700$ mm |
| 玻璃管 | 高硼硅玻璃 | 吸热板 | 铝或钢材 |
| 空晒温度 | 250℃ | 启动温度 | <25℃ |
| 单管质量 | 2.2kg | 抗冰雹 | $\Phi 35$ mm |
| 输出功率 | 70 W | 冷凝端 | $\Phi 14 \times 75$ mm |



| Heat-tube | Gravity type ultra-conductive heat-tube | Coating Absorptance | $\alpha > 0.93$ |
|----------------------------|---|-----------------------------|--------------------------|
| Vacuum | Not below 5×10^{-3} Pa | Emittance | $\epsilon < 0.08$ |
| Wind resistance | 30m/s(scale 11) | Freezing resistance | -50℃ |
| Service life | >10 years | Dimensions of a single tube | $\Phi 70 \times 1700$ mm |
| Glass tube | High-boron silica glass | Heat-absorption sheet | Aluminum or steel |
| Air stagnation temperature | 250℃ | Start temperature | <25℃ |
| Mass of a single tube | 2.2kg | Hail resistance | $\Phi 35$ mm |
| Output power | 70 W | Condensation end | $\Phi 14 \times 75$ mm |

Figure 6: Example use of heat pipe and tube specifications



All-glass evacuated solar collector tubes

- ◎ 集热效率高：真空磁控溅射铝氮铝选择性吸收涂层，太阳光谱吸收比 ≥ 0.93 ，热发射率 $\leq 6\%$ ，热损小，保温效果较好。
- ◎ 耐候性好：全年热效率较好，并可抵抗直径小于25mm的冰雹正面冲击，承压能力：0.6 MPa。
- ◎ 寿命长：保证真空管15年的使用寿命。
- ◎ High heat-collecting efficiency: The vacuum magnetic-controlled sputtered aluminum-nitrogenaluminum selective absorption coating has a solar absorptance ≥ 0.93 , a heat emittance $\leq 6\%$, a low heat loss, and a good thermal-retention effect.
- ◎ Good weather-resistance: It has a good all-year thermal efficiency and is able to withstand the front impact by the hail of a diameter below 25mm and a pressure 0.6 MPa.
- ◎ Long service life: ensures a service life of 15 years for the evacuated tube.

◆性能参数

| 名称 | 性能参数 | 国标要求 |
|----------------|---|---|
| 太阳光谱选择性吸收涂层吸收比 | $\alpha \geq 0.931$ | $\alpha \geq 0.86(AM1.5)$ |
| 半球发射比 | $\varepsilon \leq 0.06$ | $\varepsilon \leq 0.09(80 \pm 5^\circ C)$ |
| 闷晒太阳曝辐量 | $H \leq 2.639 \text{ MJ/m}^2$ | $H \leq 3.8 \text{ MJ/m}^2$ |
| 空晒性能参数 | $Y \geq 240 \text{ m}^2 \cdot ^\circ C / \text{Kw}$ | $Y \geq 175 \text{ m}^2 \cdot ^\circ C / \text{Kw}$ |
| 平均热损系数 | $U_{Lr} \leq 0.78 \text{ W/m}^2 \cdot ^\circ C$ | $U_{Lr} \leq 0.90 \text{ W/m}^2 \cdot ^\circ C$ |

◆Properties of all-glass evacuated solar collector tubes

| Item | Measured value | Specification in Chinese state standard |
|---|---|---|
| Absorptance of the solar selective absorbing coatings | $\alpha \geq 0.931$ | $\alpha \geq 0.86(AM1.5)$ |
| Hemisphere emittance | $\varepsilon \leq 0.06$ | $\varepsilon \leq 0.09(80 \pm 5^\circ C)$ |
| Solar radiance exposure using sun as medium | $H \leq 2.639 \text{ MJ/m}^2$ | $H \leq 3.8 \text{ MJ/m}^2$ |
| Stagnation parameter using air as medium | $Y \geq 240 \text{ m}^2 \cdot ^\circ C / \text{Kw}$ | $Y \geq 175 \text{ m}^2 \cdot ^\circ C / \text{Kw}$ |
| Average heat loss coefficient | $U_{Lr} \leq 0.78 \text{ W/m}^2 \cdot ^\circ C$ | $U_{Lr} \leq 0.90 \text{ W/m}^2 \cdot ^\circ C$ |



All-glass evacuated solar collector tubes

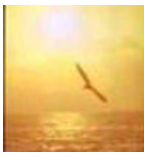
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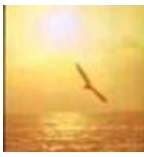
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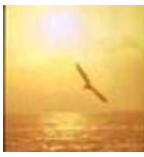
Three target vacuum pipe

- 采用全新干涉膜技术：采用铜靶、铝靶、钛靶三靶镀膜技术。
- 热效率更高：比普通真空管提高12%的吸热比。
- 抗老化、抗衰减：普通真空管在高温长时间空晒下(250℃左右)，会出现膜层老化、变色、性能衰减等问题。三靶真空管可经受高达400℃的高温，真空管使用寿命大大延长。
- 保温效果高：三靶真空管采用特有超纯铜镜面，零下30℃照样有热水使用，内管清洗、去气工序严格，真空层纯净、无杂质，真空度高且持久，在高温状态下使热量损失比普通真空管降低65%。不会出现真空管冻裂的现象。
- New intervene film technology: utilize copper, aluminum and titanium three target film technology.
- High heat efficiency: 12% higher than common vacuum pipe.
- Anti aging and attenuation: common vacuum pipe will be aged and attenuated in high temperature and shining condition (250℃). Three target vacuum pipe can bear 400℃, the life of the pipe is extended greatly.
- Excellent heat preservation feature: Three target vacuum pipe utilize super fine copper mirror, hot water is available in -30℃ condition. The inner pipe cleaning and gas discharge has strict procedure, vacuum layer is pure without impurity. Vacuum degree is high and heat loss is 65%. less than common vacuum pipe, frost crack will never happen.



heat-tube evacuated sola collector tubes

- ◎ 热管是在全玻璃真空集热管基础上研制成功的，是将热管技术、镀膜技术及真空技术综合应用在太阳能利用领域的新产品。
- ◎ 热效率高，其闷晒温度可达250℃，因而除用于热水器和开水器外，还广泛用于集体及家庭供热、制冷空调、农业养殖、海水淡化、游泳池增温等领域。
- ◎ 热管应用了高效导热的热管式管芯，铝成型吸热板，高硼硅玻璃，磁控溅射选择性吸收涂层，金属玻璃中温热压封接。
- ◎ 热管传热管内不进水，从根本上避免了真空管内因结水垢而引起水道堵塞和影响输出功率等问题。
- ◎ 特殊防冻技术，即便在-50℃的严寒气候下，仍无冻坏之忧。热管式集热管热容小，启动快，在阳光下2分钟即可启动输出能量。
- ◎ 高性能选择性吸收涂层及真空保温技术，在多云天气和冬天，日平均热效率仍可达48%以上。
- ◎ 抗风，抗冰雹冲击性能优良，能抵抗台风及直径35mm以下冰雹的冲击。
- ◎ 承受力强，当连接成大面积集热系统时，能随循环泵的压力而在承压热水系统推广中独具优势，抗冷热冲击好。完全避免了损坏一支集热管而造成整个系统不能运行的问题。安装维修简单，易于固定，风阻小，可抗台风，运行安全可靠。
- ◎ The heat tube developed on basis of the all-glass evacuated solar collector tube is a new product in solar utilization field, Which integrally uses the heat-tube technology, coating technology and vacuum technology.
- ◎ Because of the high thermal efficiency and a sunning stagnation up to 250℃, besides in water heater and water boiler, it is widely used in collective and household heat-supply, cooling, air conditioning, agricultural culture, sea water desalting, and warming of swimming pool.
- ◎ In the heat-tube the high heat-conductive heat-tube type core, shaped aluminum heat-absorbing sheet, high-B-Si glass, magnetic-controlled sputtered selective absorption coating and medium-temperature hot press and sealing of metal-glass are adopted.
- ◎ No water enters the heat-transfer tube and thus blocking of water passage and in turn impair of the output power resulted from scale in the vacuum tube are basically eliminated.
- ◎ The used special freezing-protection technology prevents the heat-tube from being frozen even under-50℃ air temperature. The heat-tube type collector tube is low in heat capacity and fast in start, and under sunshine it can start to output energy in 2 minutes.
- ◎ The superior selective absorption coating and the vacuum thermal-insulating technology ensure a daily mean thermal efficiency above 48% even at cloudy climate or winter.
- ◎ It has excellent wind-resistance and hail-resistance and withstands the impact by typhoon and hail of a diameter up to 35mm.
- ◎ Because of its high bearing capacity, when connected into a large-surface heat-collection system, it has unique advantages in the pressurized hot water system varying with the pressure of circulation pump and is highly resistant to both the cold and the heat impact. Thereby, the trouble that the entire system is impossible to run because of damage of a single collector tube is eliminated. It is easy and simple in installation, maintenance and fixation, safe and reliable in running, low in wind resistance, and highly resistant to typhoon.



Super Heat Pipe

金属热管的热量从一端传到另一端，利用管内汽液相变来传递热量，温差很小，传温过程接近等温。因它传热能量大，传热效率高，所以广泛应用于太阳能行业。

The heat conduction through the pipe is by the way of exchange of liquid and gas. The temperature difference is very low. Because of its high heat conduction feature and efficiency, the pipe is used popularly in solar industry.

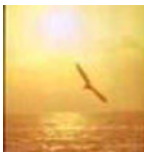
- ① 传递系数高：其导热系数是金属材料的2000-5000倍。
- ① 传递热量大：是良好金属导体的近千倍。
- ① 等温性能好：2米长的金属热管，管内蒸汽温度差不超过4℃。
- ① High heat conduction coefficient: is 2000 ~5000 times of metal materials.
- ① High quantity of heat conduction: is 1000 times of metal materials.
- ① Low temperature difference: less than 4℃ difference in 2 meter long pipe.

◆规格型号

| 产品名称 | 型号 | 型号 |
|------|-------|-------|
| 水平热管 | Φ14mm | |
| 重力热管 | Φ24mm | Φ14mm |

◆Specifications

| Product | Type | Type |
|-----------------|-------|-------|
| Horizontal pipe | Φ14mm | |
| Gravity pipe | Φ24mm | Φ14mm |



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Figure 7: Stacking tubes for shipment