

CanSIA

Canadian Directory of Solar Water Heating Products

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Notice to Reader

Acceptance into the Directory indicates only that the described products have been evaluated based on stated guidelines. Although CanSIA believes that all reasonable efforts have been made to ensure the adequacy and appropriateness of the guidelines, CanSIA does not warrant or guarantee the completeness or appropriateness of these guidelines. Neither CanSIA nor the STPAC is to be held responsible for the performance or failure of any component or system as installed or for any consequential damages to persons or property as a result of the installation of any component or system listed in this Directory.

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1. Using the Directory

Introduction

The Canadian Directory of Solar Hot Water Products provides a listing of key technical, operational and performance specifications of solar hot water products based on CSA and international standards.

A directory of accepted products provides a valuable tool for increasing the use of solar technologies for water heating. The Canadian solar industry and the federal government worked in partnership to produce regularly updated Directories from 1978 to 1986 (editions 1 –29). Edition 30, published in March 2007 is the first Canadian Directory since that time.

The Directory's aim is to make the selection process for solar water heating products simpler for:

- Government agencies that require a process to pre-qualify acceptable products for participation in support programs;
- Firms and agencies that plan to tender the selection of a solar water heating system;
- Homeowners and buyer groups who wish to pre-select qualified products for purchasing.

Currently in Canada there is limited ability for solar product manufacturers or suppliers to have their products certified due to the lack of current and appropriate Canadian standards and the lack of approved testing agencies that can certify to Canadian solar water heating standards.

This directory lists all products that are currently accepted by Canadian Solar Industries Association (CanSIA) on the basis of recommendations of the Solar Thermal Products Acceptance Committee (STPAC).

STPAC is an independent committee consisting of knowledgeable stakeholders from industry, governments and academia. Members of STPAC are approved by the board of CanSIA upon recommendation of NRCan and the CSA Renewable Energy Standards Standing Committee.

The general guidelines for acceptance into the Directory are as follows:

Solar Hot Water Collectors – those products that have gone through an independent review by NRCan and are qualified to receive support under the ecoEnergy Renewable Heat Program (previously the Renewable Energy Deployment Initiative). These products must have gone through independent testing to conform to *CAN/CSA F378-1987 – Solar Collectors* or an equivalent international standard.

Packaged Solar Domestic Hot Water Systems – those products that have been tested to *CAN/CSA-F379.1 Packaged Solar Domestic Hot Water Systems* or have been submitted to Natural Resources Canada (NRCan) for funding to be certified to *CAN/CSA-F379.1 (R2004)*.

Acceptance into the Directory indicates only that the described products have been evaluated based on the above guidelines. Although CanSIA believes that all reasonable efforts have been made to ensure the adequacy and appropriateness of the guidelines, CanSIA does not warrant or guarantee the completeness or appropriateness of these guidelines. Neither CanSIA nor the STPAC are to be held responsible for the performance or failure of any component or system as installed or for any consequential damages to persons or property as a result of the installation of any component or system listed in the Directory.

This Directory is broken into four main sections:

1. Introduction and an explanation on how to use the Product Data Sheets
2. Solar Water Heating In Canada – information on issues that affect the installation of solar water heating products
3. Directory of Solar Hot Water Collectors
4. Directory of Packaged Solar Domestic Hot Water (SDHW) Systems.

Process for Getting Products Listed in the Directory

The directory is published on a semi-annual basis and manufacturers and suppliers are encouraged to submit their products for consideration by the STPAC. Note that future directories will only be listing those products that are certified to CSA standards once various CSA certification processes are in place.

Interested suppliers should contact CanSIA to obtain information on how to submit products for inclusion in the Directory.

Listing in this directory is voluntary and does not imply an endorsement of products by CanSIA.

International Directories of Solar Thermal Products

Other countries have similar directories of solar thermal products that have been tested and certified to national standards.

USA

1. Solar Rating and Certification Corporation (SRCC)

The Solar Rating and Certification Corporation currently administer a certification, rating, and labeling program for solar collectors and a similar program for complete solar water and swimming pool heating systems.

www.solar-rating.org/

2. Florida Solar Energy Center

In accordance with Florida Law, the Florida Solar Energy Center is responsible for the testing of solar thermal products that are sold in the state of Florida.

www.fsec.ucf.edu/en/industry/testing/index.htm

Europe

Solar Keymark

The Keymark is a voluntary third-party European certification mark, demonstrating to the consumer or user of a product that it is in conformity with the relevant European Standard(s).

www.estif.org/solarkeymark/

How to Use the Product Data Sheets

The Directory provides detailed information on solar hot water collectors and packaged solar domestic hot water systems in the *Product Data Sheets*.

The Product Data Sheets and the associated listings provide the following types of information on the products:

- The manufacturer and Canadian suppliers
- The warranty and information on the experience of the manufacturer and Canadian supplier
- The type of product or system and its general application
- The technical specifications of the product (i.e. weight and dimensions)
- The operating characteristics of the product (i.e. flow rate and stagnation temperature)
- The energy performance (both absolute and relative to other comparable products)

Products certified to a solar “Standard” undergo an evaluation of generally three criteria:

- Safety
- Durability and reliability
- Energy performance

Canadian Standards for solar collectors and systems cover all three criteria. For safety and durability, acceptance is usually based on a straight pass-or-fail result. Products must meet a certain level of safety or durability (i.e. they pass the appropriate tests) or the product cannot be certified to the standard. On the other hand, testing of energy performance yields a set of values for the product for which there is no simple pass-or-fail result.

Further, while solar certification requires that the solar product be labeled to indicate that it is certified to the standard – giving assurance on safety and durability – there is no requirement to provide information on the energy performance of the product.

Thus one of the primary purposes of the Product Data Sheets is to provide information on the performance of the solar product in absolute terms and to provide a way to compare the relative performance of the product to other products.

However performance listings should not be used to estimate the actual performance that can be expected from a given product once it is installed. This is because solar products are tested under “standard” conditions simulated in the testing laboratory, which are different from variable “real world” conditions. The performance ratings are similar to the gas consumption ratings for cars or the EnerGuide ratings of appliances – they provide a benchmark for comparisons although the same performance may not be achieved in operating systems.

Site conditions that will affect the performance of a solar water heating system includes:

- Direction and tilt of the solar collectors;
- Shading on the solar collectors from topographic features and miscellaneous coverage (i.e. leaves, dirt and snow);
- Local weather conditions (amount of sunshine (dependent on location and time of year) and intensity – due to moisture content in the air);
- Method of operation – generally, using the heat from the solar collectors when it is collecting it will increase the solar product’s performance as its heat transfer fluid will operate at a cooler temperature which increases the product’s efficiency.

One of the primary reasons why a solar professional should install solar heating products is that the system performance is very dependent on proper installation. A proper installation can significantly increase the product’s energy production. Information on certified solar installers can be found in Section 2 of the Directory.

Product performance is only one criterion in choosing a solar energy system. Quality of installation, availability of service and parts, warranty, aesthetics, and the expected life of the system are other criteria that are also important.

How to Use the Solar Hot Water Collectors Data Sheets

This section provides information on the specific listings in the Data Sheets. Product Data Sheets are only included in the directory if the supplier has completed and submitted a Directory application form. Listing of products in the Directory is voluntary.

General Information

The manufacturer and Canadian suppliers are listed in the Collector data sheets. Full contact details can be found in the listing of collector supplier contacts. To be listed as a Canadian supplier of a foreign manufacturer it is necessary for the firm to supply proof that they are an approved agent of the manufacturer.

The warranty line provides details on the length of the warranty as well as any limitations to the warranty. The date that the product was first listed in the Directory as well as the date that the product was tested or certified provides information on how long the product has been on the market.

Collector Specifications & Materials

This section of the Data Sheet provides information on the physical characteristics of the solar collector as well as information on acceptable heat transfer fluids and the heat transfer fluid's flow rates. This section provides useful information when designing the installation of a solar hot water system.

The collector diagram shows the major components of the solar collector.

Energy Performance

This section will only be completed if the product has gone through independent testing to an acceptable solar collector standard and has been approved by NRCan for inclusion in the ecoEnergy Renewable Heat Program. The supplier must supply to STPAC the test report to have the product's performance listed.

Incident Angle Modifier

The ability of a solar collector to capture solar radiation varies with the angle that the sun strikes the collector. This variation from what is expected is used to calculate the "Incident Angle Modifier". It is measured from 0° to 90° both vertically and horizontally across the face of the collector. The values are reported as a percentage of the expected collector performance. Reasons for these performance variations include: collector frame shading the absorber and increased reflection/refraction from the glazing and absorber at higher angles of incident radiation. Special "solar glass" as well as absorber plate "granulation" can increase the capture rate at high incident angles.

For flat-plate collectors the incident angle modifier always represents a decrease in collector performance. For evacuated tube collectors with tubular absorbers it often provides a small increase in performance.

Power (kW) Factor Rating

Power rating provides a comparison of the instantaneous outputs of the solar collector. It is also useful in providing a mechanism to calculate financial support for agencies interested in supporting the deployment of solar hot water systems as the power rating provides a rating similar to other energy sources such as wind generators and PV modules.

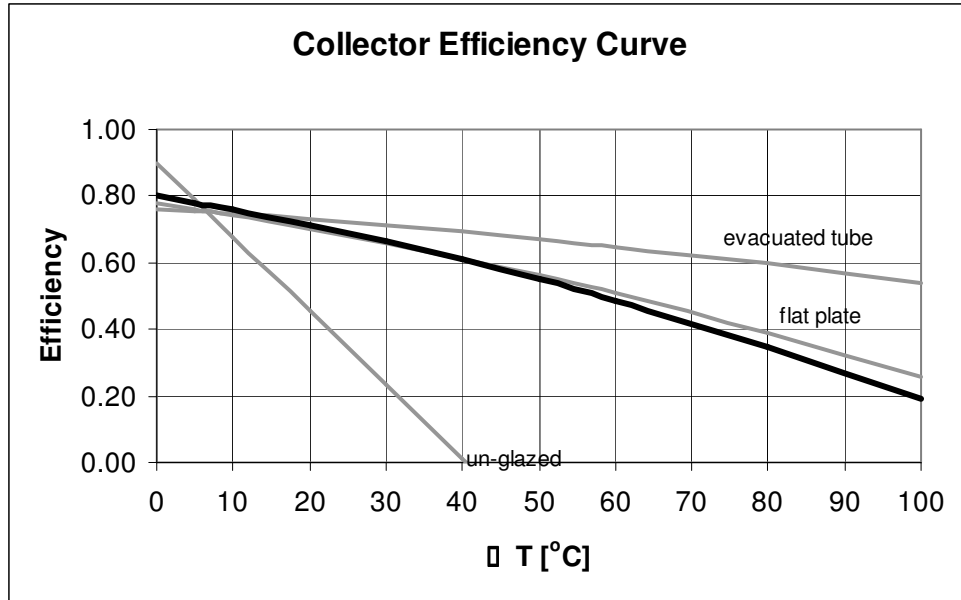
The Power Rating is the collector's efficiency (for the gross collector area) at a set temperature differential (between the fluid and the air) defined by the collector type multiplied by the solar radiation standard (1000 W/m²)

Two power ratings are given – one for kW per m² and one for the entire collector power (using gross collector area).

Comparative Efficiency Curve

The efficiency curve includes reference curves for typical performance of three classes of collectors. Only the reference curve for the type of collector (evacuated tube, glazed flat plate, unglazed flat plate) in the Data Sheet is included.

The reference curve allows the reader to make an easier comparison of different models of solar collectors. However it must be understood that the reference curve should not be used to judge whether the collector has a better or worse performance than the average collector.



Collector Performance Rating

The collector performance rating provides a means of comparing energy output between collectors for different operating conditions. Four ΔT s (the difference between ambient air temperature and the heat transfer fluid temperature) conditions are used.

- 5°C – swimming pools
- 20°C – domestic hot water (summer)
- 50°C – domestic hot water (winter)
- 80°C – process heat and refrigeration

For unglazed collectors, wind speed can affect the performance considerably so the collector performance was done using a set temperature (5°C) but with 3 wind speeds (0, 2.5, 5.0 m/sec).

The performance data will seem low compared to the expected daily output on a sunny day because the calculations use the CSA F39 standard day, which has a peak solar irradiance of only 768 W/m² and a total daily solar energy of only 12.5 MJ/m². A “sunny” day is typically one with more than 17 MJ/m² and solar irradiance of 1,000 W/m² - locations in southern Canada can easily get days with over 25 MJ/m².

The collector performance rating is not an actual energy output for a specific site, as there are many site-specific variables (including amount and hours of solar radiation). It is a rating system that allows for comparison between different collectors.

How to Use the Solar DHW System Data Sheets

This section provides information on the specific listings in the Data Sheets. Product Data Sheets are only included in the directory if the supplier has completed and submitted a Directory application form. Listing of products in the Directory is voluntary.

General Information

The manufacturer and Canadian suppliers are listed in the Solar Domestic Hot Water System Data Sheets. Full contact details can be found in the listing of collector supplier contacts. To be listed as a Canadian supplier of a foreign manufacturer it is necessary for the firm to supply proof that they are an approved agent of the manufacturer.

The system type and collector type are listed to provide information on the basic system configuration.

The warranty line provides details on the length of the warranty as well as any limitations to the warranty. The date that the product was first listed in the Directory as well as the date that the product was tested or certified provides information on how long the product has been on the market.

System Component Specifications

This section of the Data Sheets provides details of individual components of the system including:

- Solar collectors – collectors must be listed in the Directory of Solar Hot Water Collectors for the system to be listed here
- Piping – including recommended material and pipe insulation as well as the maximum distance between the collectors and the storage tank.
- Storage Tank – including the size and whether or not the tank is included with the system and information on the make and model of approved tanks.
- Pump – including the type of pump and estimated energy consumption (parasitic load) if the pump consumes utility supplied electricity.

Performance Data

System Power Rating

This rating is the Power Rating of the individual collectors multiplied by the number of collectors in the system.

Performance Rating

There are three basic classifications of SDHW systems according to their use of auxiliary energy sources:

- Solar Preheat System. A Solar preheat system is a system designed to provide solar heated water directly to a dedicated hot water tank which in turn is fed into the auxiliary heated water tank.
- Solar Plus Supplemental System. A solar plus supplemental system is a system designed to provide domestic hot water into a single storage tank, which is heated, by both solar energy and an auxiliary energy source.
- Solar Only System. A solar only system is designed to provide solar-heated domestic water with an auxiliary energy source.

The performance rating is done under 3 different hot water loads where 150/225/300 litres of hot water are drawn off the system each day.

Product Cost Evaluation

One of the main criteria in the purchasing a solar water heating product is which provides the most energy for the least cost. There are a number of methodologies that can evaluate the cost of the product.

Solar Hot Water Collectors

The first method is to divide the system cost by the Standard Day Performance Rating (for the temperature conditions that the collector will be used for).

<i>Cost Rating (Standard Day) (\$/kWh) =</i>	<i>Cost of Solar Hot Water Collector</i>
	<i>Collector Performance Rating (at selected temperature)</i>

However this does not take into account the longevity of the collectors. While the warranty period does not necessarily equate to product life, it can be an effective method to evaluate the relative cost of different products.

<i>Cost Rating (Warranty Period)(\$/kWh) =</i>	<u><i>Cost of Solar Hot Water Collector</i></u>
	<i>Collector Performance Rating (at selected temperature) X Warranty Period (years)</i>

Finally, to provide a comparison of the life cycle costing of the collector it is possible to take the Cost Rating (Standard Day) and divide this by the estimated life expectancy of the collector. Typical life expectancy of solar hot water collectors is 20-25 years.

<i>Cost Rating (Life Cycle Cost) (\$/kWh) =</i>	<u><i>Cost Rating (Standard Day)</i></u>
	<i>365 X Expected Life (20-25 years)</i>

Solar Domestic Hot Water Systems

Similar calculations can be made for SDHW Systems except that the annual rating (kWh/year) for the hot water load is selected.

<i>Cost Rating (Standard Day) (\$/kWh) =</i>	<u><i>Cost of SDHW System</i></u>
	<i>System Performance Rating (at selected hot water load)</i>

<i>Cost Rating (Warranty Period)(\$/kWh) =</i>	<u><i>Cost of SDHW System</i></u>
	<i>System Performance Rating (at selected hot water load) X Warranty Period (years)</i>

<i>Cost Rating (Life Cycle Cost) (\$/kWh) =</i>	<u><i>Cost Rating (Standard Day)</i></u>
	<i>Expected Life (20-25 years)</i>

2. Solar Water Heating In Canada

This section of the Directory includes information on the various issues that relate to the installation of solar water heaters in Canada.

Detailed information on solar hot water collectors and residential water heating systems can be found on CanSIA's website and in two of CanSIA's publications:

- STT100 – Solar Domestic Hot Water Installation - Fundamentals
- STT200 – Solar Domestic Hot Water Installation – Design, Installation & Maintenance

Both can be ordered directly from CanSIA.

Solar Product Standards

CSA Standards for Solar Hot Water Heating

Currently there are three standards that are explicitly for solar water heating products:

- CAN/CSA-F378-87 Solar Collectors
- CAN/CSA-F379.1 (2005) Packaged Solar Domestic Hot Water Systems
- CAN/CSA-F383-87 Installation Code for Solar Domestic Hot Water Systems

To order copies of the CSA Standards for solar hot water products visit CSA's online store at <http://www.csa-intl.org/onlinestore/GetCatalogDrillDown.asp>. The solar standards can be found in the Energy Section under renewable energy.

CAN/CSA-F378-87 Solar Collectors

F-378 is only for solar collectors that produce heat. Solar "modules" that produce electricity directly are not covered under this standard. This standard was last updated in 1987 and there are no testing laboratories that are currently certified to test products to it.

A project to develop an updated edition of CSA F378 has been underway since September 2005. The intent of the new edition is to harmonize with international standards for solar collectors and to expand the scope to cover additional collector types. There is also discussion on withdrawing F378 and adopting an international standard such as ISO-9806 or EN-12975. A comparison of key features of F378 to international standards can be found in Appendix B.

CAN/CSA-F379.1 (2005) Packaged Solar Domestic Hot Water Systems

F379.1 is only for packaged systems designed for single-family dwellings. It has recently been updated in 2006 and the National Solar Test Facility (NSTF) operated by Bodycote Materials Testing Canada Inc. in Mississauga, Ontario is certified by the Canadian Standards Association - International (CSA-I) to certify systems to this standard.

Natural Resources Canada, working in conjunction with CanSIA, is offering a support program to assist in the certification of SDHW systems to CSA F379.1. Further details on this program can be obtained directly from NRCan.

This standard has been mis-referenced in the National Plumbing Code – see the next section for further details.

CAN/CSA-F383-87 Installation Code for Solar Domestic Hot Water Systems

F383 is only for the installation of packaged systems for single-family dwellings and is intrinsically linked to F379.1. The current standard was done in 1987 and is in the process of being updated. The new standard may be available in 2008-2009.

Canadian Standards for SDHW System Components

There are a number of standards that relate to components used in SDHW systems. A listing of these standards can be found in Appendix C.

Development of New Standards for Solar Water Heating Products

Various stakeholders have identified the need to develop two new Canadian Standards for specific solar water heating products. Normally the cost of developing standards is borne by the industry with governments providing assistance when it is deemed in the public interest.

Proposed CSA-F383.2 Design & Installation Guide for Non-Packaged Solar Water Heating Systems.

This will meet the need of commercial and custom designed solar water heating systems. No timeline has been identified to develop this standard.

Standard for (Single Walled) Potable Water Heat Exchangers

Currently there is no standard for potable water heat exchangers and there is a recognized need for standalone standards/certification of Heat Exchangers to be used in potable water systems, in particular single-walled heat exchangers that use glycol or similar heat transfer fluids. These standards/certification could be used for non-packaged Solar Hot Water, Hydronic Systems, Ground Source heat pumps and the range of associated hybrid systems. Discussions of this proposed Standard are only at the preliminary stage.

Solar Water Heating in Canadian Building Codes

The use of Solar Domestic Hot Water Heating Systems is referenced in the 1995 National Plumbing Code (NPC), which is the current version in sections 2.10.13 and 6.1.8.

2.10.13 Solar Domestic Hot Water

(1) Equipment for solar heating of potable water shall conform to CAN/CSA-F379.1, Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)

6.1.15. Solar Domestic Hot Water Systems

Systems for solar heating of potable water shall be installed in conformance with CAN/CSA-F383, Installation Code for Solar Domestic Hot Water Systems

Currently the National Plumbing Code (and the related provincial building codes) misreferences the CSA F379 standard as it implies that all solar hot water systems must comply with a standard designed for packaged domestic systems. In 2005, a request to review this issue was made to the Canadian Code Centre of the Institute for Research in Construction. The Canadian Code Centre assists in the preparation of the National Building Code and the National Plumbing Code (NPC).

Their review identified the following:

1. The NPC does not require certification of solar systems that heat potable water (but notes that certification simplifies the inspector's job, by confirming code compliance).
2. The certification of installers is outside of the jurisdiction of the NPC (therefore, certification of installers must not be required by the NPC).
3. The intent of the NPC references to solar water heating systems was to ensure that "any potable water

heating solar system must conform to F379.1 and be installed in conformance with F383", however this puts custom and larger systems in an impossible situation since it requires that they meet F379.1 while they are excluded from the F379.1 scope. Since the intent of the NPC requirements is to ensure the integrity of the potable water system and avoid contamination, then in this situation such systems could be accepted under the NPC "equivalents" provisions.

Changes to the National Plumbing Code

In 2006, CanSIA submitted a request to change the National Plumbing Code to read as follow:

2.10.13. Solar Domestic Hot Water

1) Equipment for solar heating of potable water shall conform to CAN/CSA-F379.1 "Packaged Domestic Solar Hot Water Systems (Liquid to Liquid Heat Transfer)."

6.1.8 Solar Domestic Hot Water Systems

1) Packaged Domestic Solar Hot Water Systems used for heating of potable water shall be installed in conformance with CAN/CSA-F383, "Installation Code for Solar Domestic Hot Water Systems."

The request for change was turned down. The reason given was that CSA F379.1 was in the process of being revised.

Provincial Building Codes

The NPC is often adopted by the provinces or is used as the reference document for provincial codes. The wording in the Ontario Building Code on solar water heating is the same as the National Plumbing Code. In 2006, CanSIA and CSA made a submission to the Ontario Ministry of Municipal Affairs and Housing for changes in the referencing of the Ontario Building Code.

This request was approved. The Ontario Building Code now reads:

Division B, 7.2.10.13. Solar Domestic Hot Water

(1) Equipment forming part of a packaged system for solar heating of potable water shall conform to CAN/CSA-F379.1,

Division B, 7.6.1.15. Solar Domestic Hot Water Systems

(1) Except as provided in Sentence (2), a system for solar heating of potable water shall be installed in accordance with good engineering practice.

(2) Packaged systems for solar heating of potable water in residential occupancies shall be installed in conformance with CAN/CSA-F383.

The Inspection of Solar Water Heating Systems

CanSIA works closely with Plumbing Inspectors from many jurisdictions across Canada in resolving concerns on the installation of Solar Heating systems. Specific information for plumbing inspectors can be found below:

Permitting of Non-Packaged Solar Domestic Hot Water Systems

CSA F379 is only for packaged SDHW systems. These systems are residential hot water heating systems that come complete in one package with all components from a single supplier. However there are many applications where packaged systems are not applicable such as multi family units and combi (space and water) heating systems. Solar DHW systems can be custom designed for heating hot water and for specific customer requirements.

Custom residential SDHW systems (which include commercial SDHW systems) also do not fall under the jurisdiction of CSA F379, creating a gap in the regulatory means for installing them. However such systems are acceptable in the National Plumbing Code under the National Plumbing Code's "equivalency" provisions.

A solution to insure code and safety compliance for custom, non-packaged SDHW systems is to have an independent, licensed Professional Engineer approve the design of the SDHW system. This is the same process used to insure code and safety compliance for many other building systems such as swimming pools.

CanSIA has developed specific instructions to licensed Professional Engineers, regarding this issue. The intent is to ensure that licensed engineers are aware of the safety requirements for SDHW systems and to ensure that these requirements form part of the approved product/installation plan used by building departments. This document can be found in Appendix D.

Municipal Approval for the Installation of Solar Hot Water Systems

As the use of solar for heating water increases in Canada, various stakeholders have expressed issues related to the safety of the solar systems. Many of these issues relate to unfamiliarity with the technology and are usually overcome when the correct information is provided.

The City of Ottawa has taken a pro-active stance in providing direction to the building department on the requirements for permitting and inspecting solar water heating systems. The City of Ottawa's Guidelines for the approval for installation of solar domestic hot water systems can be found in Appendix E.

Solar Hot Water Installer Certification

CanSIA offers the **Canadian Solar Hot Water System Installer Certification Program**. The level 1 certificate is for the installation of solar domestic hot water systems for single-family residential applications. This certificate grants recognition to an individual who has met predetermined qualifications as set out by CanSIA and met the skill requirements to install SDHW systems according to CSA F383-87 Installation Code for Solar Domestic Hot Water Systems. CanSIA offers regular training workshops across Canada for solar installers. CanSIA also administers the certification exam for the installer certification as well as accredits education institutes who offer courses on the installation of Solar DHW systems.

Information on the Canadian Solar Hot Water System Installer Certification program can be found at www.cansia.ca/certification.asp.

Information on CanSIA workshops (and registration) as well as accredited training programs in Canada can be found at www.cansia.ca/education.asp

The two course manuals for the installer certification program are:

- STT100: Solar Domestic Hot Water Installation – Fundamentals;
- STT200: Solar Domestic Hot Water Installation – Design, Installation & Maintenance

These manuals can be ordered directly from CanSIA through the solar store page of the website at www.cansia.ca/solarstore.asp

A listing of companies that employ certified Canadian Solar Hot Water Installers can be found on the Canadian Solar Industry Directory at www.cansia.ca/directory/

Product Performance Evaluation

This section provides an expanded explanation on how the performance characteristics of solar water heating products was developed in the Directory

Solar Hot Water Collectors

Power Factor Rating

In 2004, the International Energy Agency and various national trade associations (including CanSIA) adopted a methodology to report solar thermal deployment levels in kW (previously this was reported in gross installed area). This allows for a comparison to other sources of energy generation (such as wind and PV). A standard 0.7 kW per m² was accepted. This report can be found in Appendix F.

However individual solar collectors will have different power ratings dependent on the efficiency curve and the temperature difference between the surrounding air and the heat transfer fluid (often referred to as the “delta T” – or ΔT). In order to determine the power rating the following typical operation conditions are assumed:

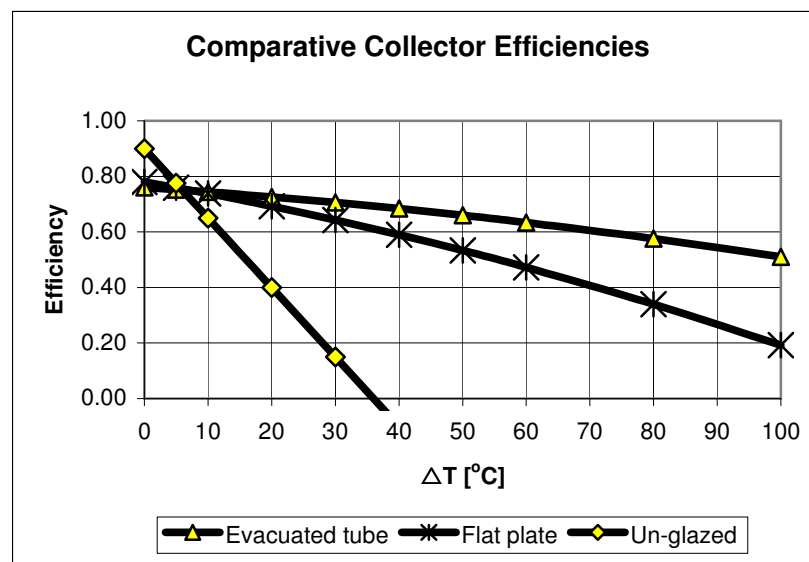
	Radiation	ΔT	Wind speed
1. Unglazed flat plate collectors	1000 W/m ²	10°C	1.5 m/s
2. Glazed flat plate collectors	1000 W/m ²	20°C	-
3. Evacuated tube collectors	1000 W/m ²	20°C	-

Solar Collector Efficiency Curve

One of the most commonly used methods to compare solar collectors is through the comparison of the efficiency curves.

The performance of solar hot water collectors is affected by a number of variables including the amount of sunlight falling on them, weather conditions (clear or cloudy), wind speed (important for unglazed collectors – see below), etc. However one of the most important variables that affect the efficiency is the difference between the surrounding air temperature surrounding the collectors and the fluid temperature. This difference is often referred to as the “delta T” – or ΔT .

Different types of collectors work better in different applications. For example an unglazed collector works very well where there is little ΔT (such as for swimming pools) while evacuated tube collectors perform better in high ΔT conditions (such as for water heating during the winter). The following chart provides comparative collector efficiencies of the different types of collectors



Collector Performance Ratings

Collector performance ratings are done for a "Standard" Day as referenced in CSA-F378. As wind speed can greatly affect the performance of unglazed collectors, the performance is done over 3 wind speeds that are found typically at close to ground levels.

For glazed collectors, the Performance Equation is of the form

$$q(h)_g = A \cdot G(K_{\tau\alpha})_{global} - C(\Delta T_{ia}) - E(\Delta T_{ia})^2$$

For unglazed collectors, the Performance Equation is of the form

$$q(h)_{ug} = (A - B \cdot V_{wind}) \cdot G(K_{\tau\alpha})_{global} - (C + D \cdot V_{wind})(\Delta T_{ia})$$

Where:

$q(h)$ [W/m²] is the Energy Collected during Hour h ,

$Q(h)$ [kWh/m²] is the Power Collected during Hour h ,

$G(K_{\tau\alpha})_{global}$ [W/m²] is the Incident Radiation,

ΔT_{ia} [°C] is the Temperature Differential ($T_i - T_a$),

T_i [°C] is Inlet Fluid Temperature,

T_a [°C] is Ambient Temperature,

V_{wind} [m/s] is the Wind Velocity

Packaged SDHW Systems

Performance Rating

Performance Ratings are defined in CAN/CSA F379.1. In Canada, solar DHW systems are tested and rated in accordance with CAN/CSA-F379. The rating of solar DHW systems is performed by a physical test of a complete system assembled in the National Solar Test Facility (NSTF) (located in the Bodycote Technology Centre in Mississauga, Ontario).

The solar collectors of the SDHW system are mounted in the NSTF solar simulator environmental chamber, facing a large area solar simulator. During the simulated daytime, the air temperature around the collectors is kept at 15°C.

The energy storage tank (if the system is so equipped) is kept in a 20°C room adjacent to the solar simulator, to represent conditions corresponding to an installation in a home. The tank room is equipped with a movable platform, which is used to support the storage tank either above (for thermosyphon system), below (for drain-back systems), or level with the collectors in the solar simulator chamber. A cold water supply controlled to a constant 15°C is attached to the inlet of the system, and the system is charged with heat transfer fluid and powered as required by the SDHW installation manual. In this way, the test conditions for the SDHW system are kept realistically close to what they would be in a normal application.

Once set up for testing, the SDHW system is subjected to environmental conditions that simulate a "standard" solar day for Canada. The collectors are irradiated by simulated sunlight at intensities that vary from approximately 337 W/m² at 8:00 AM, to 768 W/m² at noon, to 284 W/m² at 4:00 PM. The collectors are irradiated with the sunlight perpendicular to the collector aperture, so the intensity of the simulated sunlight is adjusted to account for the changing incidence angles that the sun would make on the collector array over the course of the day.

At predetermined times throughout the day, water is drawn from the SDHW system, to simulate a typical hot water use pattern for a residence. The total water volume drawn from the system in each 24-hour period can be either 150 or 225 or 300 litres, depending on the manufacturer's rating on the system.

(Typical systems consist of one or two solar collectors of about 3 square metres each, and are tested at the 300 litre per day load size.)

The energy delivery rating of the system is calculated from the measured water volume draws from the system and the difference between the water delivery temperature and the water supply main's temperature. The daily cycle of solar energy input and water draws is continued until each subsequent 24-hour energy delivery measurements are the same, within 5% of each other. The energy delivered by the system in the last 24-hour period of the test is the daily energy output rating that is reported for the system under test.

The SDHW system ratings process developed for *CAN/CSA-F379* was developed to provide test results that would be, on the one hand, representative of the annual average daily energy output of the system under test, and on the other hand, standardized to allow realistic comparisons to be made between different systems tested.

Since there is a single rating for each system, the rating is not meant to estimate actual performance in a particular part of Canada.

Indeed, the output of any given system will vary from year to year due to site-dependent factors such as amount of sunshine, volume of hot water used, and local ambient air temperature. Rather, the SDHW system energy ratings provided by *CAN/CSA-F379* are meant to be used as benchmarks for mainly comparative purposes, much like mileage ratings on automobiles are used.

3. Directory of Solar Hot Water Collectors

Listing of Solar Hot Water Collectors

The following listings are for collectors that are qualified to be used under the Canadian government's ecoEnergy Renewable Heat Program.

Company	Product Name	Model Number	Country of Origin	Original Listing Date	Revision Date	Data Sheet in Directory
Evacuated Tube Collectors						
Focus Technology Co, Ltd.	Apricus		China	-	-	-
SCHOTT-Rohrglas GmbH	Schott	ETC16	Germany	-	-	-
SUNDA Solartechnik	SEIDO	1 16	Germany	-	-	-
Thermomax Ltd	Mazdon 20	TMA 600S	U. Kingdom	07-Mar	07-Mar	yes
Thermomax Ltd	Mazdon 30	TMA 600S	U. Kingdom	07-Mar	07-Mar	yes
Thermomax Ltd	Solamax 20	20	U. Kingdom	07-Mar	07-Mar	yes
Thermomax Ltd	Solamax 30	30	U. Kingdom	07-Mar	07-Mar	yes
Viessmann Werke GmbH & Co KG	Viessmann	H30	Germany	-	-	-
Viessmann Werke GmbH & Co KG	Vitosol	20	Germany	-	-	-
Wuxi HNT Co. Ltd.	SJ	1700-10	China	07-Mar	07-Mar	yes
Wuxi HNT Co. Ltd.	SJ	1700-20	China	07-Mar	07-Mar	yes
Wuxi HNT Co. Ltd.	SJ	1900-10	China	07-Mar	07-Mar	yes
Wuxi HNT Co. Ltd.	SJ	1900-20	China	07-Mar	07-Mar	yes
Glazed Flat Plate Collectors						
CMT Net Co	CMT	ALT-1	Canada	-	-	-
Enerworks Inc.	Commercial	NL-SG1-SH10	Canada	07-Mar	07-Mar	yes
Enerworks Inc.	Residential	NL-SG1-SD10	Canada	07-Mar	07-Mar	yes
Ezinc Metal Sanayi Ve Ticaret A.S.	Ezinc	Xba.ca	Turkey	-	-	-
H. Lenz AG	Multisol	M240	Switzerland	-	-	-
Heliotech Energies	Heliotech	H1-32T	Canada	-	-	-
KBB Kollektorbeau		KBB 320	Germany	-	-	-
Solahart Industries Pty Ltd.	Solahart	M	Australia	-	-	-
Solcan Ltd.	Solcan	2100	Canada	07-Mar	07-Mar	yes
Solcan Ltd.	Solcan	2100-T	Canada	07-Mar	07-Mar	yes
Solcan Ltd.	Solcan	2101-L	Canada	07-Mar	07-Mar	yes
Solcan Ltd.	Solcan	2101-V	Canada	07-Mar	07-Mar	yes
Thermo Dynamics Ltd.	Thermodynamics	G-32	Canada	07-Mar	07-Mar	yes
Thermo Dynamics Ltd.	Thermodynamics	S-32	Canada	-	-	-
Viessmann Werke GmbH & Co KG	Vitosol	S2.5	Germany	-	-	-
Viessmann Werke GmbH & Co KG	Vitosol	100-SV1	Germany	-	-	-
Viessmann Werke GmbH & Co KG	Vitosol	SH1	Germany	-	-	-

Unglazed Flat Plate Collectors						
Aquatherm Industries, Inc,	Aquatherm		USA	-	-	-
Dawn Solar Systems	Dawn Solar	2000	USA	-	-	-
Enersol	Enersol	S-1000	Canada	-	-	-
Fafco, Incorporated	Sunsaver		USA	-	-	-
Heliocol	Heliocol	30	Isreal	07-Mar	07-Mar	yes
Heliocol	Heliocol	40	Isreal	07-Mar	07-Mar	yes
Heliocol	Heliocol	50	Isreal	07-Mar	07-Mar	yes
Hot Sun Industries, Inc.	Powermat		USA	-	-	-
Les Energies Solex	Solex		Canada	-	-	-
Techno-Solis, Inc.	Techno-Solis		Canada	-	-	-

Company	Product Name	Model Number	Conditions of Acceptance
Glazed Solar Hot Water Collectors			
CMT Net Co	CMT	ALT-1	Acceptable for vertical mounting and installations where snow loads do not exceed 1000 Pa
KBB Kollektorbeau GmbH		KBB 320	Only for use in systems where the collector loop is not routinely drained
Viessmann Werke GmbH & Co KG	Vitosol	S2.5	The Viessmann Vitosol S2.5 collector mounting systems using the clips bolted directly to the Unistrut is accepted for both rack mounting and surface mounting. The Viessmann Vitosol S2.5 hardware for sloped roof mounting systems is not accepted.

Listing of Collector Supplier Contacts

Evacuated Tube Collectors	
Manufacturer	Canadian Supplier (See Note 1)
SCHOTT -Rohrglas GmbH Erich-Schott-Strass 14 95666 Mitterteich Germany www.schott.com/solarthermal	
SUNDA Solartechnik Donauworther Str. 27 D-89420 Hochstadt Germany www.sunda.de	Canadian Solar Technologies 8459-110A Street Delta, BC Canada, V4C 2K5 www.canadiansolartechnologies.ca
Thermomax Ltd. 7 Balloo Crescent - Balloo Industrial Estate Bangor, Co. Down - BT19 7UP Northern Ireland solar@thermomax-group.com	Thermomax Industries Ltd. 3181 Kingsley Street Victoria, BC Canada, V8P 4J5 www.solarthermal.com
Viessmann Werke GmbH & Co KG Viessmannstr. 1 35107 Allendorf (Eder) Germany www.viessmann.de	Viessmann Manufacturing Company, Inc. 750 McMurray Road Waterloo, ON Canada, N5V 2G5 www.viessmann.com
Focus Technology Co, Ltd. 13th Floor Union Mansion; 32 Zhong Yang Road Nanjing, Jiangsu China, 21008	
Wuxi HNT Co. Ltd. 25 Zhujiang Road, New District Wuxi China, 214000	CAREarth 701 Eagleson Rd, P.O. Box 45006 Kanata, ON Canada, K2M 2G0 www.carearth.com
Glazed Flat Plat Collectors	
Manufacturer	Canadian Supplier (See Note 1)
EnerWorks Inc. P.O. Box 9, 252 Hamilton Crescent Dorchester, ON Canada, N0L 1G0 www.enerworks.com	EnerWorks Inc. P.O. Box 9, 252 Hamilton Crescent Dorchester, ON Canada, N0L 1G0 www.enerworks.com
Ezinc Metal Sanayi Ve Ticarot A.S. Organize Sanayi Bolgesi 11, Cadde No: 12 38070 Turkey www.ezincmetal.com	Taylor Munro Energy Systems Inc. 7157 Honeyman St. #11 Delta, BC Canada, V4G 1E2 www.taylormunro.com

<p>HLT Energies 410-1255 rue University Montreal, QC Canada, H3B 3B6 www.hltenergies.com</p>	<p>HLT Energies 410-1255 rue University Montreal, QC Canada, H3B 3B6 www.hltenergies.com</p>
<p>H. Lenz AG Hirzenstrasse 2 9244 Niederuzwil Switzerland www.lenz.ch</p>	<p>Swiss Solar Tech Ltd. 5811 Giants Head Rd Summerland, BC Canada, V0H 1Z7 www.swissolartech.com</p>
<p>Solahart Industries Pty Ltd. 35 Jonal Dr Cavan 5094, South Australia Australia www.solahart.com</p>	<p>Swiss Solar Tech Ltd. 5811 Giants Head Rd Summerland, BC Canada, V0H 1Z7 www.swissolartech.com</p>
<p>Solcan Ltd. 126 Wynchwood Park London, ON Canada, N6G 1R7 www.solcan.com</p>	<p>Solcan Ltd. 126 Wynchwood Park London, ON Canada, N6G 1R7 www.solcan.com</p>
<p>Thermo Dynamics Ltd. 101 Frazee Avenue Dartmouth, NS Canada, B3B 1Z4 www.thermo-dynamics.com</p>	<p>Thermo Dynamics Ltd. 101 Frazee Avenue Dartmouth, NS Canada, B3B 1Z4 www.thermo-dynamics.com</p>
<p>Viessmann Werke GmbH & Co KG Viessmannstr. 1 35107 Allendorf (Eder) Germany www.viessmann.de</p>	<p>Viessmann Manufacturing Company, Inc. 750 McMurray Road Waterloo, ON Canada, N5V 2G5 www.viessmann.com</p>
<p>CMT Net Co 35 Canyon Ave Toronto, ON Canada, M3H 4Y2</p>	<p>CMT Net Co 35 Canyon Ave Toronto, ON Canada, M3H 4Y2</p>
<p>KBB Kollektorbeau GmbH Kopennicker Strasse 325 D-12555 Berlin Germany www.kbb-solar.com</p>	

Unglazed Flat Plate Collectors	
Manufacturer	Canadian Supplier (See Note 1)
SCHOTT -Rohrgals GmbH Erich-Schott-Strass 14 95666 Mitterteich Germany www.schott.com/solarthermal	
Aquatherm Industries, Inc. 1940 Rutgers University Blvd. Lakewood, NJ USA 08701 www.warmwater.com	
Dawn Solar Systems 183 Route 125, Bld. A-7 Brentwood, NH USA 03833 www.dawnsolar.com	
Enersol 77 Campbellville Road Campbellville, ON Canada, L0P 1B0 www.enersol.com	Enersol 77 Campbellville Road Campbellville, ON Canada, L0P 1B0 www.enersol.com
Fafco, Incorporated 435 Otterson Drive Chico, CA USA, 95928-8207 www.fafco.com	Taylor Munro Energy Systems Inc. 7157 Honeyman St. #11 Delta, BC Canada, V4G 1E2 www.taylormunro.com
Heliocol www.heliocol.com	SunSolar Energy Technologies Inc 3262 F.X Tessier Vaudreuil-Dorion QC Canada, J7V 5V5
Hot Sun Industries 3923 Mt. Abraham Ave San Diego CA USA 92111 www.powermat.com	
Techno-Solis, Inc. 4225 Monte Saint-Hubert Saint-Hubert, QC Canada, J3Y 1V2 www.technosolis.com	Techno-Solis, Inc. 4225 Monte Saint-Hubert Saint-Hubert, QC Canada, J3Y 1V2 www.technosolis.com
Les Energies Solex 2598 Perrot Blvd. Candiac, QC Canada, J7V 8P4 www.energies-solex.com	Les Energies Solex 2598 Perrot Blvd. Candiac, QC Canada, J7V 8P4 www.energies-solex.com

Note 1: Canadian Suppliers - only those that have submitted data sheets or who are members of CanSIA are listed here.

Summary of Key Characteristics of Solar Hot Water Collectors

Manufacturer	Brand Name	Model Number	Gross Area (m ²)	Power Rating		Standard Day Energy Rating (kWh/day)				Warranty Period (years)	Tested to Standard	Date of Independent Testing
				kW/m ² (see #1)	kW/collector	5°C	20°C	50°C	80°C			
Evacuated Tube Collectors												
Wuxi HNT	SJ	SJ 1700-10	1.8	0.72	0.72	2.3	2.2	1.8	1.2	5 year	EN 12975 -1,2	Nov-04
Wuxi HNT	SJ	SJ 1700-20	3.4	0.72	1.45	4.6	4.3	3.6	2.3	5 year	EN 12975 -1,2	Nov-04
Wuxi HNT	SJ	SJ 1900-10	1.9	0.72	0.87	2.7	2.6	2.1	1.4	5 year	EN 12975 -1,2	Nov-04
Wuxi HNT	SJ	SJ-1900-20	3.7	0.72	1.66	5.2	5.0	4.1	2.7	5 year	EN 12975 -1,2	Nov-04
Thermomax	Mazdon 20	TMA 600S	3.0	-	-	-	-	-	-	-	EN12975	-
Thermomax	Mazdon 30	TMA 600S	4.5	-	-	-	-	-	-	-	EN12975	-
Thermomax	DF-100	20	2.8	0.74	1.63	5.4	5.0	4.3	3.5	-	-	-
Thermomax	DF-100	30	4.2	0.74	2.37	7.9	7.3	6.2	5.2	-	-	-
Glazed Flat Plate Collectors												
EnerWorks Inc	Residential	COL-4X8-NL-SG1-SD10	2.9	0.56	1.6	5.0	0.5	0.0	0.0	5 year	CAN/CSA F378-87	May-06
EnerWorks Inc	Commercial	COL-4X8-NL-SG1-SH10	2.9	0.69	2.0	6.8	5.5	2.6	0.7	5 year	SRCC OG-100	Jul-06
Solcan	Solcan	2100	2.9	0.60	1.7	5.9	4.4	1.5	0.4	10 year	CAN/CSA F378-82	Jun-87
Solcan	Solcan	2101	2.9	-	-	-	-	-	-	10 year	EN 12975-2	Dec-06
Unglazed Flat Plate Collectors												
Manufacturer	Brand Name	Model Number	Gross Area (m ²)	Power Rating		Standard Day Energy Rating (kWh/day)				Warranty Period (years)	Tested to Standard	Date of Independent Testing
				kW/m ² (see #1)	kW/collector	0 m/s	2.5 m/s	5.0 m/s	-			
Heliocol	Helicol	30	2.7	-	-	-	-	-	-	12 year	-	-
Heliocol	Helicol	40	3.8	-	-	-	-	-	-	12 year	-	-
Heliocol	Helicol	50	4.5	-	-	-	-	-	-	12 year	-	-

Note 1: Some Evacuated Tube collectors report efficiency on an aperture or absorber area - CSA F378 reports efficiency on a gross area.

Solar Hot Water Collector Data Sheets

Product Name: **SJ**
 Collector Type: **Evacuated Tube**
 Canadian Supplier: **Carearth Inc.**

Product Model: **SJ 1700 10**
 Applications: **Low to High Temperature output**
 Manufacturer: **HNT**
China

Warranty & Limitations: **5 years** Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	1,755	1,000	165
Gross Area (m ²):		1.8	
Net Aperture Area (m ²):		1.0	
Weight (dry) (kg):		35	
Weight (filled) (kg):		37	
Fluid Capacity (litres):		2	
Maximum Operating Temperature (°C):		235	
Maximum Operating Pressure (kPa):		600	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		n.a.	n.a.
Ideal Flow Rate (l/m):		3.0	
Heat Transfer Fluids:	n.a.		



COLLECTOR MATERIALS

Frame Material: **Aluminum**
 Coating: **none**
 Mounting Connections: **Bolt and bracket assembly**
 Glazing Material (outer): **High Quality Borosilicate Glass**
 Glazing Material (inner): **none**
 Absorber Plate Material: **Aluminum**
 Absorber Plate Coating: **Aluminum Nitride Blue color**
 Tubing Material: **-**
 Plate-Tubing Bonding Method: **-**
 Insulation (sides): **Rockwool in the header**
 Insulation (back): **-**
 Header Pipe Size (OD) (mm): **23**
 Header Pipe Material: **copper**
 Plumbing Connection Method: **soldered, flexible coupling or flexible hose**

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:		Institut für ZukunftsEnergieSysteme im Testzentrum Saarbrucken
Standard Tested to:		DIN EN 12975 - 1,2
Date of Testing or Certification:		18-Nov-04
Certified to Standard (yes/no):		

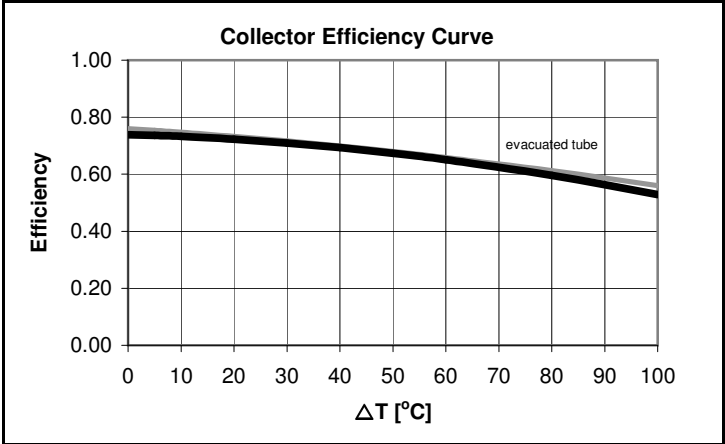
PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Flow Rate (l/min): **2.5 to 2.7**
 Test Fluid: **-**
 Efficiency Curve (W/m²-°C)
 Y Intercept [F_R(ta)]: **0.74**
 Slope of efficiency curve: [F_RU_L]: **1.540**
 Incident Angle Modifier

30°	45°	60°
1.07	1.12	0.68

Power Rating
 kW/m²: **0.72** kW/Collector: **0.72**



COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	2.3	2.2	1.8	1.2

MANUFACTURER'S COMMENTS

Performance values based on gross aperture area

Product Name: **SJ**
 Collector Type: **Evacuated Tube**
 Canadian Supplier: **Carearth Inc.**

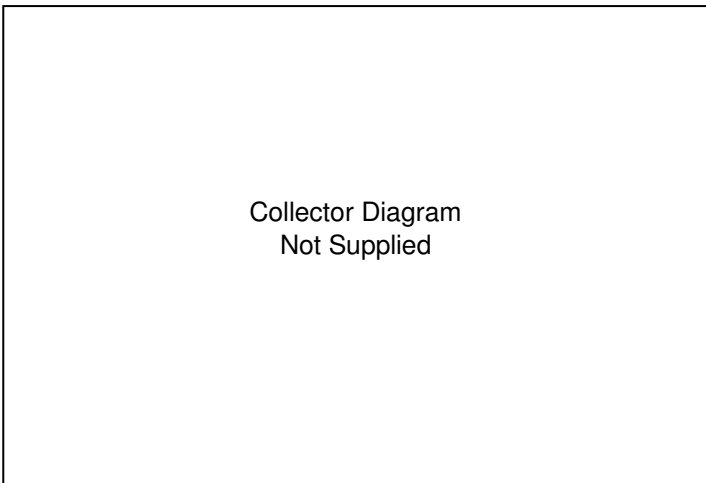
Product Model: **SJ 1700 20**
 Applications: **Low to High Temperature output**
 Manufacturer: **HNT**
China

Warranty & Limitations: **5 years**

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	1,755	1,930	165
Gross Area (m ²):		3.4	
Net Aperture Area (m ²):		2.0	
Weight (dry) (kg):		60	
Weight (filled) (kg):		64	
Fluid Capacity (litres):		4	
Maximum Operating Temperature (°C):		235	
Maximum Operating Pressure (kPa):		600	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		n.a.	
Ideal Flow Rate (l/m):		3.0	
Heat Transfer Fluids:	n.a.		



COLLECTOR MATERIALS

Frame Material: **Aluminum**
 Coating: **none**
 Mounting Connections: **Bolt and bracket assembly**
 Glazing Material (outer): **High Quality Borosilicate Glass**
 Glazing Material (inner): **-**
 Absorber Plate Material: **Aluminum**
 Absorber Plate Coating: **Aluminum Nitride Blue color**
 Tubing Material: **-**
 Plate-Tubing Bonding Method: **-**
 Insulation (sides): **Rockwool in the header**
 Insulation (back): **-**
 Header Pipe Size (OD) (mm): **23**
 Header Pipe Material: **copper**
 Plumbing Connection Method: **soldered, flexible coupling or flexible hose**

INDEPENDENT TESTING/CERTIFICATION

Canadian Standards

Other Standards

Name of Testing Authority:	Institut für ZukunftsEnergieSysteme im Testzentrum Saarbrücken
Standard Tested to:	DIN EN 12975 - 1,2
Date of Testing or Certification:	18-Nov-04
Certified to Standard (yes/no):	

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Flow Rate (l/min): **2.5 to 2.7**
 Test Fluid: **n.a.**
 Efficiency Curve (W/m²·°C)
 Y Intercept [F_R(ta)]: **0.74**
 Slope of efficiency curve: [F_RU_L]: **1.540**

Incident Angle Modifier

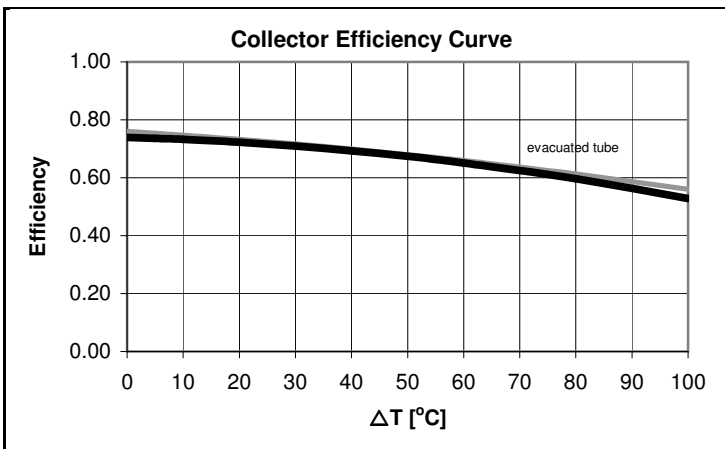
30°	45°	60°
1.07	1.12	0.68

Power Rating

kW/m²: **0.72** kW/Collector **1.45**

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	4.6	4.3	3.6	2.3



MANUFACTURER'S COMMENTS

Performance values based on gross aperture area

Product Name: **SJ**
 Collector Type: **Evacuated Tube**
 Canadian Supplier: **Carearth Inc.**

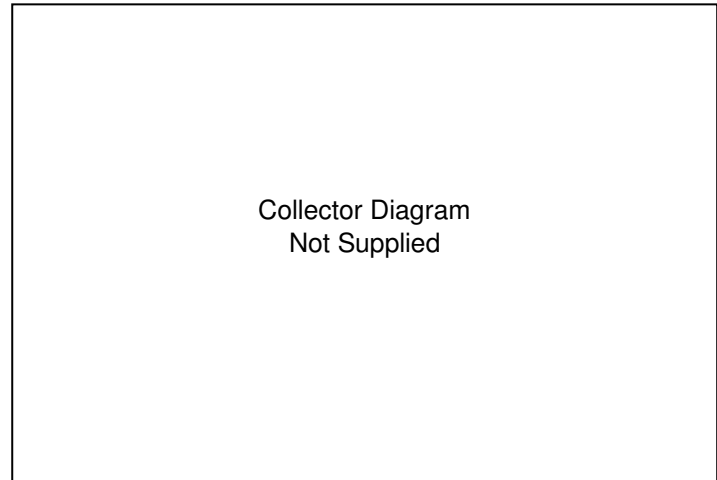
Product Model: **SJ 1900 10**
 Applications: **Low to High Temperature output**
 Manufacturer: **HNT**
China

Warranty & Limitations: **5 years**

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	1,905	1,000	165
Gross Area (m ²):		1.9	
Net Aperture Area (m ²):		1.2	
Weight (dry) (kg):		38	
Weight (filled) (kg):		40	
Fluid Capacity (litres):		2	
Maximum Operating Temperature (°C):		235	
Maximum Operating Pressure (kPa):		600	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		n.a.	n.a.
Ideal Flow Rate (l/m):		3.0	
Heat Transfer Fluids:	n.a.		



COLLECTOR MATERIALS

Frame Material: **Aluminum**
 Coating: **none**
 Mounting Connections: **Bolt and bracket assembly**
 Glazing Material (outer): **High Quality Borosilicate Glass**
 Glazing Material (inner): **-**
 Absorber Plate Material: **Aluminum**
 Absorber Plate Coating: **Aluminum Nitride Blue color**
 Tubing Material: **-**
 Plate-Tubing Bonding Method: **-**
 Insulation (sides): **Rockwool in the header**
 Insulation (back): **-**
 Header Pipe Size (OD) (mm): **23**
 Header Pipe Material: **copper**
 Plumbing Connection Method: **soldered, flexible coupling or flexible hose**

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:	Institut für ZukunftsEnergieSysteme im Testzentrum Saarbrucken	
Standard Tested to:	DIN EN 12975 - 1,2	
Date of Testing or Certification:	18-Nov-04	
Certified to Standard (yes/no):		

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Flow Rate (l/min): **2.5 to 2.7**
 Test Fluid: **n.a.**
 Efficiency Curve (W/m²·°C)
 Y Intercept [F_R(t_a): **0.74**
 Slope of efficiency curve: [F_RU_L): **1.540**

Incident Angle Modifier

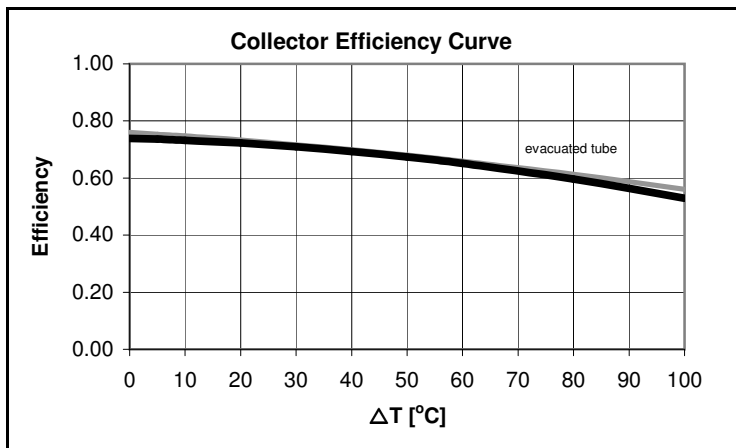
30°	45°	60°
1.07	1.12	0.68

Power Rating

kW/m²: **0.72** kW/Collector: **0.87**

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	2.7	2.6	2.1	1.4



MANUFACTURER'S COMMENTS

Performance values based on gross aperture area

Product Name: **SJ**
 Collector Type: **Evacuated Tube**
 Canadian Supplier: **Carearth Inc.**

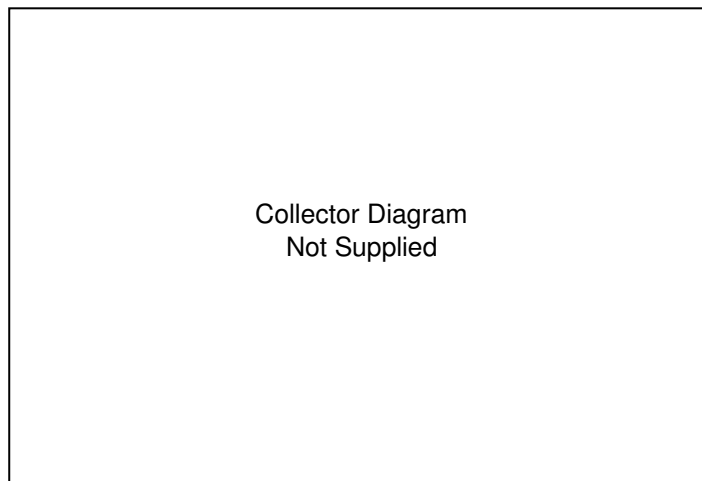
Product Model: **SJ 1900 20**
 Applications: **Low to High Temperature output**
 Manufacturer: **HNT**
China

Warranty & Limitations: **5 years**

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	1,905	1,930	165
Gross Area (m ²):		3.7	
Net Aperture Area (m ²):		2.3	
Weight (dry) (kg):		66	
Weight (filled) (kg):		70	
Fluid Capacity (litres):		4	
Maximum Operating Temperature (°C):		235	
Maximum Operating Pressure (kPa):		600	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		n.a.	n.a.
Ideal Flow Rate (l/m):		3.0	
Heat Transfer Fluids:	n.a.		



COLLECTOR MATERIALS

Frame Material: **Aluminum**
 Coating: **none**
 Mounting Connections: **Bolt and bracket assembly**
 Glazing Material (outer): **High Quality Borosilicate Glass**
 Glazing Material (inner): **n.a.**
 Absorber Plate Material: **Aluminum**
 Absorber Plate Coating: **Aluminum Nitride Blue color**
 Tubing Material: **-**
 Plate-Tubing Bonding Method: **-**
 Insulation (sides): **Rockwool in the header**
 Insulation (back): **-**
 Header Pipe Size (OD) (mm): **23**
 Header Pipe Material: **copper**
 Plumbing Connection Method: **soldered, flexible coupling or flexible hose**

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:		Institut für ZukunftsEnergieSysteme im Testzentrum Saarbrücken
Standard Tested to:		DIN EN 12975 - 1,2
Date of Testing or Certification:		18-Nov-04
Certified to Standard (yes/no):		

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Flow Rate (l/min): **2.5 to 2.7**
 Test Fluid: **n.a.**
 Efficiency Curve (W/m²·°C)
 Y Intercept [F_R(t_a):] **0.74**
 Slope of efficiency curve: [F_RU_L]: **1.540**

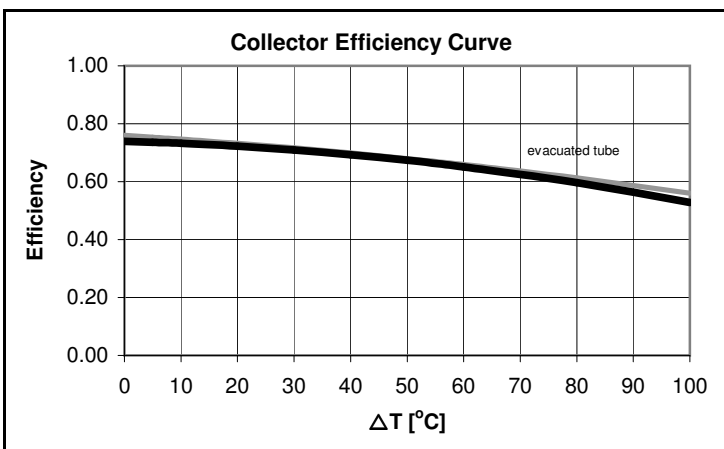
Incident Angle Modifier

30°	45°	60°
1.07	1.12	0.68

Power Rating
 kW/m²: **0.72** kW/Collector: **1.66**

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	5.2	5.0	4.1	2.7



MANUFACTURER'S COMMENTS

Performance values based on gross aperture area

Product Name: **Mazdon 20**
 Collector Type: **Evacuated Tube**
 Canadian Supplier: **Thermomax industries Ltd**

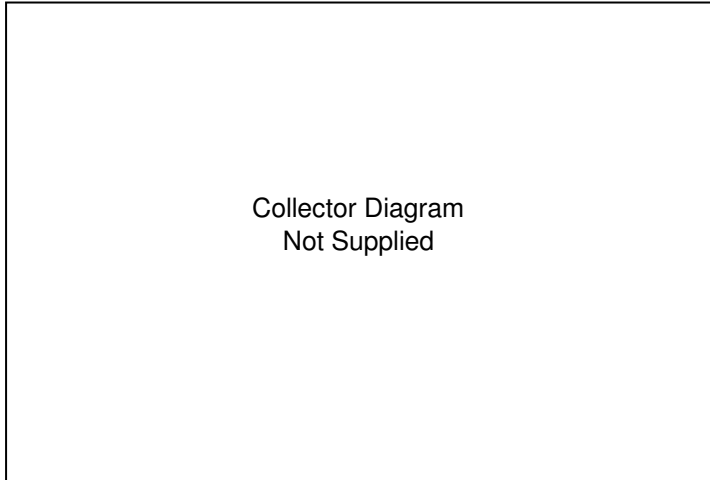
Product Model: **TMA 600S**
 Applications:
 Manufacturer: **Thermomax UK**

Warranty & Limitations:

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	2,021	1,500	161
Gross Area (m ²):		3.0	
Net Aperture Area (m ²):		2.1	
Weight (dry) (kg):		53	
Weight (filled) (kg):			
Fluid Capacity (litres):		0.6	
Maximum Operating Temperature (°C):		157	
Maximum Operating Pressure (kPa):			
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		2.0	5.0
Ideal Flow Rate (l/m):		2.7	
Heat Transfer Fluids:			



COLLECTOR MATERIALS

Frame Material:	Stainless Steel
Coating:	none
Mounting Connections:	Stainless Steel
Glazing Material (outer):	borasilicate glass
Glazing Material (inner):	Single layer glass tube
Absorber Plate Material:	copper
Absorber Plate Coating:	sunselect
Tubing Material:	Copper
Plate-Tubing Bonding Method:	N/A
Insulation (sides):	10-5 mbar vaccum
Insulation (back):	10-5 mbar vaccum
Header Pipe Size (OD) (mm):	22
Header Pipe Material:	copper
Plumbing Connection Method:	22mm compression fittings

INDEPENDENT TESTING/CERTIFICATION

Canadian Standards

Other Standards

Name of Testing Authority:	Institut fur Solartechnik SPF
Standard Tested to:	EN12975
Date of Testing or Certification:	
Certified to Standard (yes/no):	

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid:	water - glycol (33.3%)
Test Flow Rate (l/min):	2.5
Efficiency Curve (W/m ² -°C)	
Y Intercept [F _R (ta)]:	-
Slope of efficiency curve: [F _R U _L]:	-

Incident Angle Modifier

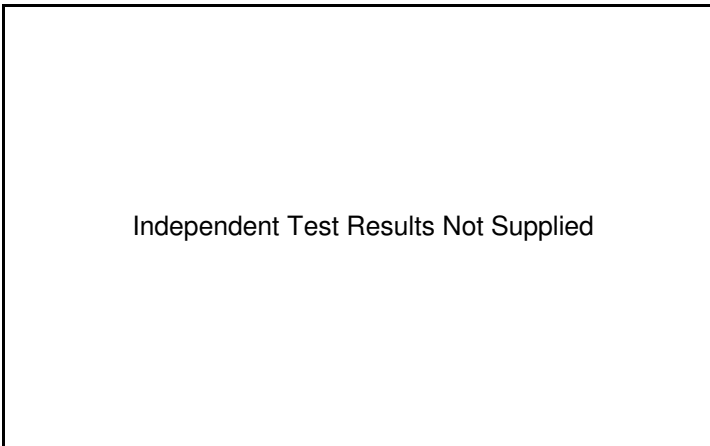
30°	45°	60°
0.96	0.93	-

Power Rating

kW/m²: kW/Collector:

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day				



MANUFACTURER'S COMMENTS

Efficiency equation data based on absorber area

Product Name: **Mazdon 30**
 Collector Type: **Evacuated Tube**
 Canadian Supplier: **Thermomax industries Ltd**

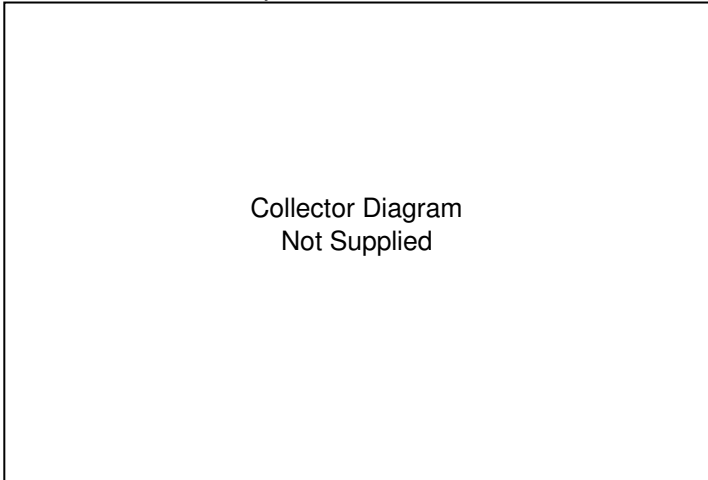
Product Model: **TMA 600S**
 Applications:
 Manufacturer: **Thermomax UK**

Warranty & Limitations:

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	2,021	2,210	161
Gross Area (m ²):		4.5	
Net Aperture Area (m ²):		3.2	
Weight (dry) (kg):		89	
Weight (filled) (kg):		90	
Fluid Capacity (litres):		0.8	
Maximum Operating Temperature (°C):		99	
Maximum Operating Pressure (kPa):			
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		3.0	7.5
Ideal Flow Rate (l/m):		4.0	
Heat Transfer Fluids:			



COLLECTOR MATERIALS

Frame Material:	Stainless Steel
Coating:	none
Mounting Connections:	Stainless Steel
Glazing Material (outer):	borasilicate glass
Glazing Material (inner):	Single layer glass tube
Absorber Plate Material:	copper
Absorber Plate Coating:	sunselect
Tubing Material:	Copper
Plate-Tubing Bonding Method:	N/A
Insulation (sides):	10-5 mbar vaccum
Insulation (back):	10-5 mbar vaccum
Header Pipe Size (OD) (mm):	22
Header Pipe Material:	copper
Plumbing Connection Method:	22mm compression fittings

INDEPENDENT TESTING/CERTIFICATION

Canadian Standards

Other Standards

Name of Testing Authority:	Institut fur Solartechnik SPF
Standard Tested to:	EN12975
Date of Testing or Certification:	
Certified to Standard (yes/no):	

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid:	water - glycol (33.3%)
Test Flow Rate (l/min):	3.8
Efficiency Curve (W/m ² -°C)	
Y Intercept [F _R (ta)]:	
Slope of efficiency curve: [F _R U _L]:	

Incident Angle Modifier

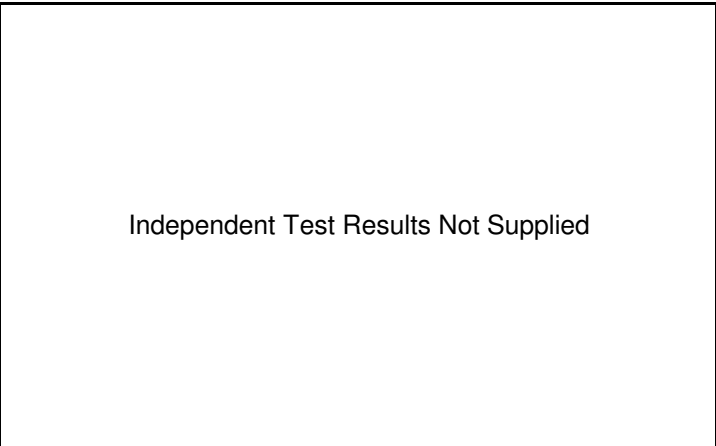
30°	45°	60°
	0.93	

Power Rating

kW/m²: kW/Collector:

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day				



MANUFACTURER'S COMMENTS

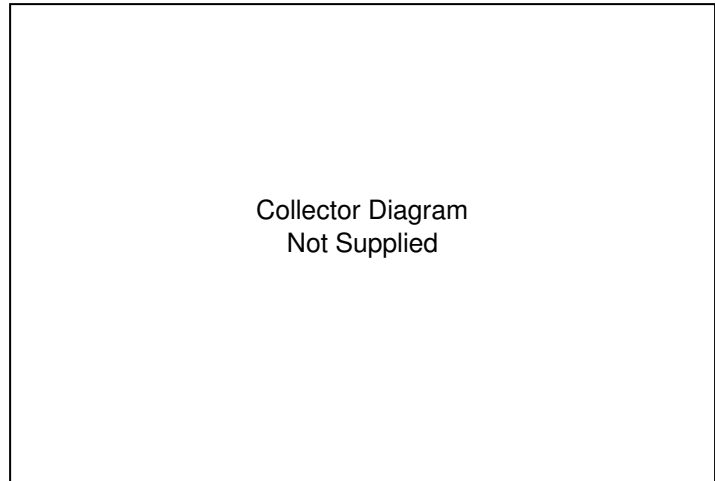
Efficiency equation data based on absorber area

Product Name: **DF 100** Product Model: **20**
 Collector Type: **evacuated tube** Applications: **Medium Temperature, High Temperature**
 Canadian Supplier: **Thermomax industries Ltd** Manufacturer: **Thermomax UK**

Warranty & Limitations: Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	1,996	1,418	97
Gross Area (m ²):		2.8	
Net Aperture Area (m ²):		2.2	
Weight (dry) (kg):		55	
Weight (filled) (kg):		57	
Fluid Capacity (litres):		3.8	
Maximum Operating Temperature (°C):		286	
Maximum Operating Pressure (kPa):		800	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		2.0	12.0
Ideal Flow Rate (l/m):			
Heat Transfer Fluids:	30-50% glycol/water		



COLLECTOR MATERIALS

Frame Material: **aluminum**
 Coating: **none**
 Mounting Connections: **multiple configurations**
 Glazing Material (outer):
 Glazing Material (inner): **Single layer glass tube**
 Absorber Plate Material:
 Absorber Plate Coating: **sunselect**
 Tubing Material: **Copper**
 Plate-Tubing Bonding Method: **n/a**
 Insulation (sides): **10-5 mbar vaccum**
 Insulation (back): **10-5 mbar vaccum**
 Header Pipe Size (OD) (mm): **22**
 Header Pipe Material:
 Plumbing Connection Method: **22mm compression fittings**

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:		DIN CERO Alboinstrabe 56, D-12103 Berlin
Standard Tested to:		Solar keymark
Date of Testing or Certification:		
Certified to Standard (yes/no):		

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid: **3.8**
 Test Flow Rate (l/min): **propalyne glycol**
 Efficiency Curve (W/m²·°C)
 Y Intercept [F_R(ta)]: **-**
 Slope of efficiency curve: [F_RU_L]: **-**

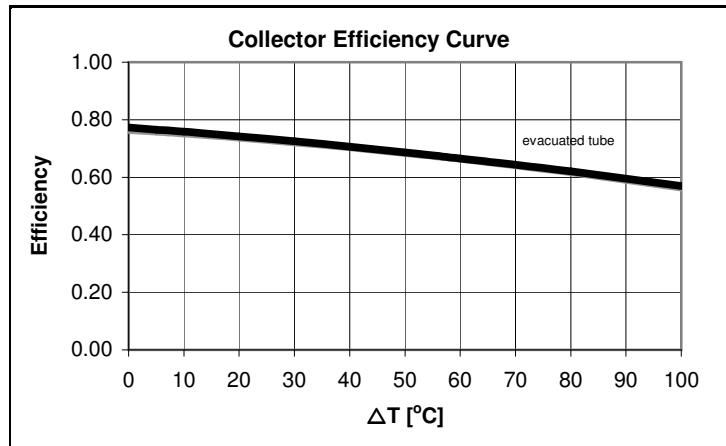
Incident Angle Modifier

30°	45°	60°
0.98	0.95	0.88

Power Rating
 kW/m²: **0.74** kW/Collector: **1.63**

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	5.4	5.0	4.3	3.5



MANUFACTURER'S COMMENTS

Efficiency equation data based on absorber area

Product Name: **DF 100**
 Collector Type: evacuated tube
 Canadian Supplier: **Thermomax industries Ltd**

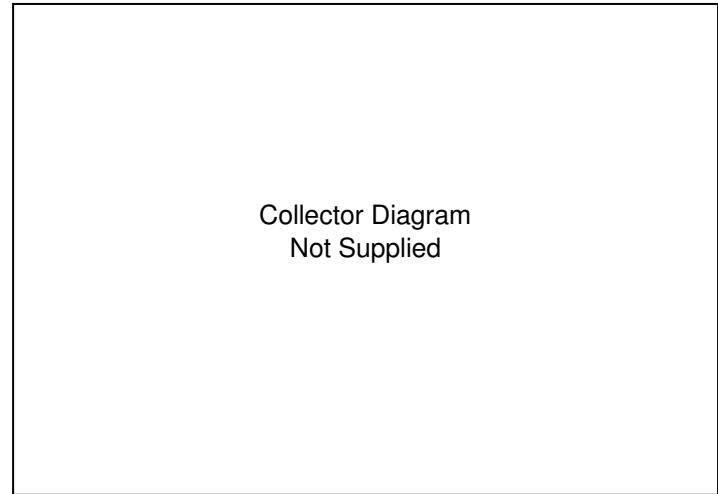
Product Model: **30**
 Applications: **Medium Temperature, High Temperature**
 Manufacturer: **Thermomax UK**

Warranty & Limitations:

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	1,996	2,127	97
Gross Area (m ²):		4.2	
Net Aperture Area (m ²):		3.2	
Weight (dry) (kg):		81	
Weight (filled) (kg):		83	
Fluid Capacity (litres):		5.6	
Maximum Operating Temperature (°C):		286	
Maximum Operating Pressure (kPa):		800	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		2.0	12.0
Ideal Flow Rate (l/m):			
Heat Transfer Fluids:	propalyne glycol		



COLLECTOR MATERIALS

Frame Material: **aluminum**
 Coating: **none**
 Mounting Connections: **multiple configurations**
 Glazing Material (outer):
 Glazing Material (inner): **Single layer glass tube**
 Absorber Plate Material: **copper**
 Absorber Plate Coating: **sunselect**
 Tubing Material: **Copper**
 Plate-Tubing Bonding Method: **N/A**
 Insulation (sides): **10-5 mbar vaccum**
 Insulation (back): **10-5 mbar vaccum**
 Header Pipe Size (OD) (mm): **22**
 Header Pipe Material: **Copper**
 Plumbing Connection Method: **22mm compression fittings**

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:		DIN CERO Alboinstrabe 56, D-12103 Berlin
Standard Tested to:		Solar keymark
Date of Testing or Certification:		
Certified to Standard (yes/no):		

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid: -
 Test Flow Rate (l/min): -
 Efficiency Curve (W/m²-°C)
 Y Intercept [F_R(t_a): -
 Slope of efficiency curve: [F_RU_L]: -

Incident Angle Modifier

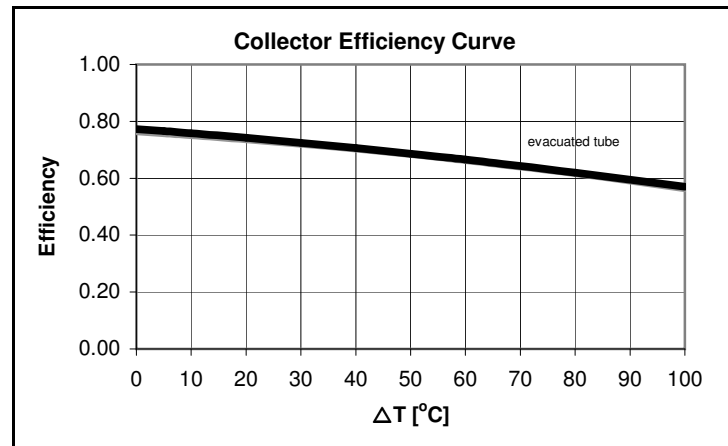
30°	45°	60°
0.98	0.95	0.88

Power Rating

kW/m²: **0.74** kW/Collector: **2.37**

COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	7.9	7.3	6.2	5.2



MANUFACTURER'S COMMENTS

Efficiency equation data based on absorber area

Product Name:

Residential

Collector Type:

Glazed Flat Plate

Canadian Supplier:

EnerWorks Inc.

Product Model:

COL-4X8-TL-SG1-SD10

Applications:

Medium and Low Temperature

Manufacturer:

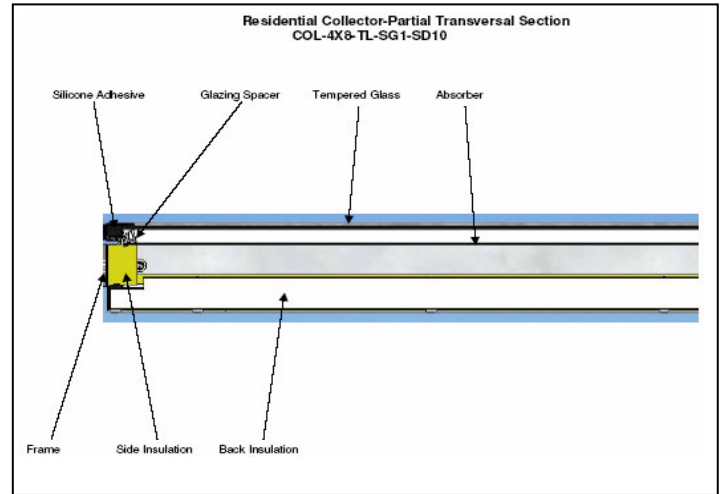
**EnerWorks Inc.
Canada**

Warranty & Limitations: **5 year material replacement, labour up to \$100 first year**

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	2,441	1,171	80
Gross Area (m ²):		2.9	
Net Aperture Area (m ²):		2.7	
Weight (dry) (kg):		50	
Weight (filled) (kg):		51	
Fluid Capacity (litres):		1	
Maximum Operating Temperature (°C):		125	
Maximum Operating Pressure (kPa):		345	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		0.6	3.0
Ideal Flow Rate (l/m):		1.2	
Heat Transfer Fluids:	Propylene Glycol		



COLLECTOR MATERIALS

Frame Material:	Mild Steel
Coating:	Galvalume
Mounting Connections:	Mounting brackets attach to collector frame with screws
Glazing Material (outer):	Low iron, tempered glass
Glazing Material (inner):	none
Absorber Plate Material:	Aluminum, continuous sheet
Absorber Plate Coating:	Selective
Tubing Material:	Copper
Plate-Tubing Bonding Method:	Laser spot welding
Insulation (sides):	Iso-cyanurate foam
Insulation (back):	Mineral wool with aluminum sheet outer protection
Header Pipe Size (OD) (mm):	10
Header Pipe Material:	Copper Serpentine Tube (not header)
Plumbing Connection Method:	Push-On Quick Connect

INDEPENDENT TESTING/CERTIFICATION

Canadian Standards

Other Standards

Name of Testing Authority:	NSTF/Bodycote Materials Testing
Standard Tested to:	CAN/CSA F378-87
Date of Testing or Certification:	01-May-06
Certified to Standard (yes/no):	No

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Flow Rate (l/min):	1.2
Test Fluid:	50% Propylene Glycol
Efficiency Curve (W/m ² -°C)	
Y Intercept [F _R (t _a)]:	0.65
Slope of efficiency curve: [F _R U _L]:	4.442

Incident Angle Modifier

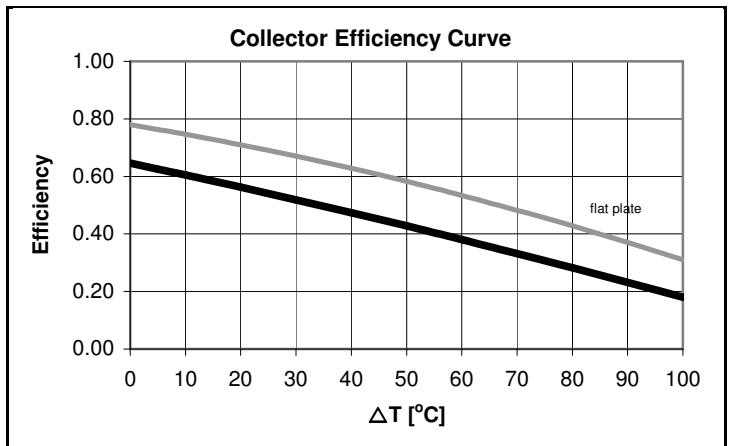
30°	45°	60°
0.97	0.91	0.80

Power Rating

kW/m ² :	0.56	kW/Collector:	1.63
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COLLECTOR PERFORMANCE RATING

kWh/day	5°C	20°C	50°C	80°C
Standard Day	5.0	0.5	0.0	0.0



MANUFACTURER'S COMMENTS

This collector is fitted with a device that passively limits its maximum temperature to prevent overheating. The collector is suitable for closed loop glycol systems; it is not recommended for drain-back systems.

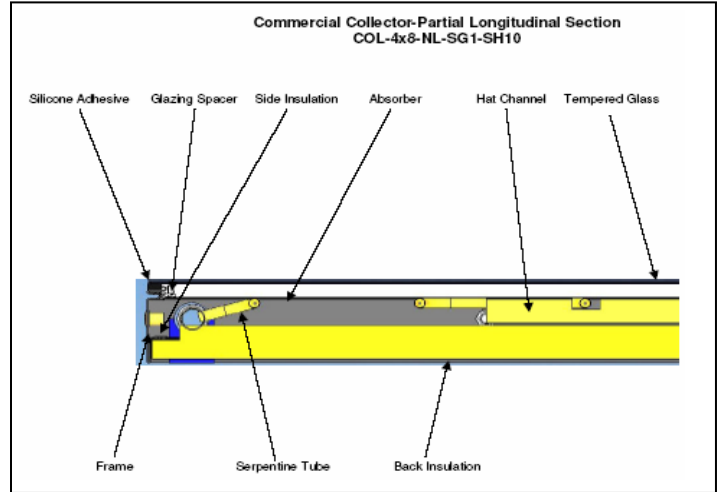
Product Name: **Commercial**
 Collector Type: **Glazed Flat Plate**
 Canadian Supplier: **EnerWorks Inc.**

Product Model: **COL-4X8-NL-SG1-SH10**
 Applications: **Medium and Low Temperature**
 Manufacturer: **EnerWorks Inc.**
Canada

Warranty & Limitations: **5 year material replacement, labour up to \$100 first year**
 Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	2,445	1,175	80
Gross Area (m ²):		2.9	
Net Aperture Area (m ²):		2.7	
Weight (dry) (kg):		50	
Weight (filled) (kg):		52	
Fluid Capacity (litres):		2	
Maximum Operating Temperature (°C):		230	
Maximum Operating Pressure (kPa):		690	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		0.6	3.5
Ideal Flow Rate (l/m):		2.4	
Heat Transfer Fluids:	Propylene Glycol		



COLLECTOR MATERIALS

Frame Material:	Mild Steel
Coating:	Galvalume
Mounting Connections:	Mounting brackets attach to collector frame with screws
Glazing Material (outer):	Low iron, tempered glass
Glazing Material (inner):	none
Absorber Plate Material:	Aluminum, continuous sheet
Absorber Plate Coating:	Selective
Tubing Material:	Copper
Plate-Tubing Bonding Method:	Laser spot welding
Insulation (sides):	Iso-cyanurate foam
Insulation (back):	Mineral wool with aluminum sheet outer protection
Header Pipe Size (OD) (mm):	22
Header Pipe Material:	Copper
Plumbing Connection Method:	Clamp, O-ring and metal bellow

INDEPENDENT TESTING/CERTIFICATION

Canadian Standards

Other Standards

Name of Testing Authority:	NSTF/Bodycote Materials Testing
Standard Tested to:	SRCC OG-100
Date of Testing or Certification:	05-Jul-06
Certified to Standard (yes/no):	No

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Flow Rate (l/min):	3.4
Test Fluid:	50% Propylene Glycol
Efficiency Curve (W/m ² ·°C)	
Y Intercept [F _R (t _a)]:	0.77
Slope of efficiency curve: [F _R U _L]:	4.036

Incident Angle Modifier

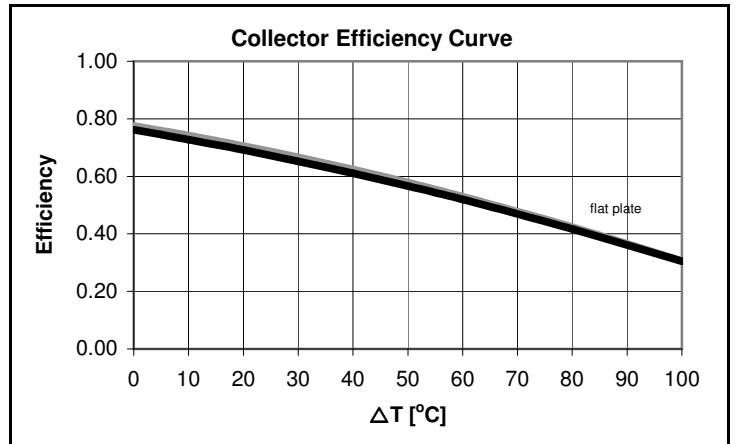
30°	45°	60°
1.01	0.99	0.84

Power Rating

kW/m ² :	0.69	kW/Collector:	2.00
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COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	6.8	5.5	2.6	0.7



MANUFACTURER'S COMMENTS

This collector is manufactured using bonding technology for added strength, flex and a better seal. The collector is suitable for closed loop glycol systems; it is not recommended for drain-back systems.

Product Name:

Solcan

Collector Type:

glazed flat plate

Canadian Supplier:

Solcan Ltd

Product Model:

2100

Applications:

medium temperature

Manufacturer:

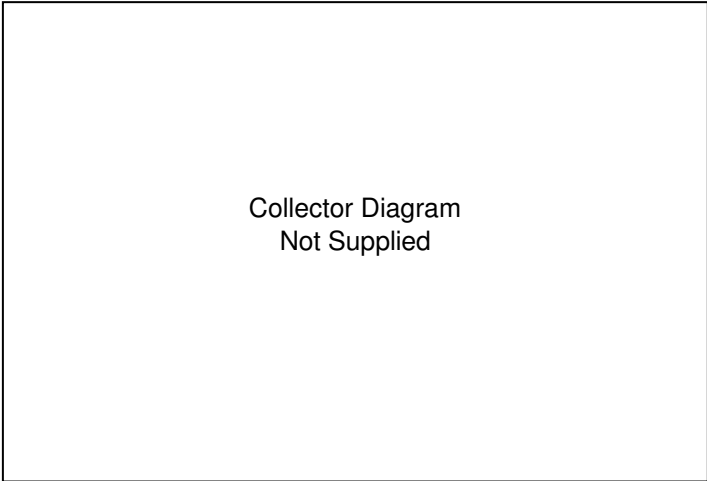
**Solcan Ltd
Canada**

Warranty & Limitations: **full warranty for 10 years**

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	2,450	1,175	76
Gross Area (m ²):	2.9		
Net Aperture Area (m ²):	2.7		
Weight (dry) (kg):	50		
Weight (filled) (kg):	52		
Fluid Capacity (litres):	2		
Maximum Operating Temperature (°C):	165		
Maximum Operating Pressure (kPa):	300		
	<i>min</i>	<i>max</i>	
Acceptable Flow Rates (l/min):	0.9	2.5	
Ideal Flow Rate (l/m):	1.0		
Heat Transfer Fluids:	water, propylene glycol		



COLLECTOR MATERIALS

Frame Material:	aluminum
Coating:	none
Mounting Connections:	rt angle aluminum bracket
Glazing Material (outer):	low iron tempered glass
Glazing Material (inner):	none
Absorber Plate Material:	aluminum fin
Absorber Plate Coating:	selective
Tubing Material:	copper
Plate-Tubing Bonding Method:	high frequency welding
Insulation (sides):	foil-faced isocyanurate foam
Insulation (back):	foil-faced isocyanurate foam
Header Pipe Size (OD) (mm):	19
Header Pipe Material:	copper
Plumbing Connection Method:	male/female unions

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:	NSTF	
Standard Tested to:	CSA F378-M1982	
Date of Testing or Certification:	15-Jun-87	
Certified to Standard (yes/no):	no	

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid:	60/40 water propylene glycol	
Test Flow Rate (l/min):	0.9	
Efficiency Curve (W/m ² ·°C)		
Y Intercept [F _R (t _a):	0.64	
Slope of efficiency curve: [F _R U _L]:	4.040	

Incident Angle Modifier

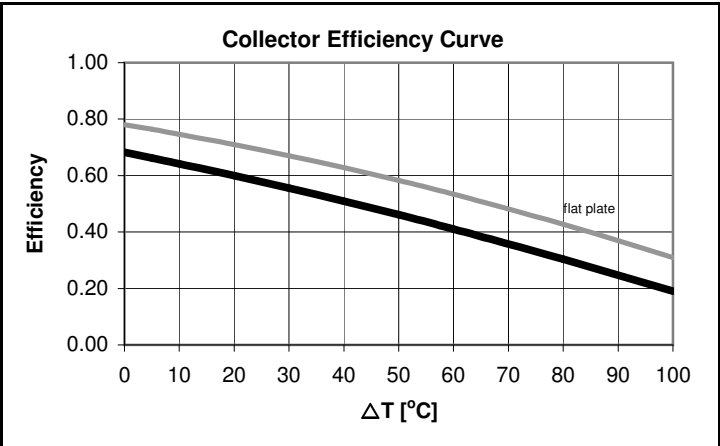
30°	45°	60°
0.99	0.96	0.83

Power Rating

kW/m ² :	0.60	kW/Collector:	1.74
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COLLECTOR PERFORMANCE RATING

<i>kWh/day</i>	5°C	20°C	50°C	80°C
Standard Day	5.9	4.4	1.5	0.4



MANUFACTURER'S COMMENTS

Manufacturer's recommended flow is 1.0 l/min.

Product Name: **Solcan**
 Collector Type: **glazed flat plate**
 Canadian Supplier: **Solcan Ltd**

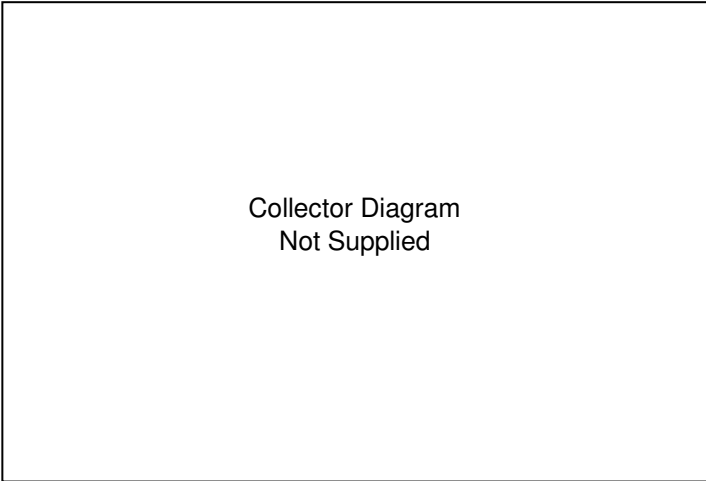
Product Model: **2101**
 Applications: **medium temperature**
 Manufacturer: **Solcan Ltd**
Canada

Warranty & Limitations: **full warranty for 10 years**

Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	2,450	1,175	76
Gross Area (m ²):	2.9		
Net Aperture Area (m ²):	2.7		
Weight (dry) (kg):	50		
Weight (filled) (kg):	52		
Fluid Capacity (litres):	0		
Maximum Operating Temperature (°C):	165		
Maximum Operating Pressure (kPa):	300		
	<i>min</i>	<i>max</i>	
Acceptable Flow Rates (l/min):	2.0	3.0	
Ideal Flow Rate (l/m):	2.2		
Heat Transfer Fluids:	water, propylene glycol		



COLLECTOR MATERIALS

Frame Material:	aluminum
Coating:	none
Mounting Connections:	rt angle aluminum bracket
Glazing Material (outer):	low iron tempered glass
Glazing Material (inner):	none
Absorber Plate Material:	copper fin
Absorber Plate Coating:	selective
Tubing Material:	copper
Plate-Tubing Bonding Method:	high frequency welding
Insulation (sides):	foil-faced isocyanurate foam
Insulation (back):	foil-faced isocyanurate foam
Header Pipe Size (OD) (mm):	19
Header Pipe Material:	copper
Plumbing Connection Method:	male/female unions

INDEPENDENT TESTING/CERTIFICATION	<i>Canadian Standards</i>	<i>Other Standards</i>
Name of Testing Authority:		Swedish NTRI
Standard Tested to:		EN12975-2
Date of Testing or Certification:		01-Dec-06
Certified to Standard (yes/no):		

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid: **60/40 water propylene glycol**
 Test Flow Rate (l/min): **2.8**
 Efficiency Curve (W/m²·°C)
 Y Intercept [F_R(t_a)]: **0.77**
 Slope of efficiency curve: [F_RU_L]: **3.400**

Incident Angle Modifier

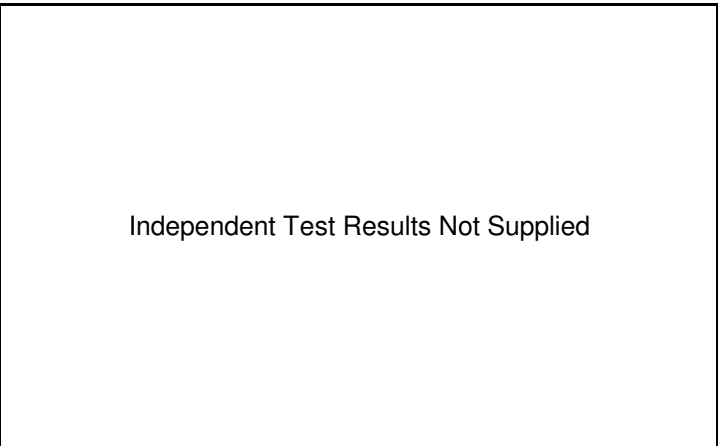
30°	45°	60°
0.98	0.93	

Power Rating

kW/m²: **0.71** kW/Collector **1.92**

COLLECTOR PERFORMANCE RATING

kWh/day	5°C	20°C	50°C	80°C
Standard Day				



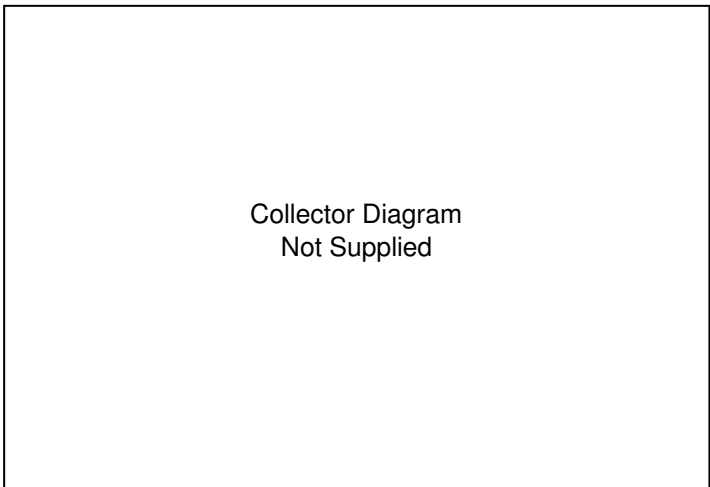
MANUFACTURER'S COMMENTS

A system test was carried out in 2000 at the NSTF with two 2101 collectors to F379. The absorber with Batec absorber was tested by Batec in Sweden.

Product Name: **Heliocol** Product Model: **Heliocol 40**
Collector Type: **Stationary Pool Collector** Applications: **Low Temperature**
Canadian Supplier: **Sunsolar Energy Technology (SET)** Manufacturer: **Heliocol Israel**
Warranty & Limitations: **12 Year Warranty** Date First Listed in Directory: **Mar-07**

COLLECTOR SPECIFICATIONS

	<i>height</i>	<i>width</i>	<i>depth</i>
Dimensions (mm):	3,226	1,172	40
Gross Area (m ²):		3.8	
Net Aperture Area (m ²):		3.8	
Weight (dry) (kg):		9	
Weight (filled) (kg):		16	
Fluid Capacity (litres):		12	
Maximum Operating Temperature (°C):			
Maximum Operating Pressure (kPa):		207	
		<i>min</i>	<i>max</i>
Acceptable Flow Rates (l/min):		15.1	30.3
Ideal Flow Rate (l/m):		19.2	
Heat Transfer Fluids:	WATER, PROPYLENE GLYCOL		



COLLECTOR MATERIALS

Mounting Connections: **GATOR CLAMPS AND/OR ZBARS**
Absorber Plate Material: **POLYPROPYLENE**
Header Pipe Size (OD) (mm):
Header Pipe Material:
Plumbing Connection Method:

INDEPENDENT TESTING/CERTIFICATION

Canadian Standards *Other Standards*

Name of Testing Authority:
Standard Tested to:
Date of Testing or Certification:
Certified to Standard (yes/no):

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Test Fluid:
Test Flow Rate (l/min):
Efficiency Curve (W/m²·°C)
Y Intercept [F_R(ta)]:
Slope of efficiency curve: [F_RU_L]:

Incident Angle Modifier

30°	45°	60°

Power Rating
kW/m²: kW/Collector:

UNGLAZED COLLECTOR PERFORMANCE RATING

<i>Wind Speed</i>	0.0 m/s	2.5 m/s	5.0 m/s
<i>kWh/day</i>			

Performance Rating done for Standard Day with a Δ T of 5° C



MANUFACTURER'S COMMENTS

4. Directory of Packaged Solar DHW Systems

Listing of Packaged Solar DHW Systems

The following listing is for packaged solar domestic hot water systems that have submitted applications to NRCan for support to become certified to CSA-F379.1-2004.

Company	Product Name	Model Number	CAN/CSA F379.1		Original Listing Date	Revision Date	Data Sheet in Directory
			Date of Testing	Date of Certification			
CaREarth	-	-		pending			
Copperhill Alternate Energy Inc.	-	-		pending			
EnerWorks Inc.	Solar DHW Appliance	EWRA1	Nov-06	Nov-06	Mar-07	Mar-07	yes
EnerWorks Inc.	Solar DHW Appliance	EWRA2	Nov-06	Nov-06	Mar-07	Mar-07	yes
EnerWorks Inc.	Solar DHW Appliance	EWRA3	Nov-06	Nov-06	Mar-07	Mar-07	yes
EnerWorks Inc.	Solar DHW Appliance	EWRA4	Nov-06	Nov-06	Mar-07	Mar-07	yes
Globe Solar Energy Inc.	-	-		pending			
Solcan Ltd.	Solar DHW Package	DD64-60	-	-	Mar-07	Mar-07	yes
Solcan Ltd.	Solar DHW Package	SC64-60	May-00	-	Mar-07	Mar-07	yes
Solcan Ltd.	Solar DHW Package	TS32-60	-	-	Mar-07	Mar-07	yes
Thermomax Industries Ltd.	Thermomax	DF100-20		pending	Mar-07	Mar-07	yes
Thermomax Industries Ltd.	Thermomax	DF100-30		pending	Mar-07	Mar-07	yes
Trimline Design Centre Inc.	-	-		pending	Mar-07	Mar-07	yes

Listing of Supplier Contacts

Products tested to F379.1
Solcan Ltd. 126 Wynchwood Park London, ON Canada, N6G 1R7 www.solcan.com

Products Certified to F379.1
EnerWorks Inc. P.O. Box 9, 252 Hamilton Crescent Dorchester, ON Canada, N0L 1G0 www.enerworks.com

Products Submitted for Certification
CaREarth 701 Eagleson Rd, P.O. Box 45006 Kanata, ON Canada, K2M 2G0 www.carearth.com
Copperhill Alternate Energy Inc. 2524 Asphodel 10th Line Norwood, ON Canada, K0L 2V0 www.copperhill.ca
Globe Solar Energy Inc. 136 Finch Ave. East Toronto, ON Canada, M2N 4R7 www.globesolarenergy.com
Thermomax Industries Ltd. 3181 Kingsley Street Victoria, BC Canada, V8P 4J5 www.solarthermal.com
Trimline Design Centre Inc. 6772 99 Street NW Edmonton, AB Canada, T6E 5B8 www.trimlinedesigncentre.com

Note: Only suppliers who have submitted their product for listing or are members of CanSIA are listed.

Summary of Key Characteristics of Packaged Solar DHW Systems

Manufacturer	Brand Name	Model Number	System Type	Solar Collector				System Power Rating (kW)	Tank Size (litres)	Storage Method	Performance Rating (kWh/year)			Warranty Period (years)
				Collector Name	Collector Manufacturer	Collector Type	No.				150 litres	225 litres	300 litres	
EnerWorks Inc.	Solar DHW Appliance	EWRA1	closed loop	COL-4X8-TL-SG1-SD10	EnerWorks	glazed flat plate	1	1.6	113 - 273	-	-	-	-	5
EnerWorks Inc.	Solar DHW Appliance	EWRA2	closed loop	COL-4X8-TL-SG1-SD10	EnerWorks	glazed flat plate	2	3.2	273 - 365	-	-	-	-	5
EnerWorks Inc.	Solar DHW Appliance	EWRA3	closed loop	COL-4X8-TL-SG1-SD10	EnerWorks	glazed flat plate	3	4.8	365 - 454	-	-	-	-	5
EnerWorks Inc.	Solar DHW Appliance	EWRA4	closed loop	COL-4X8-TL-SG1-SD10	EnerWorks	glazed flat plate	4	6.4	454 - 545	-	-	-	-	5
Solcan Ltd.	Solar DHW Package	DD64-60	drain back	2100	Solcan	glazed flat plate	2	3.4	225	-	-	-	-	10
Solcan Ltd.	Solar DHW Package	SC64-60	closed loop	2100	Solcan	glazed flat plate	1	1.7	225	-	-	-	-	10
Solcan Ltd.	Solar DHW Package	TS32-60	thermosiphon	2101	Solcan	glazed flat plate	2	-	225	-	-	-	-	10
Thermomax Industries Ltd.	Thermomax	DF100-20	direct flow	DF100-20	Thermomax	evacuated tube	1	1.6	230 - 456	-	-	-	-	10
Thermomax Industries Ltd.	Thermomax	DF100-30	direct flow	DF100 -30	Thermomax	evacuated tube	1	2.4	230 - 456	-	-	-	-	10
Trimline Design Centre Inc.	-	-	-	-	-	glazed flat plate	-	-	-	-	-	-	-	-

Packaged Solar DHW System Data Sheets

Product Name: **Solar DHW Appliance**
System Type: **Closed loop**
Canadian Supplier: **EnerWorks Inc**

Model: **EWRA1**
Collector Type: **Glazed flat plate**
Manufacturer: **EnerWorks Inc.**
Canada

Warranty: **5 yr full; labour reimbursable up to \$100 in 1st year**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: **Residential Collector**
Model #: **COL-4X8-TL-SG1-SD10**
Collector Type: **Glazed flat plate**
Manufacturer: **EnerWorks**
Number of collectors: **1**
Net Aperture Area (m²): **-**

Piping

Material: **Copper, refrigeration grade, flexible**
Size (mm): **9.5/7.2**
Max Pipe Run (m): **30**
Recommended Temperature Tolerances (°C):
130 minimum 150 maximum
Insulation: **3/8" ID x 3/8" wall thickness; must be protected from UV radiation**

Solar Storage Tank

Tank Required (yes/no): **yes**
Storage Capacity (litres):
Tank Included (yes/no): **no**
Approved Tanks (Manufacturer and Model Number)

Any CSA approved tank; Recommended size: EWRA1=113 to 273L; EWRA2=273 to 365L; EWRA3=365 to 454L; EWRA4=454 to 545 L

Pump

Type of Pump: **Miniature gear pump, Fluid-O-Tech MG209, 6W, fixed flow**
Power Source: **Standard AC 115V/60Hz**
Flow rate (litres/min) **1.1 minimum 1.1 maximum**
Power Rating **25 watts 115 volts**
Estimated Energy Consumption (kWh/year): **75**

Heat Exchanger

Description **External brazed plate, 316 Stainless Steel plates with pure copper brazing**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
Certification Test # **Bodycote #05-08-9129; CSA-Int Master Contract #232023, Cert.#1721596**
Date of Certification **08-Nov-06**

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

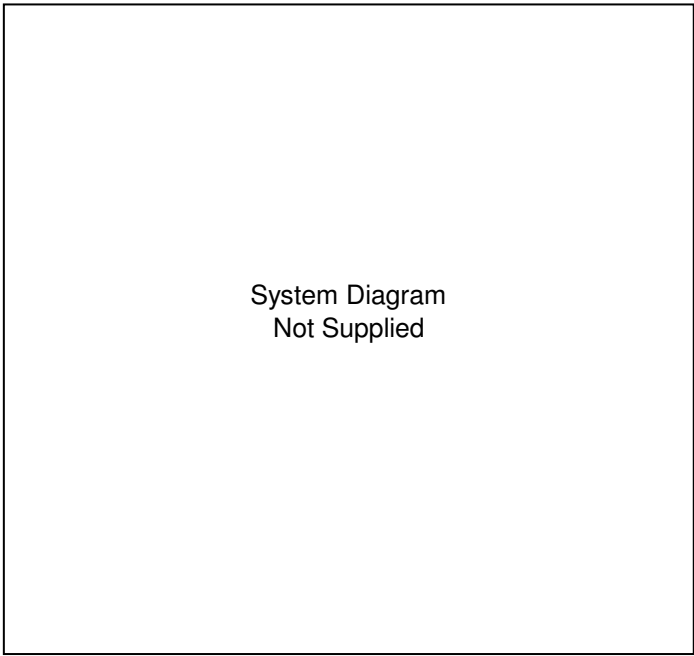
Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Micro-flow, closed loop glycol system with patented collector overheat protection device and automatic heat exchanger cleaning valve



Product Name: **Solar DHW Appliance**

System Type: **Closed loop**

Canadian Supplier: **EnerWorks Inc**

Model: **EWRA2**

Collector Type: **Glazed flat plate**

Manufacturer: **EnerWorks Inc.
Canada**

Warranty: **5 yr full; labour reimbursable up to \$100 in 1st year**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: **Residential Collector**
Model #: **COL-4X8-TL-SG1-SD10**
Collector Type: **Glazed flat plate**
Manufacturer: **EnerWorks**
Number of collectors: **2**
Net Aperture Area (m²): **-**

Piping

Material: **Copper, refrigeration grade, flexible**
Size (mm): **9.5/7.2**
Max Pipe Run (m): **30**
Recommended Temperature Tolerances (°C):
130 minimum 150 maximum
Insulation: **3/8" ID x 3/8" wall thickness; must be protected
from UV radiation**

System Diagram
Not Supplied

Solar Storage Tank

Tank Required (yes/no): **yes**
Storage Capacity (litres):
Tank Included (yes/no): **no**
Approved Tanks (Manufacturer and Model Number)

**Any CSA approved tank; Recommended size: EWRA1=113 to 273L; EWRA2=273 to 365L; EWRA3=365 to 454L;
EWRA4=454 to 545 L**

Pump

Type of Pump: **Miniature gear pump, Fluid-O-Tech MG209, 6W, fixed flow**
Power Source: **Standard AC 115V/60Hz**
Flow rate (litres/min) **1.1 minimum 1.1 maximum**
Power Rating **25 watts 115 volts**
Estimated Energy Consumption (kWh/year): **75**

Heat Exchanger

Description **External brazed plate, 316 Stainless Steel plates with pure copper brazing**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems

Certification Test # **Bodycote #05-08-9129; CSA-Int Master Contract #232023, Cert.#1721596**

Date of Certification **08-Nov-06**

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Micro-flow, closed loop glycol system with patented collector overheat protection device and automatic heat exchanger cleaning valve

Product Name: **Solar DHW Appliance**
 System Type: **Closed loop**
 Canadian Supplier: **EnerWorks Inc**

Model: **EWRA3**
 Collector Type: **Glazed flat plate**
 Manufacturer: **EnerWorks Inc.
 Canada**

Warranty: **5 yr full; labour reimbursable up to \$100 in 1st year**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: **Residential Collector**
 Model #: **COL-4X8-TL-SG1-SD10**
 Collector Type: **Glazed flat plate**
 Manufacturer: **EnerWorks**
 Number of collectors: **3**
 Net Aperture Area (m²): **-**

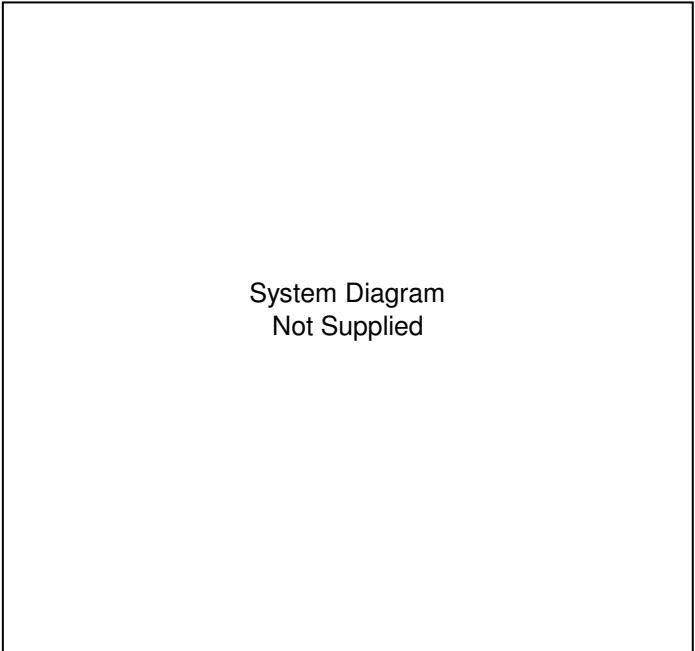
Piping

Material: **Copper, refrigeration grade, flexible**
 Size (mm): **9.5/7.2**
 Max Pipe Run (m): **30**
 Recommended Temperature Tolerances (°C):
130 minimum 150 maximum
 Insulation: **3/8" ID x 3/8" wall thickness; must be protected
 from UV radiation**

Solar Storage Tank

Tank Required (yes/no): **yes**
 Storage Capacity (litres):
 Tank Included (yes/no): **no**
 Approved Tanks (Manufacturer and Model Number)

**Any CSA approved tank; Recommended size: EWRA1=113 to 273L; EWRA2=273 to 365L; EWRA3=365 to 454L;
 EWRA4=454 to 545 L**



Pump

Type of Pump: **Miniature gear pump, Fluid-O-Tech MG209, 6W, fixed flow**
 Power Source: **Standard AC 115V/60Hz**
 Flow rate (litres/min) **1.1 minimum 1.1 maximum**
 Power Rating **25 watts 115 volts**
 Estimated Energy Consumption (kWh/year): **75**

Heat Exchanger

Description **External brazed plate, 316 Stainless Steel plates with pure copper brazing**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
 Certification Test # **Bodycote #05-08-9129; CSA-Int Master Contract #232023, Cert.#1721596**
 Date of Certification **08-Nov-06**

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Micro-flow, closed loop glycol system with patented collector overheat protection device and automatic heat exchanger cleaning valve

Product Name: **Solar DHW Appliance**
System Type: **Closed loop**
Canadian Supplier: **EnerWorks Inc**

Model: **EWRA4**
Collector Type: **Glazed flat plate**
Manufacturer: **EnerWorks Inc.**
Canada

Warranty: **5 yr full; labour reimbursable up to \$100 in 1st year**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: **Residential Collector**
Model #: **COL-4X8-TL-SG1-SD10**
Collector Type: **Glazed flat plate**
Manufacturer: **EnerWorks**
Number of collectors: **4**
Net Aperture Area (m²): **-**

Piping

Material: **Copper, refrigeration grade, flexible**
Size (mm): **9.5/7.2**
Max Pipe Run (m): **30**
Recommended Temperature Tolerances (°C):
130 minimum 150 maximum
Insulation: **3/8" ID x 3/8" wall thickness; must be protected from UV radiation**

Solar Storage Tank

Tank Required (yes/no): **yes**
Storage Capacity (litres):
Tank Included (yes/no): **no**
Approved Tanks (Manufacturer and Model Number)

Any CSA approved tank; Recommended size: EWRA1=113 to 273L; EWRA2=273 to 365L; EWRA3=365 to 454L; EWRA4=454 to 545 L

Pump

Type of Pump: **Miniature gear pump, Fluid-O-Tech MG209, 6W, fixed flow**
Power Source: **Standard AC 115V/60Hz**
Flow rate (litres/min) **1.1 minimum 1.1 maximum**
Power Rating **25 watts 115 volts**
Estimated Energy Consumption (kWh/year): **75**

Heat Exchanger

Description **External brazed plate, 316 Stainless Steel plates with pure copper brazing**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
Certification Test # **Bodycote #05-08-9129; CSA-Int Master Contract #232023, Cert.#1721596**
Date of Certification **08-Nov-06**

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

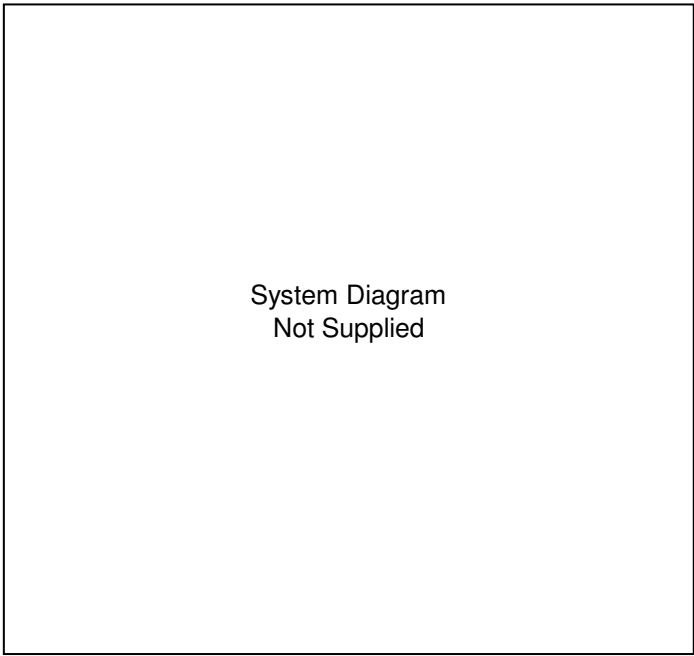
Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Micro-flow, closed loop glycol system with patented collector overheat protection device and automatic heat exchanger cleaning valve



Product Name: **Solar DHW package**
System Type: **closed loop**
Canadian Supplier: **Solcan Ltd.**

Model: **SC64-60**
Collector Type: **glazed flat plate**
Manufacturer: **Solcan Ltd
Canada**

Warranty: **ten years full warranty on collectors**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

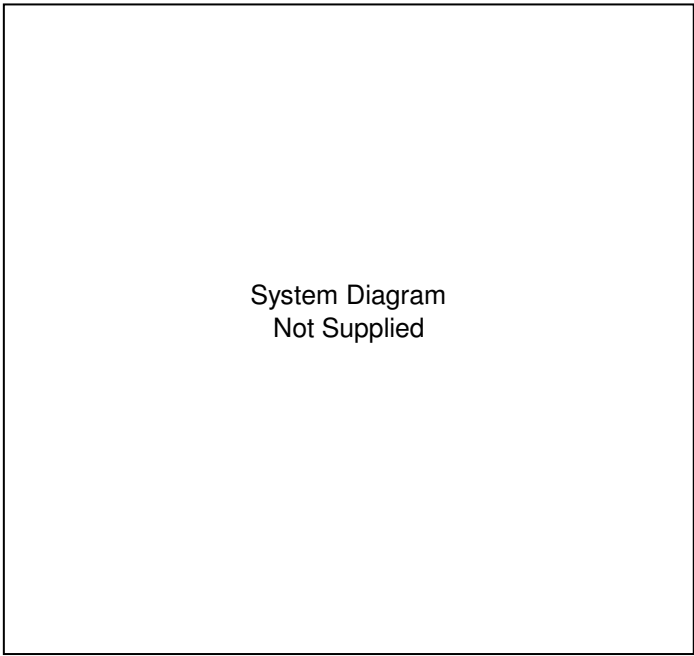
Product Name: **Solcan**
Model #: **2101**
Collector Type: **glazed flat plate**
Manufacturer: **Solcan**
Number of collectors: **2**
Net Aperture Area (m²): **5.45**

Piping

Material: **copper**
Size (mm): **13**
Max Pipe Run (m): **20**
Recommended Temperature Tolerances (°C):
-40 minimum 165 maximum
Insulation: **fibreglass is recommended, 0.6 RSI, 40 mm**

Solar Storage Tank

Tank Required (yes/no):
Storage Capacity (litres): **225**
Tank Included (yes/no):
Approved Tanks (Manufacturer and Model Number)
Advance Metalpres JASS 60P stainless steel tank with stainless steel internal HX



Pump

Type of Pump: **Grundfos UP15-42 B5**
Power Source: **AC powerline**
Flow rate (litres/min) **1 minimum 2.5 maximum**
Power Rating **70 watts 120 volts**
Estimated Energy Consumption (kWh/year): **140**

Heat Exchanger

Description **internal heat exchanger**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
Certification Test # **00-08-9042-Solcan**
Date of Certification **18-May-00**

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Package is available with other sizes of stainless steel tanks or with glass-lined tank with external stainless steel plate HX.

Product Name: **Solar DHW package**
 System Type: **thermosiphon**
 Canadian Supplier: **Solcan Ltd**

Model: **TS32-60**
 Collector Type: **glazed flat plate**
 Manufacturer: **Solcan Ltd
Canada**

Warranty: **ten years full warranty on collectors**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: **Solcan**
 Model #: **2100**
 Collector Type: **glazed flat plate**
 Manufacturer: **Solcan Ltd.**
 Number of collectors: **1**
 Net Aperture Area (m²): **2.73**

Piping

Material: **copper**
 Size (mm): **13**
 Max Pipe Run (m): **n/a**
 Recommended Temperature Tolerances (°C):
0 minimum 90 maximum
 Insulation: **Nomalock is recommended, 0.3 RSI, 40 mm**

Solar Storage Tank

Tank Required (yes/no):
 Storage Capacity (litres): **225**
 Tank Included (yes/no):
 Approved Tanks (Manufacturer and Model Number)
Advance Metalpres stainless steel tank.

Pump

Type of Pump: **n/a**
 Power Source: **n/a**
 Flow rate (litres/min) **n/a** *minimum* **n/a** *maximum*
 Power Rating **n/a** *watts* **n/a** *volts*
 Estimated Energy Consumption (kWh/year): **n/a**

Heat Exchanger

Description **n/a**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
 Certification Test # **00-08-9042-Solcan**
 Date of Certification

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

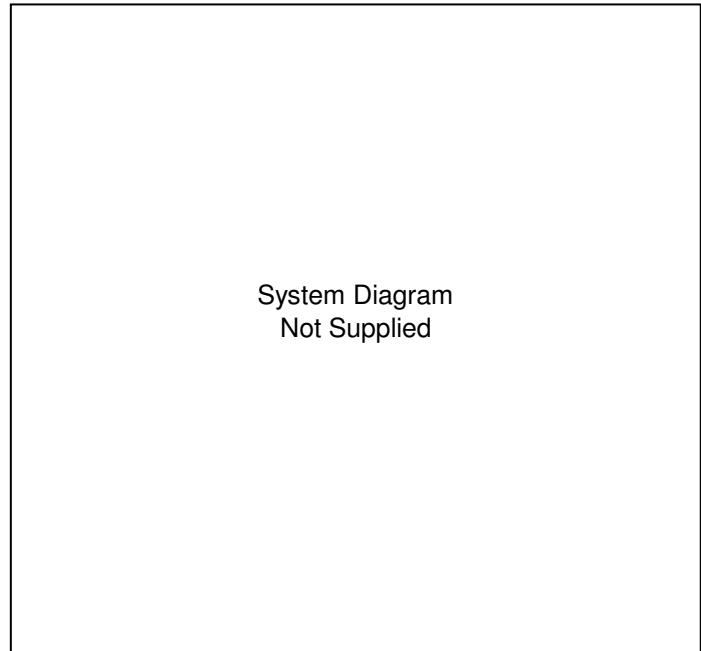
Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS



Product Name: **Solar DHW package**
System Type: **drainback**
Canadian Supplier: **Solcan Ltd**

Model: **DD64-60**
Collector Type: **glazed flat plate**
Manufacturer: **Solcan Ltd
Canada**

Warranty: **ten years full warranty on collectors**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors *(see separate Collector Data Sheet)*

Product Name: **Solcan**
Model #: **2101**
Collector Type: **glazed flat plate**
Manufacturer: **Solcan**
Number of collectors: **2**
Net Aperture Area (m²): **5.45**

Piping

Material: **copper**
Size (mm): **13**
Max Pipe Run (m): **20**
Recommended Temperature Tolerances (°C):
-40 minimum 165 maximum
Insulation: **fibreglass is recommended, 0.6 RSI, 40 mm**

Solar Storage Tank

Tank Required (yes/no):
Storage Capacity (litres): **225**
Tank Included (yes/no):
Approved Tanks (Manufacturer and Model Number)

Advance Metalpres JASS 60P stainless steel tank with stainless steel internal HX for solar storage plus 40 litre drainback tank.

Pump

Type of Pump: **Grundfos UP26-96BF**
Power Source: **AC powerline**
Flow rate (litres/min) **1 minimum 2.5 maximum**
Power Rating **120 watts 120 volts**
Estimated Energy Consumption (kWh/year): **240**

Heat Exchanger

Description **available with internal or external heat exchanger**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
Certification Test #
Date of Certification

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

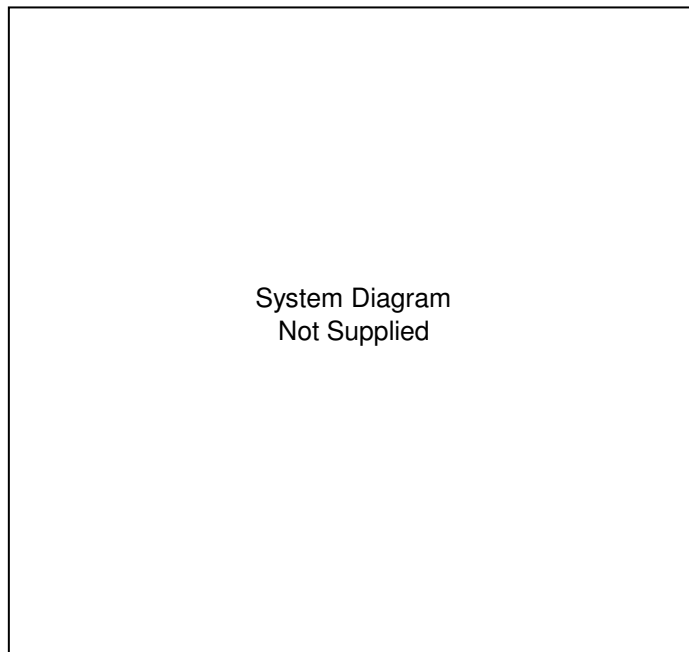
Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Package is available with other sizes of stainless steel or glass-lined tanks.



Product Name: **Thermomax**
 System Type: **coaxial copper direct flow**
 Canadian Supplier: **Thermomax industries Ltd**

Model: **DF 100-20**
 Collector Type: **Evacuated Tube**
 Manufacturer: **Thermomax UK**

Warranty: **10 years**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

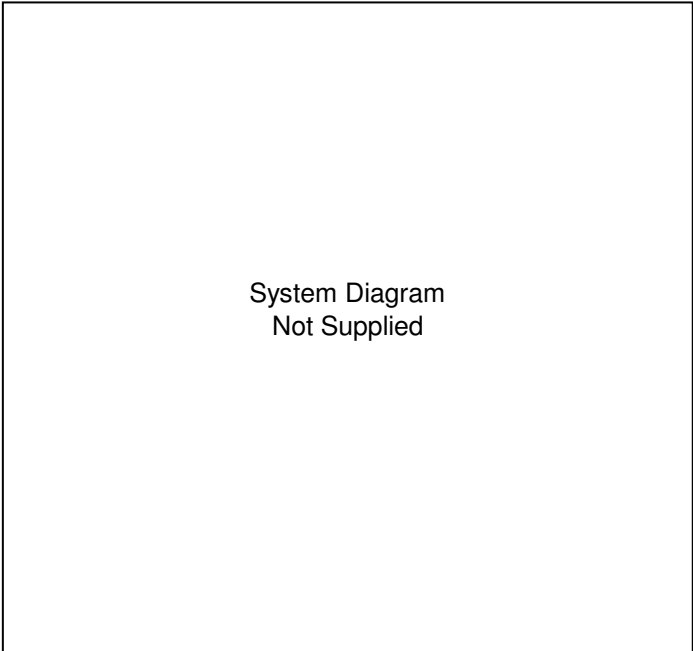
Product Name: **Thermomax**
 Model #: **DF 100-20**
 Collector Type: **evacuated tube**
 Manufacturer: **Thermomax**
 Number of collectors: **1**
 Net Aperture Area (m²): **2.153**

Piping

Material: **Copper**
 Size (mm): **1/2"-3/4"+ ID system dependent**
 Max Pipe Run (m): **100**
 Recommended Temperature Tolerances (°C):
 -50 minimum 110 maximum
 Insulation: **High temperature boiler run insulation e.g. Armaflex**

Solar Storage Tank

Tank Required (yes/no):
 Storage Capacity (litres): **230, 304, 456**
 Tank Included (yes/no):
 Approved Tanks (Manufacturer and Model Number)
 SST 60, 80, 120, Rheem 80/120, others.



Pump

Type of Pump: **Wilco Star 16U 15, Grundfoss, Taco, various**
 Power Source: **AC**
 Flow rate (litres/min) **1.6 minimum 58 maximum**
 Power Rating **80 watts 115 volts**
 Estimated Energy Consumption (kWh/year):

Heat Exchanger

Description **various.**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
 Certification Test #
 Date of Certification

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Product Name: **Thermomax**
System Type: **coaxial copper direct flow**
Canadian Supplier: **Thermomax industries Ltd**

Model: **DF 100-30**
Collector Type: **Evacuated Tube**
Manufacturer: **Thermomax UK**

Warranty: **10 years**

Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: **Thermomax**
Model #: **DF 100-30**
Collector Type: **evacuated tube**
Manufacturer: **Thermomax**
Number of collectors: **1**
Net Aperture Area (m²): **3.228**

Piping

Material: **Copper**
Size (mm): **1/2"-3/4"+ ID system dependent**
Max Pipe Run (m): **100**
Recommended Temperature Tolerances (°C):
-50 minimum 110 maximum
Insulation: **High temperature boiler run insulation e.g. Armaflex**

Solar Storage Tank

Tank Required (yes/no):
Storage Capacity (litres): **230, 304, 456**
Tank Included (yes/no):
Approved Tanks (Manufacturer and Model Number)
SST 60, 80, 120, Rheem 80/120, others.

System Diagram
Not Supplied

Pump

Type of Pump: **Wilco Star 16U 15, Grundfoss, Taco, various**
Power Source: **AC**
Flow rate (litres/min) **1.6 minimum 58 maximum**
Power Rating **80 watts 115 volts**
Estimated Energy Consumption (kWh/year):

Heat Exchanger

Description **various.**

CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
Certification Test #
Date of Certification

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year			

MANUFACTURER'S COMMENTS

Product Name: -
 System Type: **Medium temperature (service hot water)**
 Canadian Supplier: **Trimline Design Centre Inc.**

Model: -
 Collector Type: **Glazed Flat Plate**
 Manufacturer: **Trimline Design Centre Inc.
 Canada**

Warranty: - Date First Listed in Directory: **Mar-07**

SYSTEM COMPONENT SPECIFICATIONS

Collectors (see separate Collector Data Sheet)

Product Name: -
 Model #: -
 Collector Type: **Glazed Flat Plate**
 Manufacturer: -
 Number of collectors: -
 Net Aperture Area (m²): -

Piping

Material: -
 Size (mm): -
 Max Pipe Run (m): -
 Recommended Temperature Tolerances (°C):
 - *minimum* - *maximum*
 Insulation: -

Solar Storage Tank

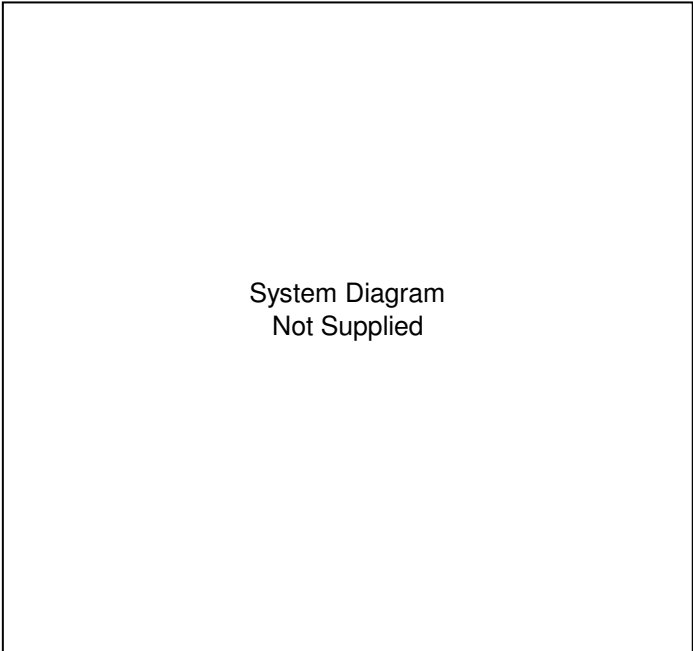
Tank Required (yes/no): -
 Storage Capacity (litres): -
 Tank Included (yes/no): -
 Approved Tanks (Manufacturer and Model Number)
 -

Pump

Type of Pump: -
 Power Source: -
 Flow rate (litres/min) - *minimum* - *maximum*
 Power Rating - *watts* - *volts*
 Estimated Energy Consumption (kWh/year): -

Heat Exchanger

Description -



CSA CERTIFICATION

Certified to CAN/CSA-F379.1-88 (R2004): Solar Domestic Hot Water Systems
 Certification Test #
 Date of Certification

PERFORMANCE DATA

Note: This section is only completed if supplier has submitted independent test results

Total System Power Rating (kW):

Water Storage Method: Solar Preheat Solar Plus Solar Only

Net Annual Solar Energy Contribution (kWh/year)

Daily Hot Water Load	150 litres/day	225 litres/day	300 litres/day
kWh/year	-	-	-

MANUFACTURER'S COMMENTS

[Empty box for manufacturer's comments]

Appendix A: Conversion Factors

Metric	Imperial
1 kg	2.20 lb
1 m	3.281 ft
1 cm	0.394 in
1 m ²	10.76 sq ft.
1 J	277.77 Watt-hours
1 L	0.0353 cubic ft
1 L	0.264 gal (US liquid)
1 L	0.22 gal (UK)
$^{\circ}\text{C} = (^{\circ}\text{F}-32)\times(5/9)$	$^{\circ}\text{F} = ^{\circ}\text{C}\times(9/5)+32$
1 kg of water	1 liter

Appendix B: Comparison of Key Features of CSA F378 to International Standards

CSA-F378 (Liquid & Air Collectors)	SRCC 100 (Liquid & Air Collectors)	ISO 9806-1, -2, -3 (Liquid Collectors)	EN 12975-1, -2 (Liquid Collectors)
		Three (3) collectors required for full test sequence.	
6.2.1 Liquid collector static pressure leakage: 15 minute duration; 1.5 times specified maximum operating pressure.	4.2 Pressure test, liquid collector: 15 minute duration; 160 psig for street pressure collectors; different pressures for other types.	5.1 Internal pressure, liquid collector (metal absorber): 10 minute duration; 1.5 times specified maximum operating pressure. 5.2 Internal pressure, liquid collector (organic absorber): 1 hour duration; 1.5 times specified maximum operating pressure; Solar exposure & high ambient temp. Required.	5.2.1 Internal pressure (metal absorber): 15 minute duration; 1.5x specified maximum operating pressure. 5.2.2 Internal pressure (organic absorber): 1 hour duration; 1.5x specified maximum operating pressure; Solar exposure & high ambient temp. required.
6.2.2 Air collector static pressure leakage: 5 test pressures up to 750 kPa or to specified maximum operating pressure, for 5 minutes each	4.2 Pressure test, air collector: Apply pressure of 125 Pa for one hour, monitor air volume required to maintain it.	5.3 Internal pressure, air collector (metal absorber): 1.2 times specified maximum operating ΔP for 10 min. 5.4 Internal pressure, air collector (organic absorber): Test temperature as determined by high temperature resistance test (6.); 1.2 times specified maximum operating ΔP for 1 hour.	
5.5.2.4 Solar collector shall have a pressure drop of not greater than one-half of the mfrs. recommended working pressure at manufacturer's recommended flow rate.	4.2.4 Pressure Drop test (ΔP vs. flow): Measure at points from minimum to maximum design flow rates, including ASHRAE standard flow rate.	12. Pressure Drop test: Measure at points which span range likely to be used. If flow rate is not specified by the supplier, test at five equally spaced measurements over range of 0.005 - 0.03 kg/s/m ² of collector area. For unglazed collectors use 0.02 - 0.1 kg/s/m ² of collector area.	6.1.8 Pressure Drop test: Measure at points which span range likely to be used. If flow rate is not specified by the supplier, test at five equally spaced measurements over range of 0.005 - 0.03 kg/s/m ² of collector area. For unglazed collectors use 0.02 - 0.1 kg/s/m ² of collector area.
		6. High Temperature Resistance Test: 3 classes: 950-1049 W/m ² at 25 - 29.9 °C ambient; 1050-1200 W/m ² at 30 - 40 °C ambient; or >1200 W/m ² at >40 °C ambient. Monitor collector temperature. One-hour solar exposure (dry), or use a hot fluid loop.	5.3 High Temperature Resistance Test: 1 hour of solar exposure >1000 W/m ² at 20 - 40 °C ambient air temperature. Monitor collector temperature.
6.2.3 Outdoor no-flow exposure test: 30 days Start wet One 30-minute rain penetration spray at start;	4.3 Exposure test: 30 days Dry start	7. Exposure Test: 30 days Dry start 10. Rain Penetration Test: Tilt collector at 45° (or manufacturer's specified tilt angle), spray for 4 hours. Collector is weighed before and after spray, or visual inspection is made for water penetration.	5.4 Exposure test: 30 days Dry start 5.7 Rain Penetration Test (glazed collectors only): Tilt collector at 30° (or manufacturer's specified tilt angle); spray for 4 hours. Collector is weighed before (3 times) & after spray, or visual inspection is made for water penetration.
	3 water sprays (5 minutes) after 20 exposure days;	Two water sprays, 15 minutes each (section 8.);	5.5 Two water sprays (15 minutes each);
1 cold fill, 5 minute duration; 17 MJ/m ² per day; 1/2 hour period >950 + 5(30-Ta) W/m ²	1 cold fill (5 minutes) after 20 exposure days; 18 MJ/m ² per day; 4 hour period >950 W/m ² > 27 °C ambient.	1 cold fill, 5 minutes (section 9.); 14, 18 or 20 MJ/m ² per day (3 classes); 30 hours exposure at one of 3 climate classes specified.	5.6 Two cold fills, 5 minutes; 14 MJ/m ² per day; 30 hours exposure >850 W/m ² at >10 °C ambient.

Appendix C: Canadian Standards Applicable to Solar DHW System Components

SDHWS Component	Applicable Standard
Solar Collectors	CSA F378-87 (with the exception of Clause 4 and Clause 6.1)
Air vents	None
Piping/adapters	None
Globe valves	None
Pumps	CSA C22.2 No. 108
Strainers	None
Air eliminators	None
Expansion tanks	None
Gate valves	None
Drain valves	CSA B125
Check valves	(soft seating required)
Pressure relief valves	CGA CAN1-4.4 or ANSI Z21.22
Differential thermostats	CSA C22.2 No.24
Storage tanks	CSA C309
Heat exchangers	F379.1 clause 7.4
Pressure and temperature relief valves	CGA CAN1-4.4 or ANSI Z21.22
Backflow preventer	CSA B64 Series
Mixing or tempering valve	None
Pressure gauge	None
Thermometer	None
Solenoid valves	CSA C22.2 No. 139
Water hammer arrestors	None
Plumbing fittings	CSA B125
Vacuum breakers	CSA B64 Series
Controls	CSA C22.2 No. 24

Appendix D: CanSIA Guidelines for the Inspection of Packaged SDHW Systems

Instructions to the Professional Engineer Providing Independent Assessment of Non-Packaged Solar Domestic Hot Water Heating (SDHW) Systems

- Date:** November 3, 2005
- Equipment:** Non-Packaged (custom) Solar Domestic Hot Water Heating Systems
- References:** CSA F379.1-88 Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)
- CSA F379.2- M89 Seasonal Use Solar Domestic Hot Water Systems
- CSA International Technical Information Letter (TIL) MSE-45 – Interim Certification Requirements for Packaged Solar Domestic Hot Water (SDHW) Systems
- Purpose:** To provide the equivalent of product certification for Solar Domestic Hot Water Heating (SDHW) Systems that do not fall within the scope of CSA F379.1 and TIL No. MSE-45.

Background

Solar Domestic Hot Water Heating (SDHW) Systems may be pre-engineered to comply with the above reference documents and are known as “packaged systems”. These standards offer the requirements for both factory-packaged and add-on packaged systems as proposed by a manufacturer for all subcomponents and materials of a given SDHW design.

Packaged systems are intended to provide a supply of heating energy to a domestic hot water storage tank, through the use of solar thermal collectors, liquid heat transfer media (with or without antifreeze protection), heat transfer exchanger between the heat transfer media and potable water, appropriate plumbing and electrical controls to affect this transfer.

A category of non-packaged or “custom systems” are available where captured heat energy may be directed to multiple sources of thermal energy absorbers such as hot tubs, swimming pools and saunas, in addition to providing domestic hot water. Although it may be possible to install a multiplicity of packaged systems, this is known to be an inefficient and expensive proposition.

Custom residential SDHW systems (which include commercial SDHW systems) do not fall under the jurisdiction of the above noted reference standards, creating a gap in the regulatory means for installing them. Municipal code enforcement personnel and industry do not have an effective means for bridging this gap.

This plan offers a solution to the problem of code and safety compliance for custom, non-packaged SDHW systems, by providing specific instructions to licensed Professional Engineers, regarding this issue. The intent of these requirements is to ensure that licensed engineers are aware of these requirements and to ensure that these requirements form part of the approved product plan from building departments.

Requirements

1. Licensed Professional Engineers will certify that the applicant custom-engineered Solar Domestic Hot Water (SDHW) System conforms with the intent of CSA International Technical Information Letter MSE-45 (or CSA F379.1-05 once it is published) and the intent of the requirements for SDHW systems in the National Plumbing Code of Canada.
2. The Licensed Engineer will apply sound engineering practices as intended by the above Reference Documents to ensure the public safety.
3. To affix to a copy of this document the Seal of a Licensed Professional Engineer, indicating that these requirements formed a part of the proposed SDHW design.
4. By affixing the above referenced Seal to this document, the Licensed Professional Engineer certifies that they have the technical competence to complete and certify the requirements contained herein.

Installer Requirements:

Installations may be completed by qualified installers certified by the Canadian Solar Industries Association (www.cansia.ca) or by persons who are not certified to industry standards. In the latter case, the professional engineer shall be called on to examine the final installation to ensure installation compliance with CAN/CSA-F383.

Appendix E: City of Ottawa Guidelines for the Approval for Installation of Packaged SDHW Systems

GUIDELINE: Solar Domestic Hot Water Heating Systems

Date: January 2007

Purpose: This guideline provides direction respecting the application and interpretation of building code requirements relating to solar domestic hot water heating systems.

Background

In the early 80's, the National Standards of Canada drafted four CSA standards providing the framework for the evaluation of active solar water heating systems. These standards included criteria for the durability and thermal performance of solar collectors, packaged solar water-heating systems (small pre-engineered factory designed systems intended for domestic use) and guidelines for the safe installation of the systems.

A packaged solar domestic hot water heating (SDHW) systems generally consists of a complete series of assembled components providing a supply of heating energy to a domestic hot water storage tank through the use of solar thermal collectors, heat transfer exchangers (utilizing liquid heat transfer media and potable water) and includes all appropriate plumbing and electrical controls to affect the transfer.

The Ontario Building Code (O. Reg. 403/97) refers to (SDHW) through reference in Part 7 of the Code specifying that SDHW systems must conform to the requirements of National Standards. This includes,

7.2.10.13 Solar Domestic Hot Water

(1) Equipment for solar heating of potable water shall conform to CAN/CSA-F379.1, Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)

and

7.6.1.15. Solar Domestic Hot Water Systems

(1) Systems for solar heating of potable water shall be installed in conformance with CAN/CSA-F383, Installation Code for Solar Domestic Hot Water Systems

It should be clearly noted that the prescriptive requirements of the Code by reference of the above standards provide an approval mechanism for “packaged systems” only.

From an industry perspective the regulatory requirements and referenced standards imposed a level of certification and testing that was not available. Manufacturers cited several shortcomings including the lack of an accredited testing body and testing program for the equipment, standards that are considered “out-dated” based on current technology and finally the absence of standards for systems that are not pre-packaged (such as non-standard or custom designed SDHW systems). Efforts have been made to resolve these barriers and to date progress has been made to address industry concerns.

CSA International has now commenced the creation of a certification program for SDHW systems through the development of current standards for solar equipment. To date, technical information letter (TIL) has been drafted as an interim certification standard and the National Solar Test Facility (operated by Bodycote Materials Testing Canada Inc.) is now accredited to facilitate system testing and certification. The TIL prescribes requirements for both factory packaged and *add-on packaged systems proposed by a manufacturer and for all subcomponents and materials. Custom systems however continue to be excluded from the certification framework creating a gap in the regulatory environment.

(*an add-on package refers to a unit intended to be used with or attached to an approved thermal storage device at the location of the final installation)

Ontario Regulation 349/06

In response to these and other concerns respecting energy-efficiency the Ministry of Municipal Affairs and Housing introduced a number of amendments to be included in the upcoming 2006 code cycle changes. A technical advisory committee comprising designers, builders, regulators, manufacturers, and energy suppliers and advocates reviewed the input from these consultations with recommendations drafted in the new Building Code.

As a result Ontario Regulation 349/06 was filed on June 28, 2006, providing in part some regulatory reform to SDHW. (amended wording in bolded font).

Division B, 7.2.10.13. Solar Domestic Hot Water

- (1) Equipment **forming part of a packaged system** for solar heating of potable water shall conform to CAN/CSA-F379.1,

and

Division B, 7.6.1.15. Solar Domestic Hot Water Systems

- (1) **Except as provided in Sentence (2), a system for solar heating of potable water shall be installed in accordance with good engineering practice.**
- (2) **Packaged** systems for solar heating of potable water in residential occupancies shall be installed in conformance with CAN/CSA-F383.

The amendment attempts to clarify that the referenced standard for solar domestic hot water systems applies to packaged systems and furthermore allows for non-packaged systems to be designed in accordance with good engineering practice. However, the amendment fails to consider that the referenced standard applies to packaged systems only.

In an effort to provide clarity respecting the interpretation of this Code requirement while still exercising our due diligence as the principal authority for provisions of health and safety, the Branch is prepared to entertain the approval of (custom) non-packaged SDHW systems where third party professional involvement is undertaken.

Building Permit Requirements for Non Packaged SDHW Systems

1. A professional engineer licensed in the Province of Ontario shall certify that the proposed custom-engineered Solar Domestic Hot Water (SDHW) System conforms with the intent of CSA International Technical Information Letter (TIL) MSE-45 (as amended), the referenced standards applicable to SDHW components listed in Table 1 of the TIL and the intent of the requirements for SDHW systems in the Ontario Building Code. The building permit submission documents shall include a statement of compliance to the above reference documents.

2. Compliance of the installation to “good engineering practice” shall be confirmed by a professional engineer licensed in the Province of Ontario.

3. Installation of the system shall be undertaken by a qualified installer certified by the Canadian Solar Energy Industry Association (www.cansia.ca).

4. Packaged SDHW Systems in possession of a Certificate of Compliance with CSA International in accordance to Technical Information Letter (TIL) MSE-45 and CSA F379.1-88 Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer) shall be exempt from clause 1 and 2 above.

Submission Requirements

Plans and specifications shall reflect the scope and installation of the system including;

- System components, documentation and specifications,
- Solar panel installation - loading and attachment details,
- Plumbing schematic

References: CSA F379.1-88, Solar Domestic Hot Water Systems (Liquid to Liquid Heat Transfer)

CAN/CSA-F383, Installation Code for Solar Domestic Hot Water Systems

CSA International Technical Information Letter (TIL) MSE-45 – Interim Certification Requirements for Packaged Solar Domestic Hot Water (SDHW) Systems

Appendix F: Converting solar thermal collector area into installed capacity (m² to kW_{th})

A Report to the IEA SHC Executive Committee (September 2004)

Introduction

In the past, the installed base of solar thermal systems was measured in terms of collector area (square meters or square feet) rather than in terms of installed capacity to produce heat. As a consequence, solar thermal was not easily comparable with other (renewable) energy sources and thus was often left out of relevant statistics.

On 8th September 2004, representatives of the International Energy Agency's Solar Heating and Cooling Programme (IEA SHC) and several major solar thermal trade associations met in Gleisdorf, Austria (for a list of participating associations please see the end of this document). During this meeting, they discussed and agreed on an official recommendation for how to convert solar thermal collector area into installed capacity. Work is currently being done on defining also a suitable methodology to convert collector area into energy yield.

This recommendation was published jointly by IEA SHC and the involved associations who hope that this methodology will be used worldwide by all those who are concerned with solar thermal statistics.

The recommended conversion factor

For the purpose of solar thermal statistics, the installed capacity ([kW_{th}] – Kilowatt thermal) shall be calculated by multiplying the aperture area of the solar collector area [m²] by the conversion factor 0.7 [kW_{th}/m²].

This factor shall be used uniformly for unglazed collectors, flat plate collectors and evacuated tubular collectors.

Explanatory Note

The following notes explain the origins of the conversion factor of 0.7 kW_{th}/m².

3.1 Area

Three definitions of collector area exist:

- Absorber area = the area of absorber
- Aperture area = the area in which the solar radiation enters the collector
- Gross area = the area based on the outer dimensions of collector

All three areas are defined for glazed liquid heating collectors in the European standard EN12975-2 annex I. In EN12975-2 test reports all three areas are given. Efficiency coefficients in these reports are given based on both absorber area and aperture area. As there is a current trend towards using aperture area on certificates (e.g. DIN CERTCO Solar Keymark, SPF Factsheets) aperture area¹ shall be used.

¹ For unglazed collectors the three areas are the same

This implies:

- It is assumed that the existing statistics have counted aperture area.
- Aperture area should be counted in future statistics.
- Capacity conversion is done using the efficiency based on aperture area.

3.2 Collector classification

Proposed collector classification:

1. Unglazed flat plate collectors: All unglazed collectors (selective and non-selective, tubes, tube/fin, all-wetted, ...).
2. Glazed flat plate collectors: All glazed collectors of every type (single/double glazed, with/without convection suppression, selective and non-selective, tubes, tube/fin, all-wetted, air/gas...).
3. Evacuated tubular collectors: All types of evacuated tubular collectors (heat-pipe, direct, tube/fin, all-glass, ...).

3.3 Typical collector efficiency

The capacity conversion is based on the following simplified typical collector efficiencies (based on aperture area):

1. Unglazed flat plate collectors²: $\eta_0 = 0,90$, $a_1 = 20,0 \text{ W}/(\text{K}\cdot\text{m}^2)$, $a_2 = 0,00 \text{ W}/(\text{K}^2\cdot\text{m}^2)$
2. Glazed flat plate collectors³: $\eta_0 = 0,78$, $a_1 = 3,2 \text{ W}/(\text{K}\cdot\text{m}^2)$, $a_2 = 0,015 \text{ W}/(\text{K}^2\cdot\text{m}^2)$
3. Evacuated tubular collectors⁴: $\eta_0 = 0,76$, $a_1 = 1,2 \text{ W}/(\text{K}\cdot\text{m}^2)$, $a_2 = 0,008 \text{ W}/(\text{K}^2\cdot\text{m}^2)$

3.4 Operation conditions

For the capacity conversion the following typical operation conditions are assumed⁵:

1. Unglazed flat plate collectors: $G = 1000 \text{ W}/\text{m}^2$, $T_a = 20 \text{ }^\circ\text{C}$, $T_m = 30 \text{ }^\circ\text{C}$, $u = 1,5 \text{ m/s}$
2. Glazed flat plate collectors: $G = 1000 \text{ W}/\text{m}^2$, $T_a = 20 \text{ }^\circ\text{C}$, $T_m = 50 \text{ }^\circ\text{C}$
3. Evacuated tubular collectors: $G = 1000 \text{ W}/\text{m}^2$, $T_a = 20 \text{ }^\circ\text{C}$, $T_m = 50 \text{ }^\circ\text{C}$

3.5 “Installed” or “nominal” capacity: Capacity per m² of collector area

Definition 1:

“Nominal Capacity” of unglazed flat plate collectors is the instantaneous thermal output of the collector with the operation conditions:

- $G = 1000 \text{ W}/\text{m}^2$
- $T_a = 20 \text{ }^\circ\text{C}$
- $T_m = 30 \text{ }^\circ\text{C}$
- $u = 1,5 \text{ m/s}$

Definition 2:

“Nominal Capacity” of glazed flat plate collectors and evacuated tubular collectors are the instantaneous thermal output of the collector with the operation conditions:

- $G = 1000 \text{ W}/\text{m}^2$
- $T_a = 20 \text{ }^\circ\text{C}$
- $T_m = 50 \text{ }^\circ\text{C}$

² Estimate

³ Average of last 10 EN tested flat plate collectors in SPF Collector Catalogue 2004

⁴ Average of last 10 EN tested ETC collectors in SPF Collector Catalogue 2004

⁵ These operation conditions are given in the power tables in the “conformity report” in the EN12975-2

Definition 3:

“Specific Nominal Capacity” of a collector is the nominal capacity of a collector divided by its aperture⁶ area.

Using the assumption above, the factor for converting – for each collector type – square meters of collector area to specific nominal capacity:

1. Unglazed flat plate collectors: $P/A = 0.7 \text{ kW}_{\text{th}}/\text{m}^2$
2. Glazed flat plate collectors: $P/A = 0.671 \text{ kW}_{\text{th}}/\text{m}^2$
3. Evacuated tubular collectors: $P/A = 0.717 \text{ kW}_{\text{th}}/\text{m}^2$

Taking into consideration the uncertainty on each value it is reasonable to use only one value: $0.7 \text{ kW}_{\text{th}}/\text{m}^2$.

Participating organizations

The following organisations participated in the Gleisdorf meeting where the conversion factor of $0.7 \text{ kW}_{\text{th}}/\text{m}^2$ was agreed upon:

- Austria Solar – www.austriasolar.at
- Bundesverband Solarindustrie, Germany (BSi) – www.bsi-solar.de
- Canadian Solar Industries Association (CanSIA) – www.cansia.ca
- European Solar Thermal Industry Federation (ESTIF) – www.estif.org
- Holland Solar – www.hollandsolar.nl
- Solar Heating and Cooling Programme of the International Energy Agency (IEA SHC) – www.iea-shc.org
- Solar Energy Association of Sweden (SEAS) – www.solenergiforeningen.se
- Solar Energy Industries Association, USA (SEIA) – www.seia.org

⁶ For unglazed collectors the aperture area equals the absorber area

Appendix G: Detailed Instructions For Completion of the Product Data Sheet

Detailed Instructions For Completion of the Solar Water Collector Data Sheet

The following notes provide detailed information on specific information data as well as guidance on descriptive words to use. The descriptive words listed below are for guidance and are not meant to be an exclusive listing.

Note 1: Warranty	Include length of warranty (years) and limitations (full, prorated – 10% less each year, etc)
Note 2: Collector Type	Glazed Flat Plate, Unglazed Flat Plate, Concentrator, Evacuated Tube, Integrated Collector Storage Stationary, Tracking
Note 3: Application	Low temperature (swimming pools); Medium temperature (service hot water); High temperature (process heat, air conditioning)
Note 4: Canadian Supplier	If Canadian supplier is the same as the manufacturer insert “same” into cell
Note 5: Independent Testing/Certification	<p>In order to have the collector’s performance rating listed in the directory it is necessary to submit a copy of the test report with the application. The collectors must be tested by an independent testing laboratory that tests to one of the following standards:</p> <ul style="list-style-type: none"> - CAN/CSA-F378-87 (R2004): Liquid & air collectors - EN 12975-1.2 (Liquid collectors) – or listing to the KeyMark xxx - SRCC OG100 (Liquid & Air Collectors) - ISO 9806-1.-2.-3 (Liquid collectors) <p>If the collectors have been tested to multiple standards then you have the option of listing all the standards that the product has been tested/certified to. You must include full test reports to one standard and proof of certification for the other standards you want listed.</p> <p>Submission of other standards for acceptance will be reviewed by the Product Acceptance Committee.</p>
Note 6: Gross and Net Aperture Area	<p>Gross Area is the outside dimension of the collector (height x width)</p> <p>Gross Aperture Area includes the area that between absorber plates</p> <p>Absorber Area is the actual absorption area that collects solar radiating</p> <p>Note: for flat plate collectors the Gross Aperture Area will usually be the same as the Absorber Area, while for evacuated tube it will be less due to the air gaps between heat tubes</p>
Note 7: Heat Transfer Fluids	Potable Heat Transfer Fluids (water); Non-Toxic Heat Transfer Fluids (Propylene Glycol); Toxic Heat Transfer Fluids (Ethanol)
Note 8: Frame Material	Aluminum, fibreglass, extruded, none
Note 9: Frame Coating	Anodized, painted, none
Note 10: Mounting Connections	Describe how the collectors is attached to the mounting frame or roof
Note 11: Glazing Materials	Glass, glass vacuum tube, clear rigid plastic, none, tempered, low iron
Note 12: Absorber Material	Copper, copper fin, aluminum fin
Note 13: Absorber Coating	Selective, moderately selective, non-selective, none
Note 14: Absorber Tubing Material	Copper, aluminum

Note 15: Plate-Tubing Bonding Method	Soldered, spot weld, extruded
Note 16: Insulation Material	Vacuum, fiberglass, none
Note 17: Header Pipe Material	Copper, plastic
Note 18: Connection Method	Explain how the header pipe is connected to other collectors or the plumbing run – soldered, threaded joint (size of thread), male (or female) pipe thread.
Note 19: Performance Data	<p>In order to list the collector's performance data in the directory a test report must be submitted as outlined in Note 5 above. The efficiency equation must be reported based on the gross collector area as required by CSA F378. The equation must be of the form:</p> <p><u>For Glazed Collectors the efficiency equation is:</u></p> $\eta = \frac{a - \frac{b\Delta T}{I} - \frac{c\Delta T^2}{I}}{I}$ <p><u>For Unglazed Collectors the efficiency equation is:</u></p> $\eta = \frac{a - bu - \frac{c\Delta T}{I} - \frac{d u \Delta T^2}{I}}{I}$ <p>Where: a, b, c, d are constants defined for the specific collector I is the total solar irradiance measured in the plane of the collector ΔT is the difference between the collector inlet fluid temperature and the ambient air temperature u is the wind speed</p>

Detailed Instructions on The Solar Water Collector Cross Sectional Diagram

The diagram must be done by auto-cad and submitted electronically. Hand drawn diagrams will not be accepted.	
View	View must be a 3 - dimensional cut away showing all key elements. A full collector diagram is not required as long as all key elements can be shown.
Elements to Include	The drawing must show all collector elements that are installed to collect solar energy. For example in the case of an Evacuated Tube systems the evacuated tubes and the collection tank/header must be shown. The following is a partially listing of possible elements: glazing, collector container, riser tubes, headers (including penetration through the collector container), absorber plate, insulation, mounting details (such as extrusion tracks)
Absorber Plate Information	The drawing must clearly show the header and riser tube connection and the tubing pattern on the absorber.
Sizing of Diagram	The diagram must be clear when it is scaled to an approximate printing size of 10 cm x 10 cm – the font for diagram labels at this size must be approximately 8 pt
Labeling of diagram elements	The key elements of the solar collector must be clearly labeled. The labeling should be done in Arial font.
File Type	The diagram must be submitted as a pdf, jpeg, or tiff file.

Detailed Instructions For Completion of the Solar Packaged Hot Water System Data Sheet

The following notes provide detailed information on specific information data as well as guidance on descriptive words to use. The descriptive words listed below are for guidance and are not meant to be an exclusive listing.

Note 1: Warranty & Limitations	
	Include length of warranty (years) and limitations (full, prorated – 10% less each year, etc)
Note 2: Collector Type	
	Glazed Flat Plate, Unglazed Flat Plate, Concentrator, Evacuated Tube, Integrated Collector Storage Stationary, Tracking
Note 3: System Type	
	Drain down, drain back, thermosyphon, closed loop
Note 4: Piping material	
	Recommended types of pipes to be used with the system, i.e. copper
Note 5: Insulation Description	
	Type of insulation recommended, RSI value, diameter of insulation
Note 6: Solar Storage Tank	
	List the storage tank that comes included with the system (manufacturer, model #). If the storage tank is not included but are from an approved list include all storage tanks that are approved (manufacturer, model #)
Note 7: Type of Pump	
	Items to include: manufacturer, model, rating (HP), fixed flow, variable flow
Note 8: Power Source	
	List power source for pump – i.e. AC powerline, PV module
Note 9: Heat Exchanger	
	Describe location and type of heat exchanger. I.e. internal heat exchanger is solar storage tank, external heat exchanger, tube in shell, wrap around, plate.

Detailed Instructions on the Packaged SDHW System Schematic Diagram

The diagram must be done by auto-cad and submitted electronically.	
View	The diagram should be of a standard 1-line format that would be acceptable to use for plumbing permit applications.
Elements to include	The diagram must show all system components including: solar collectors, pump, controls and sensors, plumbing, valves (all types), heat exchanger, water storage tanks.
Diagram symbols	Symbols used in the diagram must conform to the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) <i>Fundamentals Manual</i> or represent actual parts of the solar water heating system.
Sizing of Diagram	The diagram must be clear when it is scaled to an approximate printing size of 10 cm x 10 cm – the font for diagram labels at this size must be approximately 8 pt
Labelling of diagram elements	The key elements of the solar collector must be clearly labeled. The labeling should be done in Arial font.
File Type	The diagram must be submitted as a pdf, jpeg, or tiff file.

Appendix H: Glossary of Terms

This section is under development