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European Regulations and Recommendations for Separation between Solar Collector Fluids and Domestic Water

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1. INTRODUCTION

In the past, national regulations on protection against pollution of potable water have strongly influenced the design of solar domestic hot water (SDHW) systems. For instance, until 1999 only water was allowed as solar collector fluid if a single wall heat exchanger is used in the Netherlands. Consequently, the Dutch solar industry developed solar heating systems making use of the drain back principle with water as the solar collector fluid. Solar heating systems in the Netherlands are therefore designed differently than solar heating systems in the rest of the world.

An overview of the present regulations and recommendations for separation between solar collector fluids and domestic water for different European countries will be given in the following sections.

2. EUROPEAN STANDARD, EN 1717

In May 2001 the European standard, EN 1717 "Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow", [1], became national standards in the following European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

In the standard fluids are classified in five categories:

Category 1: Water to be used for human consumption coming directly from a potable water distribution system.

Category 2: Fluid presenting no human health hazard. Fluid recognised as being fit for human consumption, including water taken from a portable water distribution system, which can have undergone a change in taste, odour, colour or a temperature change (heating or cooling).

Category 3: Fluid representing some human health hazard due to the presence of one or more harmful substances.

Category 4: Fluid representing a human health hazard due to the presence of one or more toxic or very toxic substances or one or more radioactive, mutagenic or carcinogenic substances.

Category 5: Fluid presenting a human health hazard due to the presence of microbiological or viral elements.

Solar collector fluids consisting of a mixture of water and an anti-freeze like glycol are classified as a category 3 or category 4 fluid. The border between category 3 and category 4 is in principle LD 50=200 mg/kg body weight in reference to the EU Directive 93/21/EEC dated April 27th, 1993.

The standard defines single wall and double wall separators in the following way:

A single wall separator consists of a single fixed and sealed partition or casing that can be in contact with the potable water on one side, and with another fluid on the other.

A double wall separator consists of at least two fixed and sealed partitions or casings creating a neutral intermediate zone between the potable water on one side and another fluid on the other. The intermediate zone may be designed in two ways: Containing a gaseous fluid or an inert porous material (open cells) or containing a fluid of category 1, 2 or 3.

The rules of the standard are that category 2 and 3 fluids may be separated from potable water by a single wall, while a single wall is not sufficient for category 4 and 5 fluids. A double wall with a safety medium in between (liquid or gas) and an acoustical or visual alarm system is required when the fluid from which the potable water shall be protected against is of category 4 or 5.

The European rules are apparently clear. However, so far there are no common European agreements on which glycol/water mixtures are category 3 fluids and which glycol/water mixtures are category 4 fluids. Further, regulations concerning separation between solar collector fluid and domestic water are related to human health. Therefore, for the time being the rules mentioned in the standard are only recommendations that can be disregarded by special national rules for each country. Consequently, the rules in this field are different from one European country to another. It is estimated that common rules in this field for all European countries will not be available until in about 15-20 years.

Furthermore, the European standards on heat exchangers separating solar collector fluids from domestic water do not include rules concerning the heat exchanger design, see for instance the European standards and a draft of a standard [2], [3] and [4]. The rules on design of heat exchangers separating solar collector fluids and domestic water are therefore also different from one European country to another.

The national rules in a number of European countries will be described in the following section.

3. NATIONAL RULES

3.1 Austria

If a single wall heat exchanger is used the solar collector fluid must be non flammable, biological decomposable, non toxic and non corrosive in the concentration used in the solar collector loop according to the Austrian standard ÖNORM M 7731, [5], which is under a revision process at the moment. The fluid must be approved according to the Austrian standard ÖNORM H 5195-2, [6]. At present, propylene glycol/water mixtures with different additives as well as synthetic heat transfer fluids are approved. There is no list of approved fluids available.

There are no rules concerning design on heat exchangers.

3.2 Denmark

A solar collector fluid approved by the Danish Environmental Protection Agency must be used if a single wall heat exchanger is used. At present, the following are approved:
-Water
-BP Termovæske S
-Propylene glycol/water mixtures with Brilliant Blue

-Propylene glycol/water mixtures with Green S as tracer

There are no requirements on the material, wall thickness, or design of the single wall heat exchanger. The only requirement is that the heat exchanger must be protected against corrosion. If St 37-2 steel is used as the heat exchanger material it must be enamelled and the tank must be equipped with an anode.

3.3 Germany

Propylene glycol/water mixtures are allowed as solar collector fluids if a single wall heat exchanger is used.

There are no rules concerning the design on heat exchangers.

3.4 the Netherlands

Since February 1999, water or a fluid with an ATA (Attestation Toxicological Aspects) approval are allowed as solar collector fluid if a single wall heat exchanger is used, [7]. The institution Kiwa N.V. is responsible for the approval, and at present the following solar collector fluids have an ATA approval, [8]:

- Colpro from Kalsbeek B.V., [9]
- Hartgard from Solarhart Australia
- Tyfocor LS from Tyforop Chemie GmbH, [10]
- Tyfocor HTL from Tyforop Chemie GmbH, [10]
- Tyfocor L from Tyforop Chemie GmbH, [10]

The requirements on the heat exchanger are described in [11]. The heat exchanger material must be corrosion-resistant or protected against corrosion. Stainless steel, copper and copper alloys and steel are for instance allowed, provided that the materials meet the requirements specified in [11]. The strength of the heat exchanger must also meet the requirements specified in [11].

3.5 Spain

Propylene glycol/water mixtures can be used as solar collector fluids if a single wall heat exchanger is used.

There are no rules on the specific design on heat exchangers.

3.6 Sweden

There are no rules concerning solar collector fluids or design on heat exchangers, since domestic hot water is not considered to be human foodstuff.

3.7 Switzerland

According to the guidelines of the organization SVGW (Schweizerischer Verein des Gas- und Wasserfaches), [12] both non toxic fluids like propylene glycol/water mixtures and toxic fluids like ethylene glycol/water mixtures are allowed if a single wall heat exchanger is used.

There are no rules on the design on heat exchangers if a non toxic solar collector fluid is used. If a toxic solar collector fluid, for instance a mixture of ethylene glycol and water, is used a safe heat exchanger material, that is stainless steel or copper, must be used.

4. CONCLUSION

The rules concerning separation between solar collector fluids and domestic water are different from one European country to another. The regulations are by far the most clear and strict in the Netherlands, while other countries like Sweden and Switzerland (almost) have no requirements.

From the survey it is clear that the topic is not considered to be of great importance by the authorities, test institutes and the solar heating branch in Europe. The authorities judge, that there are much more important environmental problems to deal with.

However, the ambition is to work out common European rules concerning the fluid categories mentioned in EN 1717 and concerning requirements on the heat exchanger design. Based on experience on CEN work it is estimated that such common rules first will be available around 2020.

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