SWEP Brazed Plate Heat Exchangers

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1. About this Publication

These instructions have been prepared according to the following standards:

- BS EN ISO 11442: Technical product documentation. Document management;
- BS EN ISO 12100: Safety of machinery - General principles for design - Risk assessment and risk reduction;
- BS EN 62023: Structuring of technical information and documentation;
- BS EN 82079-1: Preparation of instructions for use. Structuring, content and presentation. General principles and detailed requirements.

1.1. Safety Warnings and Symbols

The system of safety warnings and symbols is based on:

- BS EN ISO 7010: Graphical symbols. Safety colours and safety signs. Registered safety signs;
- BS EN 82079-1: Preparation of instructions for use. Structuring, content and presentation. General principles and detailed requirements.

⚠ DANGER

This indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury if instructions, including recommended precautions, are not followed.

⚠ WARNING

This indicates a hazard with a medium level of risk, which if not avoided, will result in death or serious injury if instructions, including recommended precautions, are not followed. In addition, there is a high risk of damage to the component, product or process.

⚠ CAUTION

This indicates a hazard with a low level of risk, which if not avoided, will result in minor or moderate injury if instructions, including recommended precautions, are not followed. In addition, there is a potential risk of damage to the component, product or process.

NOTE: Draws attention to important additional information.

1.2. Units of Measurement

Quantities are expressed in SI units or SI derived units; refer to J & E Hall International Standard JEH-ES-02 Guide to the International System of Units (SI).

1.3. Terminology

Terminology, abbreviations and acronyms are those currently in use throughout the refrigeration and air conditioning industry; refer to J & E Hall International Standard JEH-ES-01 Definition of Terms and Acronyms Used in the Refrigeration Industry.

1.4. Additional Copies

Obtain additional copies of these instructions from J & E Hall International; go to www.jehall.com.

2. Application

The brazed plate heat exchanger (BPHE) can be used as a cooler, condenser or evaporator.

The location of the plate heat exchanger, and the application, can be found from the system schematic flow diagram and in Part A : Specification.

This publication covers types SWEP type B and V brazed plate heat exchangers.

3. Terminology

The following terminology is used throughout this publication.

Brazed Plate Heat Exchanger (BPHE)

An assembly of channel plates, front and back cover plates and connections brazed together to form a self-contained heat exchanger having internal channels for fluid flow.

Channel Plate

A sheet of stainless steel pressed into a corrugated pattern.

Connection

A length of threaded and/or machined tube/bar brazed onto the front cover plate. The interface for the fluid into and out from the channels.

Cover Plate

A flat plate covering a stack of plates and providing support for connections, supports and lifting devices.

Heat Transfer Area

The area of the plate which is in contact with both fluids.

Total Heat Transfer Area

The total surface area of all the plates which is in contact with both fluids.

4. Operation

The principle of operation is illustrated in Fig 1.

The heat exchanger consists of a number of pattern-embossed plates of stainless, acid resistant steel.

The embossed pattern is reversed on every intermediate channel plate so that the ridges on adjacent plates intersect with one another creating a lattice of contact points, these plates are brazed together to produce a compact and pressure-resistant heat exchanger in which virtually all material is utilised for heat transfer.

Inlet connections at two corners of the front cover plate distribute the warm and cold fluids through alternate narrow channels between the plates, always in counter-current flow.

The warmer fluid gives up some of its heat through the thin plate wall to the cooler fluid on the other side.

The thin plates have a specially designed fish bone geometry to creates a turbulent flow pattern resulting in heat transfer coefficients superior to other types of heat exchanger.

The fluids exit through outlet connections at the other two corners of the front cover plate.

Fluids can pass through the heat exchanger in different ways.

For parallel flow heat exchangers there are two different flow configurations: co-current and counter-current.

Counter-current flow is the arrangement used for refrigeration applications; refer to Fig 2.

The front plate is marked with an arrow, either an adhesive sticker or embossed on the cover plate. The arrow indicates the front of the PHE and the location of the inner and outer circuits/channels.

With the arrow pointing up, the left-hand side (ports F1 - F3) is the inner circuit and the right-hand side (ports F2 - F4) is the outer circuit. The outer circuit has a slightly lower pressure drop as it contains one more channel.

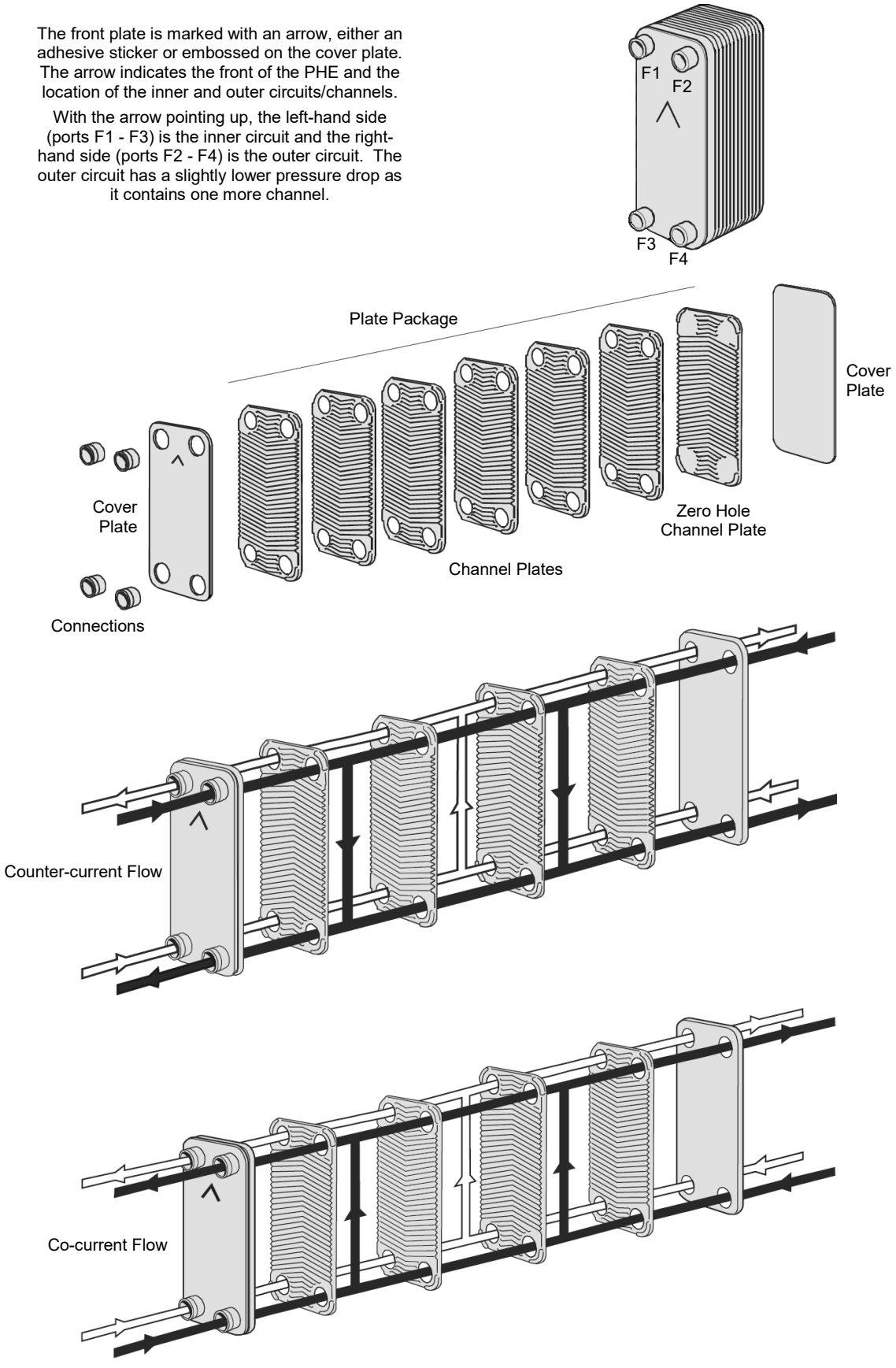

Fig 1 Construction and Flow Configurations

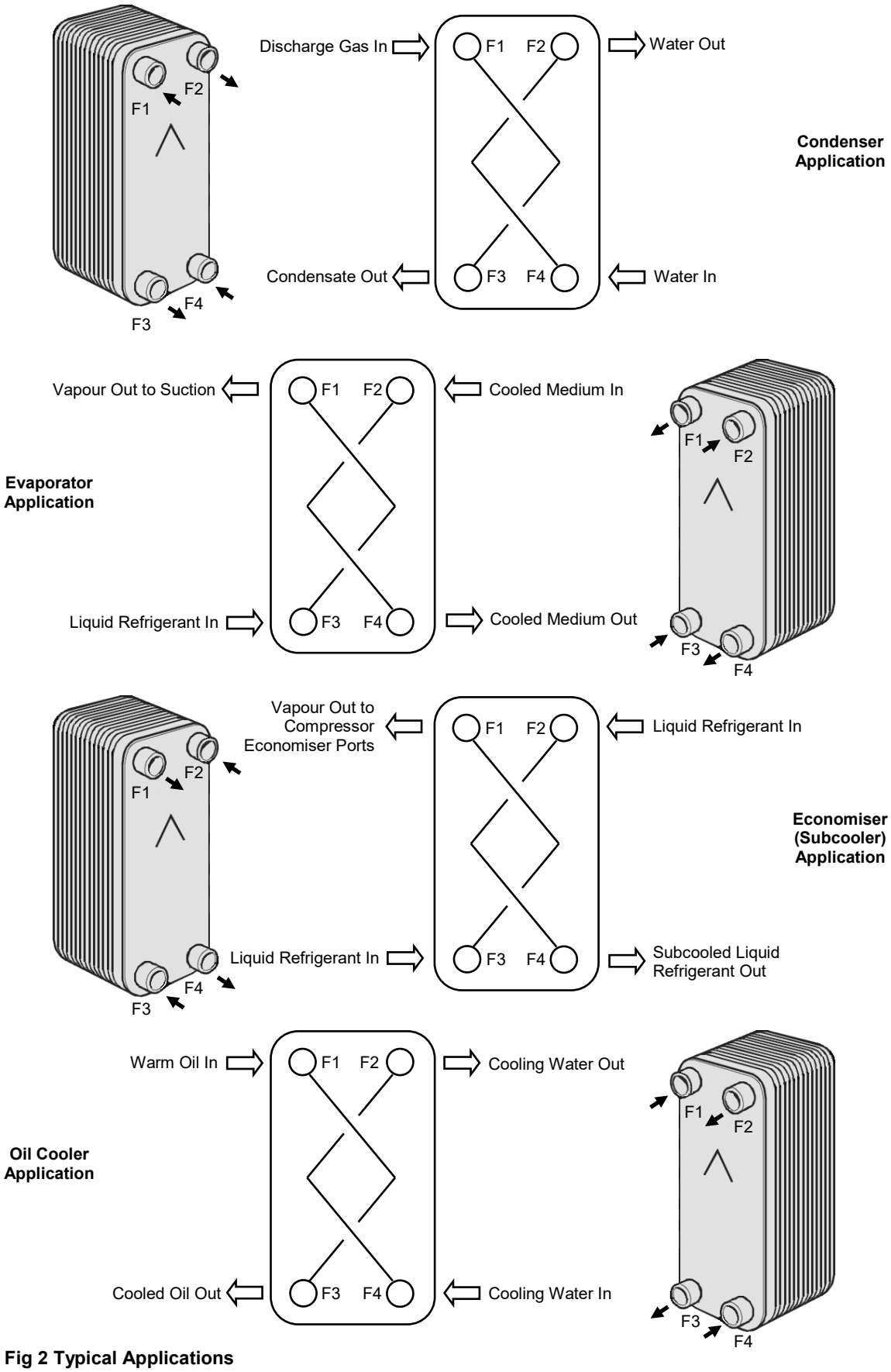

Fig 2 Typical Applications

5. Technical Data

The BPHE is supplied with an adhesive identification label, which provides important technical data including the model number, serial number and basic operating parameters.

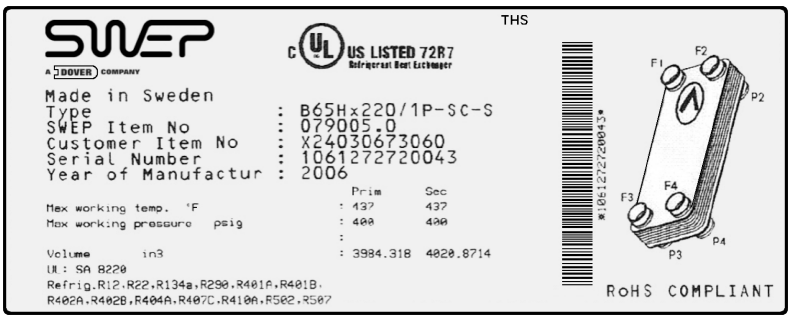

Fig 3 Identification Label (Typical)

6. Installation

The following general instructions are intended to assist in the correct installation of plate heat exchangers in packaged units and site built systems.

6.1. Location

Position the heat exchanger with the arrow on the front plate pointing upwards as illustrated in Fig 4, which also includes some mounting suggestions. Flows should be counter-current as shown in Fig 2.

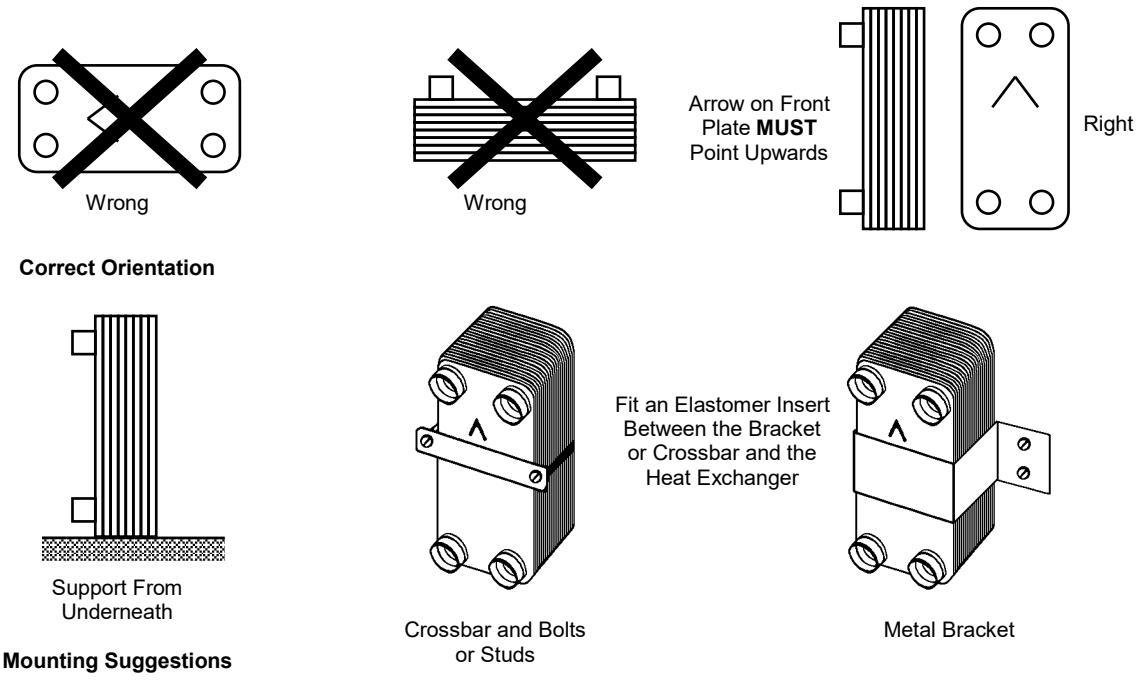

Fig 4 Correct Orientation and Mounting Suggestions

6.2. Protection Against Vibration and Water-Hammer

It is important to prevent vibrations or pulsations being transmitted to the plate heat exchanger.

Flexible connections are recommended, especially in a remote application.

Water-hammer can occur when the flow through pipelines containing incompressible fluids such as water, glycol etc., suddenly change velocity caused, for example, by a valve suddenly closing in the line.

The high intensity pressure waves produced travel back and forth in the line, and can damage the plate heat exchanger by distorting the front plate or end plate, resulting in internal/external leakage.

This problem can be prevented by fitting an air chamber or water hammer arrestor in the line, or by using valves with controlled closing characteristics.

6.3. Threaded Connections

If threaded connections are used, tighten sufficient to achieve a leak-tight joint, do not overtighten or the heat exchanger may be damaged.

6.4. Soldered Connections

For soldered connections, use hard silver solder with a minimum 45 % silver content, maximum heat 650 °C.

While soldering is taking place, do not direct the flame at the BPHE, use a wet rage to prevent overheating; pass nitrogen through the line to prevent oxide forming.

Do not circulate water through the heat exchanger during the soldering process.

After soldering, continue to circulate nitrogen to cool the joint and surrounding material. Remove all traces of flux.

6.5. Condenser, Evaporator and Oil Cooler Applications

The following refers to applications using water as the cooling medium (condenser or oil cooler) or as the cooled medium (evaporator).

⚠ WARNING

When the plate heat exchanger is used as an evaporator or economiser, all insulation MUST be vapour sealed, otherwise condensation may form beneath the insulation on the cold outer surfaces of the heat exchanger, freeze and rupture the plates; refer to Fig 5.

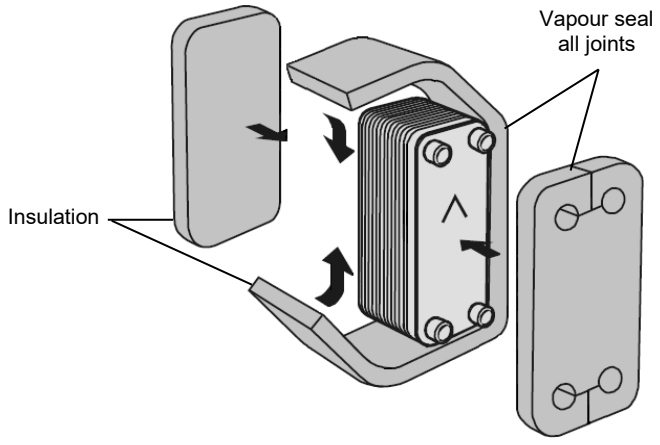

Fig 5 Insulation for Evaporator and Economiser Applications

6.5.1. Inlet Strainer (All Applications)

Provision **MUST** be made for fitting a fine mesh strainer (0.5 mm mesh size) at the inlet, to prevent foreign matter fouling the heat exchanger and impairing its efficiency.

The strainer should be checked and cleaned at regular intervals. Provision for fitting a differential pressure gauge across the strainer is useful for determining the condition of the strainer without having to stop the plant for a visual check.

6.5.2. Cooling Water Quality (Condenser and Oil Cooler Applications)

The cooling water supply should have a pH value as near 8 as possible, i.e. slightly alkaline.

Frequent tests should be carried out to check this value.

If blue litmus paper is used its colour will change to pink if the water is acidic. Acidic water will cause rapid corrosion.

If necessary, consult a water treatment specialist.

The water in some districts contains carbonate and lime salts which form a deposit on the interior surfaces of the plates.

The efficiency of the plate heat exchanger is thereby lowered because of the resistance to heat transfer produced by the deposit.

In such cases, water treatment should be considered.

If there is a build-up of deposits, chemical cleaning may be necessary; refer to 8. Servicing.

In a closed circuit cooling system, for example, with a cooling tower, the amount of bleed-off from the circulation pump delivery should also be checked to ensure that it is sufficient to prevent an undesirable mineral concentration in the water.

6.5.3. Protection Against Freezing (Condenser and Oil Cooler Applications)

If the cooling water should freeze during frosty weather, the expansion as the water turns to ice may rupture the plates and also damage the cooling water pump(s).

If the cooling system is not in use, draining the system offers some protection although experience has shown that surface tension means that some water will be retained inside the plate heat exchanger. Whether water left behind will cause damage depends upon how quickly the freezing occurs and where the residual water collects inside the heat exchanger.

For closed circuit cooling systems, as an alternative to draining, a suitable anti-freeze can be added to the cooling water.

For example, a 25 % concentration of ethylene glycol will give protection down to -12 °C. Before adding anti-freeze, make sure all materials used in the cooling water system are compatible with the type of anti-freeze at the desired concentration.

6.6. Water Treatment for Closed Circuit Chilled Water Systems

⚠ WARNING

The following instruction is only applicable if the chilled water is used as a secondary refrigerant. Do NOT add corrosion preventative if the water is intended for human consumption.

The use of untreated or improperly treated water may result in deterioration of the evaporator's performance due to scale formation, erosion, slime or other foreign material.

Consideration should be given to the addition of a suitable corrosion preventative to closed circuit chilled water systems.

7. Maintenance

In evaporator (cooled medium) applications, or in condenser/oil cooler applications, the cooled medium/cooling medium side should be checked for fouling, annually, or at intervals of 5,000 operating hours, whichever is the sooner.

The inlet strainer should be removed and cleaned at the same time, or more frequently as may be found necessary.

8. Servicing

In some applications the fouling tendency can be very high, for example, in hard water areas.

It is possible to clean the water passages by circulating a weak acid solution from a tank as shown in Fig 6.

Use a mixture of 5 % to 15 % phosphoric acid in water, although for frequent cleaning 5 % oxalic acid should be substituted.

⚠ WARNING

These acids are corrosive, protective clothing, gloves and goggles must be worn.

For optimum cleaning the cleaning solution flow rate should be a minimum 1.5 x the normal flow rate in the opposite direction to normal flow.

Afterwards, flush through with large amounts of fresh water to get rid of the last traces of acid.

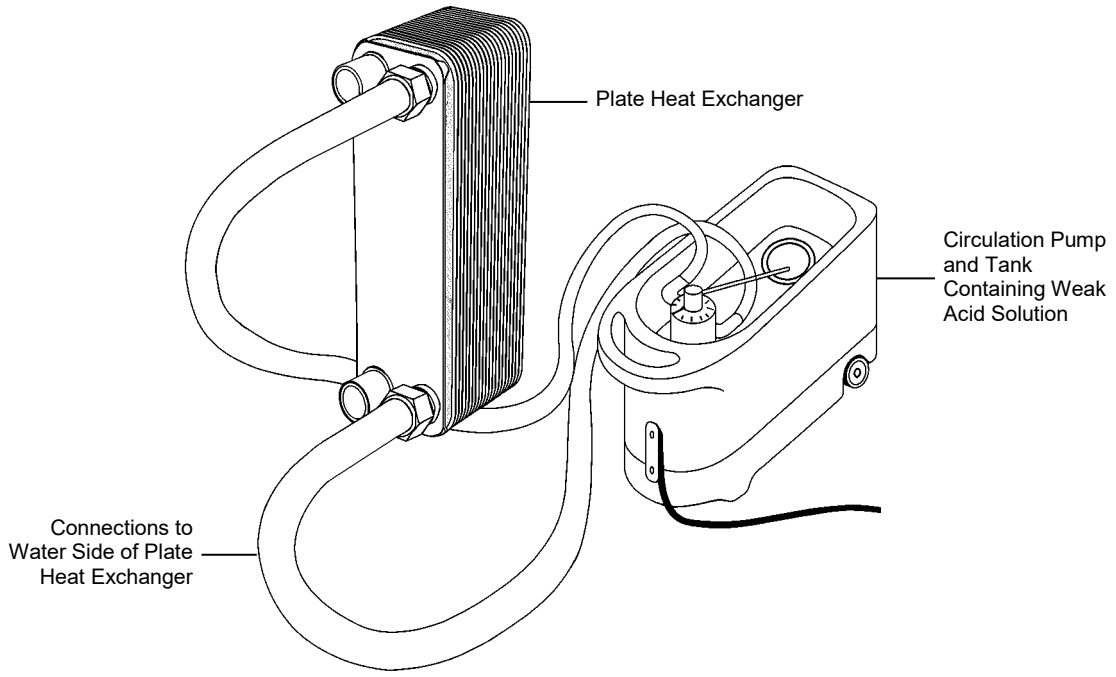

Fig 6 Chemical Cleaning

9. New Components and Spare Parts

Obtain spare parts from the address below:

J & E Hall International
Hansard Gate,
West Meadows,
Derby,
DE21 6JN
England

Telephone: +44 (0) 1332-253400
Fax: +44 (0) 1332-371061
Email: spares@jehall.co.uk
Website: www.jehall.com

When ordering always quote the J & E Hall International contract number and the component serial number (if available).