

Table of contents:

- I. Application**
- II. Operating Principle**
- III. Construction Features and Basic Dimensions**
- IV. Operating Parameters and Safety Instructions**
- V. Materials**
- VI. Equipment for operation**
- VII. Operating Precautions**
- VIII. Installation**
- IX. Insulation**
- X. Start up**
- XI. Cleaning**
- XII. Storage/Transportation**
- XIII. Name plate**
- XIV. Certification will be added**
- XV. Warranty**
- XVI. Sales and Service**

I. Application

B-line heat exchangers are designated especially for heating swimming pool water, alternatively supply water or hot water. Typical applications :

- Swimming pool water heating,
- Preheating of feeding water in boiler rooms
- Refrigeration
- Technological devices in food processing industry and chemical industry

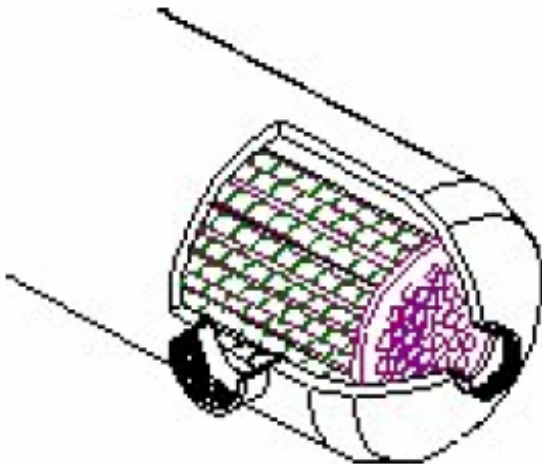
The construction and used materials of B-line heat exchangers enables them to be used in demanding applications as heating and refrigeration of drinks, alternatively aggressive fluids.

II. Operating Principle

Heat exchangers are devices in which heat is transferred from one fluid flowing in primary side of heat exchanger (tubes) to another fluid flowing in secondary side (shell). Heat exchangers can be connected as parallel-flow or counter-flow units.

Normally, the heating medium flows through the tubes, although for specific demands or conditions (e.g. high hydraulic resistance in configuration „primary circuit in tubes“) the heated medium can flow through the shell side. The total heat load is dependent not only on input and output temperatures of working mediums, but even on its flow quantity.

III. Construction Features and basic dimensions



The heat exchangers are designed and fabricated as single units with non-removable parts. The cylindrical shell encloses a tube bundle, parallel situated between fixed tube sheets. Helicallly corrugated tubes are used in heat exchanger. Both ends of the cylindrical shell are enclosed by hemispherical heads. The connections are situated on hemispherical heads, in main axis of heat exchanger. The connections of shell are situated orthogonally to main axis of heat exchanger. **B-line** heat exchangers are fabricated in 7 sizes according to the heating area, identification in enclosure 1.

IV. Operational Parameters and Safety Instructions

Maximum working parameters for **B-line** heat exchangers are as follows:

Working place Max. pressure Max.temperature

Shell 1,6 MPa 203 oC

Tube bundle 1,6 MPa 203 oC

When operating heat exchanger or during manipulation the maximum pressure and maximum temperature of shell and tube bundle **must not be exceeded**. This values are marked on Identification plate.

In relation to purpose of use (parameters of used medium) there's need to decide, if it's necessary to secure heat exchangers on connection piperwork according to the applicable Standards (**Safety devices for Central heating and heating of supply water**).

V. Materials

Heat exchanger is manufactured as a whole unit from stainless Cr-Ni steel. Description of material is mentioned in following statement, although after agreement with manufacturer different materials may be used to suit specific customer requirements (e.g. Titanium)

Standard material : AISI 316L

VI. Equipment for operation

- Heat exchanger must be safe for pressure increased over admissible value.
- Working pressures and temperatures should change continuously.
- It's recommended to install slush separator on both input sides of heat exchanger.

VII. Operational Precautions

In order to achieve maximum performance from the heat exchanger, the following must be strictly followed:

- Prevent non-authorized personnel from having free access to the unit.
- Heat exchangers should be used according to the specification given from manufacturer.
- Pressures and temperatures should not exceed limits, see Section IV.
- Initial start up should be done according to Section X.
- Heat exchangers should be free of any dirt existing in the fluid.
- Clean the heat exchangers according to Section X.
- Prevent rapid temperature increases in the heat exchangers (temperature shocks).
- Prevent temperature of the fluids from dropping below their freezing point.
- Keep the space on the heat exchanger and around the unit clean and free of any things made from flammable materials.
- It's necessary to set away the heat exchanger before starting works which cause change of environment such as gluing, painting etc.
- The heat exchanger should not be used in environments with a danger of fire and in environments with a danger of explosion from flammable gases and fumes.

VIII. Installation

Install the heat exchanger in a manner which prevents transfer of the mechanical forces or moments to their connections. It means that at first heat exchanger is set up, then tube fittings are mounted and then we continue completing the pipework. We can prevent the heat exchanger from transferring vibrations and dilatations by using for example flexible extension or suitable compensator. For water applications, installation in both horizontal and vertical positions is possible. Installation of heat exchanger on the frame must be done with at least two circular sleeves with flexible insert. Heat exchangers situated in horizontal positions can be installed and operated in the same way. There must be enough free space around heat exchanger to make installation easier.

IX. Insulation

After the mounting and installation of the heat exchanger, followed by inspection for leaks, the units should be insulated. Insulation would prevent heat loss to the surroundings and as well protect the operators.

Temperature insulation should be carried out only by materials with very low flammability.

It is not necessary at the pools installations.

X. Start up

To prepare the heat exchanger for operation, it should initially be:

- mounted properly
- insulated
- filled with working fluids
- all connections checked for leaks

During start-up, first open the valves, then start the pump of the heated medium followed by opening pumps of the heating medium. The valves should be opened gradually in order to achieve steady increase in flow and pressure.

The system should be designed to prevent the heat exchanger from encountering pressure shocks, which can be caused mainly during careless start up of heat exchanger. This can have significant influence on durability of heat exchanger or even cause its breakdown.

Note.: When using chlorine tablets for hygienic adaptation of swimming pool water, chlorine is changed into chlorine ions and its concentration can gradually increase to the level, where together with free chlorine it can cause point corrosion

Following conditions must be kept to prevent the danger of corrosion:

♦ **chlorine feeder must not be installed directly before the heat exchanger**

♦ **keep pH as high as possible, at least > 7,0**

♦ **keep concentration on the inlet of heat exchanger :**

Cl₂ < 0,5 ppm (0,2-0,3 ppm is enough)

Cl < 150ppm for heating water to 50-60 °C

Cl < 100ppm for heating water to 70-80 °C

XI. Cleaning

It's necessary to observe operation of heat exchangers and clean them after partial fouling.. Dirt deposited in heat exchanger will result in an increase in pressure drop, lower temperature difference in the heated medium or higher outlet temperature on the heating medium side.

It's recommended to carry out periodical cleaning according to following recommendations :

- at heat exchanger operating in installation for heating the portable water at least each 36 months of operating time (according to quality and quantity of added water)
- at heat exchanger operating in installation of preparation hot domestic water at least each 12 months of operating time of heat exchanger.

It's allowed to remove exchanger only when :

- 1) All pumps are switched off and secured from unexpected start.
- 2) Device is not pressurised.
- 3) Temperature of device dropped below 40 °C but not below 10 °C.

To make the device work with required performance, cleaning must be carried out. It means, when flushing upstream with water is not sufficient, we have to clean the heat exchanger chemically.

The heat exchangers are cleansed by flushing the units with chemical fluids which do not **react with stainless steel**. Flushing must be done in reverse direction of normal flowing of the working medium.

Flushing can be done without removal of the heat exchanger from the system, although extra connections and bypasses would be required. Information about suitability of cleaning fluids are available at manufacturer of seller of this fluids.

As a guideline to purchasing the cleaning solutions, check for the following product data:

- Compatibility with **stainless steel**
- Accepted for use in food processing industries (if applicable)
- Removes scale, sludge and hard water deposits
- Easily wash-out of the system
- No objectionable or corrosive fumes

If no commercial products are available, producer recommends to use some of followed processes for cleansing, according to the application of heat exchanger.

Suitable cleaning methods:

- 1) Wash-out with 4% solution of nitric acid. After flushing neutralise with 0,1% solution NaOH.
- 2) Wash-out with 4% solution of nitric acid with 0,5% inhibitor of corrosion KJ + 0,2% sodium salt of Wersen acid RDTA.
- 3) Wash-out with 4% solution of citric acid with $C_6H_6O_7$ + inhibitor of corrosion – QRERTAN (0,2 kg per 30 litres of solution).

Note :

1. It's advantageous to use citric acid, which is suitable for its hygienically features and even for cleaning heat exchangers used for potable water and corrupt most common sediments.
2. After each use of acid agent is necessary to flush with neutralising liquid (e.g.: 1-2% solution NaOH or $NaHCO_3$) with inhibitors of corrosion and finally rinse with clean water.
3. Time of cleaning is depending on the type of sediment and grade of fouling and on the type of used agent and its speed of flowing.

Warning:

The following fluids are **prohibited** for use as a flushing agent:

- Hydrochloric acid up to 0,1 % concentration,
- Solutions containing HCl
- chlorides : $MgCl_2$
NaCl between 0,1 – 1,0 %,
CuCl up to 1,0 %,
 $CaCl_2$ from 5,0 % to saturation
KCl

- any fluid which would deposit alkaline residue or phosphorous

Presence of chlorides (e.g. NaCl, CaC.) in heating medium is forbidden.

Cleaning in the guarantee period carry out only with permission of supplier of heat exchanger.

XII. Storage/Transportation

Heat exchangers should be stored in shaded place away from corrosive environments or weather elements. During transportation, ensure that they are not exposed to mechanical damages and fouling. **Water cannot stay inside the heat exchanger when ambient temperature drops bellow freezing point. This would destroy the heat exchanger.**

XIII. Name plate

The name plate is placed on the shell and includes the following data:

- manufacturer name
- type of heat exchanger
- heat transfer area
- maximum working pressure and temperature
- serial number
- production year

XIV. Certification

UNEX works in accordance with ISO 9001-2000. UNEX heat exchangers are certified by modul H - PED 97/23 EC. Copies of the above certificates are available upon request.

XV. Warranty

UNEX guarantees its products quality, function and workmanship Commencing with date of shipment, UNEX's warranty runs for 18 months. Should the product fail to perform according to the specifications set forth by UNEX during the warranty period, UNEX will repair or replace products that finds defective without charge

UNEX will not be responsible for any products that operate outside of the conditions and parameters given by UNEX at the time of purchase, or any product which have been installed incorrectly.

XVI. Sales and Service

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