BERMO®

A COMPANY OF THE ARMATUREN GROUP

INSTRUCTION MANUAL

BCHAD

shell & coil

heat exchanger

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This manual contains important information regarding correct operation and safety of this heat exchanger. Please read this manual thoroughly before installing the device. Please take note of safety information.

APPLICATION

BCHAD heat exchangers find their application in industry as well as in HVAC, technological, cooling and heating systems. BCHAD comes in many versions able to handle wide range of temperatures and pressures. It can be successfully used in installations with increased temperature and pressure requirements. They can be used with standard media like water, glycol or steam (on the tube side) but also with corrosive water containing free oxygen, aggressive carbon dioxide, chloride and sulphate ions at concentration up to 150 ppm and many others.

This product is not appointed to work with the following fluids:

– exploding
– oxidizing
– extremely flammable
– highly flammable
– flammable
– highly toxic
– toxic

BCHAD heat exchangers are not to be used with boiling liquids.

OPERATING PRINCIPLE

A heat exchanger is a device used to transfer heat between two flowing fluids. Shell and tube heat exchanger is the most common type of heat exchangers used for liquid/liquid operation although many applications also involve steam and certain gases. BERMO heat exchangers are mostly used as counter-current flow units, which, from a thermodynamic point of view, extract more heat from a given fluid stream than other common types of heat exchangers.

Usually the heating medium flows through the tubes, although in case of specific fluid properties or conditions (e.g. high viscosity, high pressure drops), the heating medium can flow through the shell. Thermal energy is transferred through the tube walls. The total heat load is dependent on the flow parameters of the fluid.

CHARACTERISTICS

BCHAD heat exchanger is fully equipped ready-to-install set consisting of a shell & coil heat exchanger, a mount and an insulation. Unique construction of connections lower pressure loss at high flow velocity. It also reduces fouling and makes the exchanger more resistant to differences in media parameters.

Corrugated tubes promote turbulent flow which further intensifies heat exchange and helps the reduction of deposits. Compact construction, high efficiency in comparison to standard solutions, factory installed insulation and mount and reliability are the core advantages of BCHAD. It is manufactured using stainless steel and comes in numerous size versions

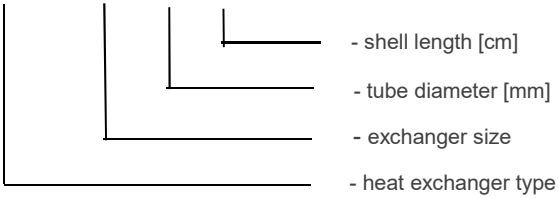
BCHAD can be successfully used in standard installations and district heating substations. Moreover, it is ideal for installations with increased temperature and pressure requirements, e.g. steam application or oil coolers.

CONSTRUCTION

BCHAD heat exchangers are counter-current flow devices. They consists of a shell with a coil of tubes inside it. Counter coiled corrugated tubes in diameter of Ø 0.31 inch make a heat exchange area. Heat exchangers are welded units build of high-alloy austenitic stainless steel. Angled connections shaped in the letter X are extended to horizontal position and ended with flanges. The exchangers are equipped with insulation and mount.

EXEMPLAR DESIGNATION

BCHAD 3.18. 08. 75



TECHNICAL DATA

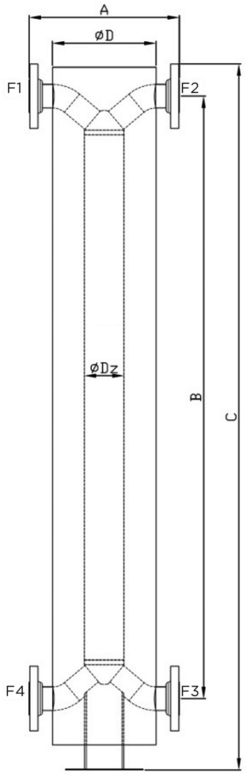
			Imperial		Metric
working parameters	max temp.	°F	482	°C	250
	min. temp	°F	-4	°C	-20
	max pressure	PSI	363	MPa	2.5

Materials:

tubes and shell: stainless steel 316

flanges: stainless steel 304

EXCHANGER DRAWING AND DIMENSIONS



Standard location of connections (in counter-flow):

F1/F4 – inlet/outlet hot side

F3/F2 – inlet/outlet cold side

TECHNICAL PARAMETERS

Type	Heat exchange area		Tube side capacity		Shell side capacity		Mass		Dimensions										connection size*
									A		B		C		D		Dz		
	ft2	m2	gal	l	gal	l	lb	kg	in	mm	in	mm	in	mm	in	mm	in	mm	
BCHAD 2.11.08.68	6.5	0.6	0.4	1.5	0.4	1.5	47	21	10.0	255	33.9	862	43.1	1095	13.7	349	3.1	80	1 1/2"
BCHAD 2.11	12.9	1.2	0.8	2.9	0.8	2.9	60	27	10.0	255	60.4	1534	69.6	1767	13.7	349	3.1	80	1 1/2"
BCHAD 3.18.08.75	12.9	1.2	0.8	3.1	0.8	3.1	66	30	10.4	265	37.3	947	47.7	1213	15.1	384	4.0	102	2"
BCHAD 3.18	21.5	2.0	1.5	5.5	1.5	5.5	86	39	10.4	265	60.6	1540	71.1	1806	15.1	384	4.0	102	2"
BCHAD 5.38.08.71	24.7	2.3	1.3	4.8	2.1	7.8	101	46	12.0	305	37.1	942	49.5	1257	17.7	450	5.6	141	2 1/2"
BCHAD 5.38	43.0	4.0	2.0	7.4	3.3	12.2	134	61	12.0	305	60.8	1544	73.2	1859	17.7	450	5.6	141	2 1/2"
BCHAD 6.50.08.72	33.4	3.1	1.7	6.2	3.1	11.5	141	64	12.6	320	37.8	960	52.2	1325	19.5	496	6.3	159	3"
BCHAD 6.50	57.0	5.3	2.1	7.9	5.5	20.5	181	82	12.6	320	60.8	1545	75.2	1910	19.5	496	6.3	159	3"
BCHAD 9.88.08.65	52.7	4.9	2.6	9.6	6.4	24.0	240	109	15.2	385	37.7	957	54.9	1395	23.8	604	8.6	219	4"
BCHAD 9.88.08.85	66.7	6.2	3.0	11.3	7.5	28.2	269	122	15.2	385	45.6	1157	62.8	1595	23.8	604	8.6	219	4"
BCHAD 9.88	115.1	10.7	5.1	19.0	8.6	32.2	344	156	15.2	385	61.1	1552	78.3	1990	23.8	604	8.6	219	4"
BCHAD 12.114.08.50	67.8	6.3	3.1	11.6	9.1	34.3	313	142	17.5	445	32.9	836	50.6	1286	26.4	670	10.8	273	5"
BCHAD 12.114.08.60	69.9	6.5	3.4	12.6	10.5	39.3	324	147	17.5	445	36.9	936	54.6	1386	26.4	670	10.8	273	5"
BCHAD 12.114.08.75	94.7	8.8	3.6	13.6	11.7	43.8	362	164	17.5	445	42.8	1086	60.5	1536	26.4	670	10.8	273	5"
BCHAD 12.114	198.0	18.4	6.3	23.7	15.9	59.5	518	235	17.5	445	68.3	1736	86.1	2186	26.4	670	10.8	273	5"

ASME U/UM certified.
Designed and manufactured according to ASME Section VIII div. 1 2015

* flanges: ASME B 16.5

INSULATION

Insulation for BCHAD heat exchanger consists of two parts fastened with latch clamps which makes the insulation easy to assembly and dismantle. It is made of mineral wool covered with aluminum.

TECHNICAL DATA OF INSULATION

thickness: 3,2 inch / 80 mm
thermal conductivity: 0.474 Btu/ft. hour °F / 0,082 W/mK at max. temperature

NAMEPLATE

Ensure that all the information on the manufacturer's nameplate corresponds to the operating conditions.

The main name plate is placed on the shell. The second name plate is placed on the insulation. Name plates must not be removed from the heat exchanger.

STORAGE, PACKING AND TRANSPORTATION

Heat exchangers are packed in a wooden boxes. They should be stored in a clean place protected against climatic influences and corrosive agents (e.g. rain, snow, wind). If there is any water left inside the exchanger be aware that it will freeze in temperature under 32°F/0°C and may damage the device. During transportation, ensure that the heat exchangers are not exposed to mechanical damages.

WORKING EQUIPMENT

The installation with heat exchanger has to be equipped and secured with safety accessories (safety valve) in case the temperature or pressure exceeds the allowable level. Moreover, the heating system has to be equipped with expansion tank, thermometer, manometer, sensor of pressure and temperature. There could also be used a water sensor or air relief valve. Heat exchanger is equipped with insulation that would prevent heat loss and protect operating personnel from high temperature of the device.

It is necessary to avoid rapid opening or closing of the valves resulting in water-hammer effect. It is also necessary to avoid rapid pressure or temperature changes. Pressure or temperature should change proportionally.

OCCUPATIONAL SAFETY

This heat exchanger was built with utmost care and its operation is safe. It may nevertheless present a risk if not used or maintained by qualified personnel or in improper way.

Any person in charge of operating or maintaining the device must have read and understood this manual.

The heat exchanger, and particularly the technical safety equipment can only be operated or maintained by qualified personnel. If you have any doubt, please contact your supplier or the manufacturer for further information. The device must be protected from unauthorized operation.

Rules and procedures must be respected at all times. Do not operate the device in a way that compromises safety.

Safety equipment protects from severe bodily harm (burns, electric shock, etc.). Any work on thermostats must be performed by qualified personnel.

Any maintenance or cleaning task performed on the heat exchanger must be done with the device turned off.

POTENTIAL RISKS

Any contact with hot media especially steam can cause severe burns.
All piping parts of the installation are hot during operation. Any contact with the piping of the installation can cause severe burns. Avoid contact with any hot part of the installation.
Caution: Once the device is stopped, it remains hot for some time and the burn risk is still present.

INSTALLATION

Only qualified personnel shall install a heat exchanger. It should be installed, operated and maintained according to specifications. Heat exchanger should be installed in a way preventing mechanical stresses and external torque (e.g. in cases of pipe expansions, use expansion compensators to relieve the stress from the connections of the heat exchanger).

The heat exchanger should be installed in vertical.

Avoid direct contact of carbon steel with the heat exchanger as it can cause corrosion of heat exchanger surfaces.

OPERATING PRECAUTIONS

In order to achieve maximum performance of the heat exchanger the following must be strictly obeyed:

- Heat exchangers should be used according to the specification given by BERMO.
- Heat exchangers cannot be used with media which can cause corrosion to austenitic stainless steel of grades 316L or 304L.
- User-operator will prepare its own instruction manual for operating personnel, taking into account risk possibilities generated by using heat exchanger within their particular area of operation/production. It will contain safety instructions for personnel in case of emergency situation.
- Pressures and temperatures should not exceed limits (see name plate).
- Initial start-up should be done according to Start-up section.
- Fluids used in heat exchanger should be free of any debris.
- Prevent sudden temperature changes in heat exchanger (temperature

shocks). The temperature increase should not exceed 18°F/min (~10 °C/min).

- It is necessary to avoid hot medium entering the working space while the other medium is cold (max. temperature difference between media is 270°F /150°C).
- Prevent any of the fluids' temperature from dropping below their solidification point (freezing point).
- Do not keep inflammable objects or materials close to the heat exchanger.
- In central heating applications the manufacturer recommends to use water treatment. Otherwise, lime deposits can form on the tube walls, every time the hot water exceeds 140°F/60°C.
- Water treatment can minimize the chloride content and help to prevent corrosion.
- Foresee and set level of working pressure on cold side in order to avoid boiling of cold medium also during control process.
- Safety equipment in the installation should prevent the heat exchanger from pressure shocks.
- Prevent rapid pressure jump in the heat exchangers (pressure shock, water hammer) which can occur with quick closing of valves or break-down of pumps.
- It is necessary to take into account all possible risks, especially to put your attention to :
  - hot steam flowing from safety valve on equipment failure
  - high shell / nozzle temperatures during operation
  - risk of external fire

  Keep maximal concentrations of chemical compounds in water within allowed limits as follows (mg/l):

Temperature	68°F/20°C	104°F/40°C	140°F/60°C	176°F/80°C	212°F/100°C and more
Chlorides (Cl^-)[2)]	400	120	50	20	10
Sulphates (SO_4^{2-})	350	250	160	100	60
For treated heating water:					
Oxygen (O_2)	0,1	0,05	0,03	0,02	0,01
Chlorine (Cl_2)	0,5	0,3	0,2	0,1	0
Carbon dioxide (free CO_2)	5	5	3	3	2

It is prohibited to allow local vaporization on heat transfer surface.

In steam applications put your attention to the following:

- Steam as a heating medium have to be used inside the tube bundle only. It cannot be used in the shell.
- Separated condensate-line has to be used to promote condensate from steam before entering the tube bundle. Steam must not be wet!
- Steam systems have to be equipped with continuous (proportional) control system of heat load of steam. It is unsuitable to use “YES/NO” control!

START UP

Before start-up of heat exchanger it is necessary to check all safety valves and safety equipment, which have to be used according to national standards, norms or other directives.

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

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

The pressure increase/decrease should not exceed 43,5 PSI/min (3 bar/min).
The temperature increase/decrease should not exceed 18°F/min (10°C/min).

During start up, first open the valves, then start the pump of the cold medium followed by opening the cycle of the heating medium. The valves should be opened gradually in order to achieve a steady increase in flow and pressure. During start-up of steam system, it is useful to preheat heat exchanger slowly

to working temperature for the minimum of 5 – 10 min and then use steam with full working parameters.

MAINTENANCE

Draining or flushing of the heat exchanger can only be performed after the media have cooled down. The devices must be in no-pressure status. Water-tightness of all connections must be checked regularly. Please check the state of water-tightening materials as they deteriorate in time due to the constant operation temperature changes.

CLEANING

It is necessary to continually check the work of heat exchanger and to clean it with partial scaling. Lower efficiency can be recognized by increasing pressure drop of heated water, worse cooling of heating medium and related necessity of flow or decreasing of heat load.

Periodical cleaning and decalcification needs to be made in order to prevent formation of hard scaling inside the heat exchanger. Frequency of the cleaning:

- for heat exchanger working in system with water treatment – min. every 18 months (depending on quality and quantity of added water)
- for heat exchanger working in system of natural water – min. every 12 months.

The heat exchanger could be removed from the installation for cleaning only if the following are fulfilled:

- all of pumps are switched off and secured
- the equipment is not under pressure
- temperature of the heat exchanger drops under 104°F / 40°C but not less than 50°F /10°C.

The heat exchangers are cleaned by flushing the units with fluids which do not react with stainless steel.

Dirt deposited in the heat exchanger will result in increase of pressure drop, lower temperature difference in the heated medium or a higher exit temperature on the heating medium side. Flushing can be done without

removing of the heat exchanger from the system, although extra connections and bypasses would be required.

The cleaning solutions (detergents) are easily accessible at businesses carrying chemical cleaning agents for heat exchangers or tubing and piping applications. As a guideline to purchasing the cleaning solutions, check for the following product data:

- compatibility with austenitic stainless steel,
- accepted for use in food processing industries (if applicable),
- removes scale, slag, tarnishes, and hard water deposits,
- easily rinsed out of the system,
- has no dangerous or corrosive fumes

Following fluids must not be used to clean heat exchangers :

- **hydrochloric acid and its solutions**
- **free chlorine with concentration higher than 0,5 ppm; (Cl_2 < 0,5 ppm)**
- **solutions containing ions of Cl-, with concentration higher than following :**

Cl- < 50 ppm heating of water up to 122 to 140°F (50 to 60°C)

Cl- < 20 ppm heating of water up to 158 to 176°F (70 to 80°C)

- **all fluids which can deposit alkaline residues or phosphorus.**