FLO FAB
SINCE 1981
PUMP SOLUTIONS MANUFACTURER

SERIES BR

Installation, Operation & Maintenance Manual

Brazed Heat Exchangers

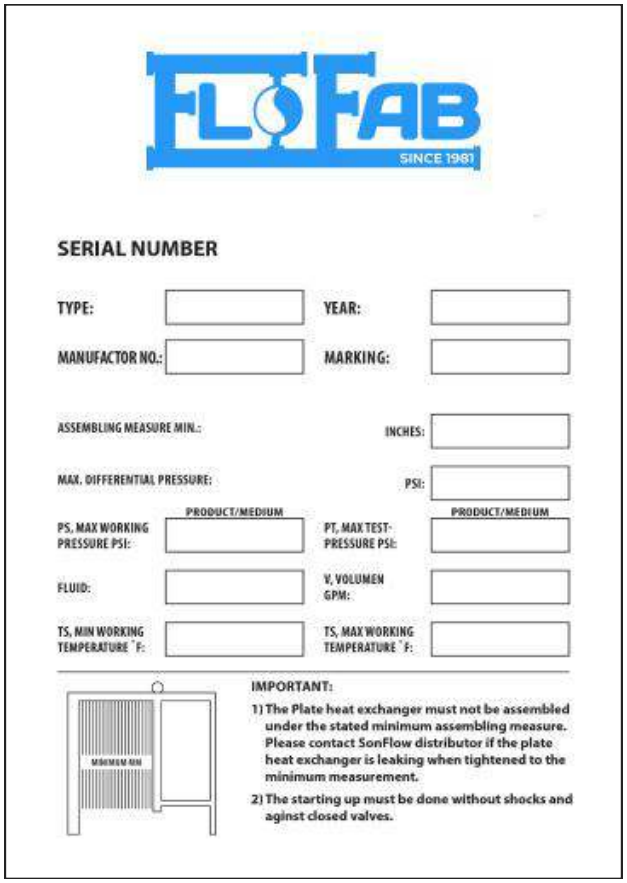
IMPORTANT! – READ ALL INSTRUCTIONS IN THIS MANUAL BEFORE OPERATING OR SERVICING A PUMP.

→NAMEPLATE

The nameplate contains important information about the construction of the BPHE. This information is related to the configuration and approval of the unit. The values on the nameplate must not be exceeded.

The following information is provided on the nameplate:

- Heat exchanger type
- Manufacture number
- Year of production
- Marking
- Maximum working pressure
- Maximum testing pressure
- Fluid group
- Volume in liters
- Minimum working temperature
- Design temperature
- Maximum working temperature



→CONSTRUCTION

The BPHE is composed of a bundle of thin, corrugated metal plates, surrounded by two thicker stabilizing plates.

During a vacuum brazing process, a thin copper foil placed between each of the thin metal plates melts and seal the BPHE.

To ensure an ideal pressure drop and flow rate, we calculate each solution based on the customer's requirements. This makes the unit energy-efficient and environmentally friendly. Based on the specific task, we also determine the number of plates and the size of the unit.

→PLATES

The corrugated plate design optimizes heat transfer by providing a large, compact total surface area for drawing heat from one liquid or gas to another.

The plates are optimized to meet specific temperature demands and capacities.

→CONNECTIONS

Threaded Connections/ Pipe Installation

When connecting pipes, use a torque wrench and adhere to the specified limits. Avoid over-tightening threaded connections, as this may damage the internal soldering. Ensure that the threads provided are parallel.

To tighten the unit, use an o-ring or circular gasket at the end of the connections. Alternatively, thread tape can be used, but be extremely careful not to over tighten the fitting.

⚠ IMPORTANT

Do not use chlorine or chlorinated water to clean stainless steel. Do not use phosphoric or sulfamic acid for cleaning titanium plates.

Maximum allowable Torque farce for Cu PHE

Connections Overview

→BRAZED CONNECTIONS

All connections are sealed to the cover plate by brazing them to the BPHE during the vacuum brazing process.

⚠ WARNING

Do not use chlorine or chlorinated water to clean stainless steel. Do not use phosphoric or sulfamic acid for cleaning titanium plates.

The available connection options depend on the application. It is crucial to choose the correct international or local standard for connections as they may not always be compatible.

The pipes should be equipped with brackets to prevent any torsion stress from concentrating at the heat exchanger's pipe connections.

The maximum allowable connection loads are given in the table on page 8 and are valid for Cu brazed PHE. If additional fatigue stress is involved, conduct additional analysis.

Flanges
1: Mickey Mouse Flanges
2: Compact Flanges

→DELIVERY/TRANSPORT

Upon receiving the BPHE, verify that all components are included according to the specifications and ensure that none of the parts, especially the connections, are damaged. If there is significant damage, promptly notify the carrier.

→BEFORE INSTALLATION

Before installing the BPHE, carefully remove all plugs and shipping covers and thoroughly inspect all openings for any foreign material.

Ensure that vent valves are installed for the BPHE, to allow purging and prevent or release any vapor or gas binding.

To prevent the BPHE from being exposed to conditions it is not designed for, it is important to install appropriate relief valves and temperature alarms.

→LIFTING INSTRUCTION

Lifting instructions for large brazed heat exchangers:

1. Properly position the straps
2. Lift the BPHE in a vertical position
3. Carefully lower the BPHE to a vertical position and place it on its feet
4. Remove the straps
5. Securely fasten the BPHE to the floor

⚠ WARNING

Be careful and keep clear of the heat exchanger during lifting to avoid personal injuries.

⚠ WARNING

Use straps when lifting. Never lift only by the connections or any of the studs.

→MOUNTING

It is advisable to mount the BPHE on the floor, using feets, or on the wall. Avoid directly welding or brazing brackets or attachments to the body of the unit.

It is crucial to mount them in a vertical position. Alternatively, if a horizontal position is preferred, ensure that all connections face upward. If you intend to deviate from these positions, please consult a FloFab representative for expert guidance.

To provide support, it is recommended to use a properly fitting mounting bracket positioned at the bottom of the unit. However, other methods that effectively protect against vibration and thermal shock are also acceptable.

Maintain a minimum space of 100 mm between adjacent BPHE units, walls, and other components. Sufficient space around the unit is essential for convenient service and maintenance.

When connecting the pipe system to the BPHE, ensure that no piping loads, including torque effects, are transferred to the BPHE. Properly isolate the pipe system against pressure pulsations, vibrations, and any thermal shock that may occur during connection to the BPHE.

→INSTALLATION FOR LIQUID/LIQUID OPERATION

The BPHE should always be connected in counter flow. H1 to H4 and H3 to H2. Or according to the thermal calculation performed for the specific task.

→INSTALLATION OF REFRIGERANTS/STEAM

The refrigerant is normally connected to the left side, while the water/brine medium is connected to the right side of the BPHE. The left and right sides are determined by vertically installing the unit with the connections facing towards you.

Moreover, H2 and H3 have an additional cooling channel, ensuring that the cold medium remains separated from the heads/followers.

→INSULATING JACKETS

If the BPHE will be operated at a very hot or very cold temperature, take protective actions, such as insulation jackets, to avoid injuries. Be certain to follow all local regulations. Be aware that the temperature limits of insulation jackets and the BPHE can be different.

Types of Insulation:

- 60 mm mineral wool with aluminum facing
- 50 mm PU foam with aluminum facing
- 30 mm two-part PU foam

→DRIP TRAYS:

Drip trays with and without drain spout.

Materials:

Painted steel, Galvanized steel, Stainless steel.

→START UP

If there is a need to pressure test the entire system where the BPHE is installed, it is essential to ensure that the testing pressure and procedure comply with PED testing requirements.

During the installation and operation, the BPHE's pressure should never exceed the maximum allowable design pressure.

Start-up sequence:

1. Close all valves connected to the BPHE
2. Fill up the cold side first
3. Gradually open the valves and start the circulation pump. Continue to open the valves gradually until they are fully open
4. Repeat the above steps on the hot side
5. Start the automatic control system

During operation, ensure the following:

- Verify that media temperatures and pressures are within the limits specified on the nameplate.
- Check for any leakages resulting from faulty connection tightening.

⚠ WARNING

Always consider personal protection when installing.

The surface of the BPHE might reach a extremely hot temperature equal to the temperature of the working media.

For optimal heat transfer performance, it is generally recommended to connect the BPHE in a configuration where the media flows through it in opposite directions (counter-current flow).

Steam

Prior to opening the steam valves, drain the steam side. This precaution reduces the possibility of water hammer, which can cause damage to the BPHE and void any warranty.

It is advisable to use only slow opening/closing steam control valves in this system.

→FILTER

To prevent clogging of the BPHE by mechanical particles or other foreign particles, we highly recommend using a filter to protect both the primary and secondary sides.

Accumulated debris inside the BPHE can lead to reduced performance, significant pressure loss, and potential freezing of the BPHE. If you have any concerns about the maximum particle size, please consult your FloFab representative for assistance.

→OPERATION

During operation, it is important to ensure protection against thermal or pressure stress for the BPHE. Adjustments to the flow rate should be made gradually to prevent sudden changes in pressure and temperature. To prevent water hammers, avoid using quick-closing valves.

BPHEs must be protected against the following:

- Blockage
- Freezing
- Steam or water hammer
- Thermal shock
- Vibration and/or pressure spikes.

→SHUTDOWN PROCEDURE

1. Close the hot side by slow adjusting the control valve. Maintain full flow on the cold side
2. When the control valve is closed, stop the pump
3. Gradually close the cold side and stop the pump
4. Close all shut-off valves
5. If the BPHE will be shut down for an extended period, it should be drained when the device is cold.

Keep in mind the possibility of freezing at low temperatures. BPHEs that are not in operation should be emptied and blown dry whenever there is a risk of freezing.

→STORAGE

If the BPHE needs to be stored, ensure that it is kept in a protective environment, away from corrosive substances and dust that may impact its performance. The storage temperature should range between -20°C to +60°C, and the humidity should be maintained between 30% to 90%.

→CLEANING

The normally high degree of turbulence facilitates a self-cleaning effect in the channels. However, certain operational conditions can lead to a significant risk of fouling, particularly when dealing with hard water and high temperatures. Fortunately, it is always possible to clean a BPHE by circulating a cleaning liquid within the system (CIP-Cleaning in Place). It is important to select a cleaning compound that matches the type of contamination present in the BPHE while ensuring that it does not damage the materials of the exchanger.

For regular cleaning of the heat exchanger, it is recommended to use a detergent with a weak acid, 5% phosphorus, or 5% oxalic acid. The detergent should be circulated throughout the BPHE to effectively clean it.

To achieve optimal cleaning, the detergent should be circulated at a flow rate of at least 1.5 times the normal flow rate. The best results are obtained by alternating the flow direction every 30 minutes, if possible. After cleaning, it is crucial to rinse the system thoroughly with clean water to remove any residual acid.

The frequency of cleaning intervals depends on factors such as the nature of the media being processed and the operating temperatures.

MAINTENANCE AND ERRORS

Table 1 Maintenance and Errors

DESCRIPTION OF THE ERROR	CAUSE	SOLUTION
Heat exchanger is dripping at the connection	The connections are not tightened sufficiently	Tighten the connections
Required outlet temperatures are not being reached	Fouling, operation not guaranteed according to data sheet, incorrect connection	Contact FloFab
Leakage at BPHE/Water under the BPHE	Corrosion/Condensation/Thermal shock	Contact FloFab
Insulation is loose	Faulty installation; Insulation is too large	Please check the measurement of the insulation and contact FloFab
Fittings cannot be tightened	Nuts cannot be screwed on	Check the connection thread/nut for damages
The feets cannot be installed	Nuts cannot be screwed on	Check the bolt thread

Table 2 Max. media temperature

MAX. CHLORID (CL) IN PPM FOR	40°C	60°C	80°C	100°C	120°C	140°C
AISI 304 / 1.4301	70	35	15	10	5	—
AISI 316/ 1.4401	350	175	80	40	20	10
SMO 254	2400	1200	600	300	150	70
Titanium	180 000	90 000	45 000	20 000	10 000	6 000

ATTENTION! This table is for guidance only.

Table 3 Corrosion resistance

INGREDIENTS	CONCENTRATION OF INGREDIENTS IN MG/L	AISI 316 1.4401	COPPER
Aluminium (Al)	< 0.2	A	A
	> 0.2	A	B
Ammonia (NH3)	< 2	A	A
	2-20	A	B
	> 20	A	C
Chloride (Cl) *)	< 250	A	A
	> 250	B	B / C
	< 10 µS/cm	A	B
Conductivity	10 - 500 µS/cm	A	A
	> 500 µS/cm	A	C
Iron (Fe) dissolved	< 0.2	A	A
	> 0.2	A	B
Carbon dioxide (CO2)	< 5	A	A
	5 - 20	A	B
	> 20	A	C
Water hardness	4.0 - 8.5 °dH	A	A
Glycol	< 20%	A	A
	20 - 50%	A	A
	> 50%	A	A
HCO3 - / SO4 2-	< 1.0	A	B / C
	> 1.0	A	B
Hydrogen carbonat (HCO3)	< 70	A	B
	70 - 300	A	A
	> 300	A	B / C
Mangan (Mn)	< 1.0	A	A
	> 1.0	A	B
Nitrate (NO3)	< 100	A	A
	> 100	A	B
pH value	< 6	B	B
	6.0 - 7.5	A / B	B
	7.5 - 9.0	A	A
	> 9	A	B
Sulfat (SO42-)	< 70	A	B
	70 - 300	A	B / C
	> 300	C	C
Sulfit SO3 free chlorine gas Cl2	< 1	A	A
	1 - 5	A	B
	> 5	A / B	B / C
Hydrogene sulfid (H2S)	< 0.05	A	A
	> 0.05	A	B / C

A = Suitable for normal conditions, long lifespan B = Risk of corrosion C = Not suitable for use *) Maximum 60°C

LIMITED WARRANTY

We warrant to our immediate customer and to the ultimate consumer that products of our manufacture will be free of defects in material and workmanship under normal use and service for the following time periods: when installed and maintained in accordance with our instructions. Pumps products: eight (8) years after date of invoicing. As used herein, "the ultimate con-sumer" is defined as the purchaser who first uses the product after its initial installation or, in the case of product designed for non-permanent installation, the first owner who used the product. It is the purchaser's or any sub-vendee's obligation to make known to the ultimate consumer the terms and conditions of this warranty. This warranty gives you specific legal rights, and there may also be other rights which vary from province/state to province/state. In the event the product is covered by the Consumer Product Warranty

(1) the duration of any implied warranty associated with the product by virtue of said law is limited to the same duration as stated herein, (2) this warranty is a LIMITED WARRANTY, and (3) no claims of any nature whatsoever shall be made against us, until the ultimate's consumer, his successor, or assigns, notifies us in writing of the defect, and delivers the product and/or defective part(s) freight prepaid to our factory or nearest authorized service station. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY AND ALL WARRANTIES WITH RESPECT TO ANY PRODUCT SHALL BE TO REPAIR AT OUR ELECTION, F.O.B. POINT OF MANUFACTURE OR AUTHORIZED PARTS REPAIR STATION, AND/OR PARTS AS PROVEN DEFECTIVE. THERE SHALL BE NO FURTHER LIABILITY, WHETHER BASED ON WARRANTY, NEGLIGENCE OR OTHERWISE. Unless stated otherwise, guarantees in the nature of performance specifications furnished in addition to the fore-going material and workmanship, warranties on a product manufactured by us, if any are subject to laboratory tests corrected for field performance. Any additional guarantees, in the nature of performance specifications must be in writing and such writing must be signed by our authorized representative.

Due to inaccuracies in field testing, if a conflict arises between the results of fleld testing conducted by or for user, and laboratory test corrected for field performance, the latter shall control. Components or accessories supplied by us but manufactured by others are warranted only to the extent of and by the terms and conditions of the original manufacturer's warranty.

RECOMMENDATION FOR SPECIAL APPLICATIONS OR THOSE RESULTING FROM SYSTEMS ANALYSIS AND EVALUATIONS WE CONDUCT WILL BE BASED ON OUR BEST AVAILABLE EXPERIENCE AND PUBLISHED INDUSTRY INFOR-MATION. SUCH RECOMMENDATIONS DO NOT CONSTITUTE A WARRANTY OF SATISFACTORY PERFORMANCE AND NO SUCH WARRANTY IS GIVEN. This warranty shall NOT apply when damage is caused by (A) improper installation, (B) improper voltage (C) lightning (D) sand or other abrasive material (E) scale or corrosion build-up due to excessive chemical content (F) rupture of mechanical seals (G) premature wear. Any modification of the original equipment will also void the warranty. We will not be responsible for loss, damage or labor cost due to interruption of service caused by defective parts. Neither will we accept charges incurred by others without our prior written approval. This warranty is void if our inspection reveals the product was in a manner inconsistent with normal industry practice and/or our specific recommendations. The purchaser is responsible for communication of all necessary information regarding the application and use of the product.

UNDER NO CIRCUMSTANCES WE WILL BE RESPONSIBLE FOR ANY OTHER DIRECT OR CONSIQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, LOST INCOME, LABOUR CHARGES, DELAYS IN PRODUCTION, IDLE PRODUCTION, WHICH ARE DAMAGES CAUSED BY ANY DEFECTS IN MATERIAL AND/OR WORKMANSHIP AND/OR DELAYS IN SHIPMENT. THIS WARRANTY IS IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No rights extended under this warranty shall be assigned to any other person, whether by operation of law or otherwise, without our prior written approval. If any litigation is commenced between the parties hereto for the enforcement of any rights hereunder, the successful party in subject litigation shall be entitled to receive from the unsuccessful party all costs incurred in connection therewith, including a reasonable amount of attorney's fees. YOUR ACCEPTANCE OF ANY GOODS SUPPLIED BY US, OR ON OUR BEHALF, SHALL BE WITHOUT LIMITATION, CONSTITUTE ACCEPTANCE OF ALL THE TERMS AND CONDITIONS. PLEASE TAKE NOTE THAT THE WARRANTY IS ANNULLED ONCE AN INVOICE FROM FLO FAB INC REMAINS UNPAID 90 DAYS AFTER THE BILLING DATE.

Our acceptance of your order is expressly conditioned on the general terms and conditions. The contract shall not include any deviating or additional terms unless expressly agreed to in writing and signed by an officer of our company.

Our acceptance of your order is expressly conditioned on the general terms and conditions set forth below and all terms stated on the face of this form. The contract shall not include any deviating or additional terms unless expressly agreed to in writing and signed by on officer of our company.

PRICES: All prices are subject to change without notice and all shipments will be invoiced at the price in effect at the time of shipment, except when otherwise agreed to in writing by our authorized representative. Published prices are for products of our standard design and construction and any item not covered by the most recent published price list must be referred to us for special pricing. Prices do not include freight. Weights shown in price lists are approximate shipping weights. The amount of any applicable present or future tax or other government charge upon the production, sale, shipment or use of goods ordered or sold is not in the price and will be added to billing unless you provide us with on appropriate exemption certificate.

QUOTATION: Prices quoted by us are valid for 30 days from date of quotation unless we have otherwise specified in writing. Clerical errors on quotations are subject to our correction and such errors will not be binding.

CANCELLATION & REVISIONS: No purchase orders accepted and acknowledged by us may be cancelled or revised by you except with our prior written consent and upon payment of reasonable cancellation charges compensating us for all costs incurred in work done and material purchased. We reserve the right to determine what constitutes reasonable cancellation charges.

RETURN OF EQUIPMENT: No equipment shall be returned to us without first obtaining a written Returned Goods Authorization and shipping instruction from us. The returner must prepay the charges in full for transportation to our factory. Credit allowed for new, undamaged equipment of current standard design will be 80% of the invoiced price or current billing price, whichever is less. Equipment which hos been used, however slight, will not be accepted. Authorization will not be given for return of equipment, (1) which would, in our opinion, result in an excess in the amount of stock we normally carry, (2) not invoiced within the last 3 months, or (3) which is non-standard and manufactured specifically to a buyer's specifications. For non-standard equipment not of our manufacture, the only credit allowed will be such credit as may be allowed by the manufacturer of such equipment. Equipment must be returned within 30 days of the issuance of the Returned Goods Authorization. No item with a net value of less than $50.00 will be authorized for return. Unauthorized returns may be refused and/or returned freight collect.

CREDIT & PAYMENT: Payment is due as noted on our invoice. Overdue accounts are subject to a service charge. All orders are subject to approval of our credit department and we may require full or partial payment in advance. Pro rata payments shall become due as shipments are made. If the shipments are delayed by you for any cause, payments shall become due from date on which we are prepared to make shipment and storage shall be at your risk and expense. If manufacture is delayed by you for any cause, a partial payment based upon the proportion of the order completed shall become due from the date on which we are notified of the delay.

SECURITY INTEREST: We shall have o lien on all goods sold as security for payment on the invoice price, and upon request you shall provide and execute a financing statement showing such lien.

DELIVERY: We will reasonable effort to meet your delivery requirement provided you provide us, on a timely basis, all approvals, technical data, instructions and credit approval requirements needed for release of the shipment. However, all delivery and/or shipment dates are estimates only unless we have expressly guaranteed delivery of such dates in writing at your specific request. In no event shall we have any liability if delivery is delayed by strikes, labour disturbances, material shortages, plant calamities or disaster, acts of God, government actions, civil disturbance, the failure of any pre-supposed condition of the contract, withholding shipments due to credit clearance, or other interferences beyond our reasonable control, and the date of delivery shall be extended for a period of time equal to the time lost because of any such reason.

SHIPPING: Unless you specify in writing and we acknowledge in writing, (A) goods will be boxed or crated as we may deem proper for protection against normal handling and for domestic shipment, (B) routing and manner of shipment will be at our discretion, and may be insured at your expense. An extra charge will be mode for special handling. All shipments are F.O.B. point of manufacture. Delivery of goods to the initial carrier will constitute delivery to you and all goods will be shipped at your risk. A claim for loss or damage in transit must be entered with the carrier and prosecuted by you. Acceptance of material from a common carrier constitutes a waiver of any claims against us for delay, damage or loss.

GOVERNING LAW: It is understood and agreed that these Terms and Condition of Sale shall be interpreted under and pursuant to the laws of the Province of Quebec; you agree that any action at law which is related to any contract of sale brought against the company shall be filed in the appropriate court located in the Province of Quebec.