



OPERATING MANUAL

Shell-and-Tube Heat Exchanger

Series BNZ



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1 Introduction

1.1 References to operating manual

This operating manual describes functions and operations of the Series BNZ shell-and-tube heat exchanger made by NewCool GmbH. This operating manual contains all necessary information for a safe and professional use.

This operating manual is divided into 9 chapters. On each page you will find the chapter title to the right or left in the heading. In the footer is listed the name of the series, the date the operating manual was issued (stated as the edition) as well as the page number. To make it easier in finding your way through these pages, the operating manual contains cross-references which help guide you through the document.

Technical data as well as figures for dimensions and weights are valid as of the date this operating manual was printed. Figures may vary on a case-by-case basis from the respective model of the shell-and-tube heat exchanger, without altering the factual information and becoming invalid. Any claims arising herefrom may not be asserted.

Discrepancies from statements contained in text and figures are possible and are dependent on the technical development and features and components of the shell-and-tube heat exchanger. The right to modify products in the interest of ongoing technical development is reserved. Additional information is contained in the related data sheets. Information on other series can be requested from NewCool GmbH or found under www.newcool.de.

1.2 Intended usage

Series BNZ shell-and-tube heat exchangers made by NewCool GmbH are intended for use as oil/water coolers and for certain operating environments, for example, in regards to pressure and temperature. Dependent upon the operating demands and related conditions of the operator, the specifications for the shell-and-tube heat exchanger is exactly determined prior to operation together with NewCool GmbH. The technical operating conditions for each heat exchanger can be taken from the type plate and data sheet.

The shell-and-tube heat exchanger may only be operated under compliance with all safety notices listed in this operating manual and only by trained and qualified personnel. A safe and trouble-free operation can only be guaran-

teed when the shell-and-tube heat exchanger is operated in accordance with the intended use as detailed in this operating manual.

Any use not in compliance with the intended use shall be considered as improper. The manufacturer shall not be liable for any damages to persons or property which result from improper use. In such cases the operator shall be solely liable.

1.3 Warranty and liability

In general the operator of the shell-and-tube heat exchanger is bound to the general terms and conditions for sales and delivery provided by NewCool GmbH. Should these terms and conditions not be included, they must be requested from the manufacturer.

Warranty and liability claims arising from damages to persons and property are excluded when they result from one or more of the following causes:

- ☐ Improper use of the shell-and-tube heat exchanger
- ☐ Improper putting into operation, assembly, operation and maintenance/repair of the heat exchanger
- ☐ Changes to the design and construction of the shell-and-tube heat exchanger without written permission by manufacturer
- ☐ Operating the heat exchanger with improperly installed connections to the plant's systems and defective or improperly installed safety features
- ☐ Non-compliance with safety regulations and notices in this operating manual
- ☐ Improper repairs
- ☐ Use of spare parts and wear-and-tear items as well as operating materials and cleaning agents other than those approved by the manufacturer

NewCool GmbH assumes warranty and liability solely for material and manufacturing faults and defects.

2 Safety Notices

2.1 Standards and guidelines

The shell-and-tube heat exchanger is built according to currently valid technical regulations and is safe to operate. Development and design of the heat exchanger incorporates all applicable safety and health requirements of corresponding laws, standards and guidelines. The safety of the heat exchanger is, when necessary, confirmed by the CE sign and declaration of conformity.

All statements in this operating manual regarding safety correspond to currently valid national laws and regulations of the European Union. Applicable laws and national regulations in other countries must be adhered followed. Instructions in this operating manual must at all times be fully complied with. Along with the safety notices in this operating manual, the generally applicable regulations regarding accident prevention and environmental protection must be observed and complied with.

2.2 Symbols and signal words

2.2.1 Safety symbols used in the manual



DANGER

Warning of possible danger to life and limb



ATTENTION

Warning of possible danger to life and limb caused by hot surface



DANGER

Warning of possible danger to life and limb caused by poisons



ATTENTION

Warning of possible property and equipment damage



NOTICE

Important general notice



NOTICE

Important notice regarding environmental protection

2.2.2 Safety markings on the shell-and-tube heat exchanger

Special warning and notice symbols are attached to the shell-and-tube heat exchanger.



DANGER

Danger of accidents and injuries caused by missing or damaged safety markings!

Damaged or missing safety symbols on the shell-and-tube heat exchanger can lead to human error resulting in damages to persons and property.

Warning and notice signs may not be removed.

Replace damaged, scratched or unreadable warning and notice signs with new ones.

Only clean warning and notice signs with water and soap, not with fuels or solvents.

The following safety symbol is attached to the shell-and-tube heat exchanger:

Triangular, black and yellow symbol for danger caused by hot surfaces



Fig. 1 Sign "Warning - Hot Surface"

2.2.3 Type plate

The following type plate is attached ex-works to clearly identify the shell-and-tube heat exchanger:


Gerätebezeichnung	BNZ-131-1-G-CN-S-GG-I-S13		
Artikelnummer	NCWT00XX		
Seriennummer	100000000		
Kommissionsnummer	2007000XX		
	Mantel	Rohr	
Betriebsdruck	40	16	bar
Betriebstemperatur	95	95	Grad Celsius
Spannung			Volt
Leistung			kW
Max. Betriebstemperatur	95		Grad Celsius

Fig. 2 Type plate

Removal of the type plate results in a loss of guarantee and warranty claims.

Based on the product key engraved on the type plate allows clear identification of dimensions, material composition and usage of the shell-and-tube heat exchanger.

BNZ - 60 - 131 - 1 - G - CN - S - GG - I - S13

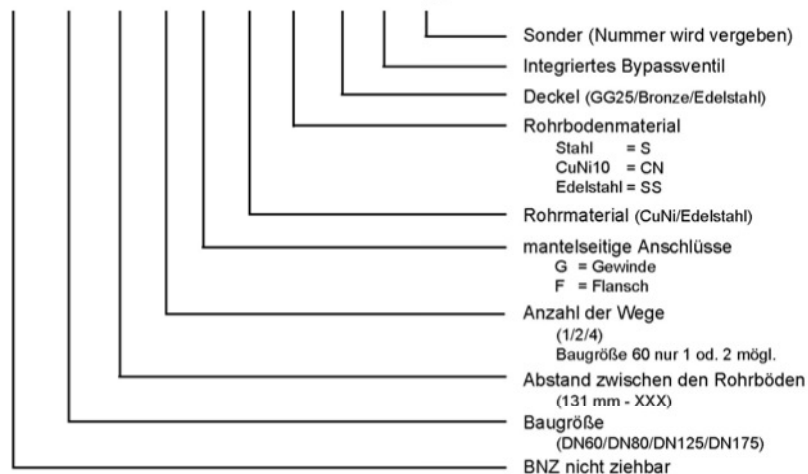


Fig. 3 Product key

2.3 General safety notices

- ☐ The shell-and-tube heat exchanger may only be used for the purpose intended.
- ☐ All attached safety and warning notices may not be removed and must remain clearly legible.
- ☐ The heat exchanger may only be assembled, operated and maintained by authorized and qualified personnel. All work is to be done with care and conducted under the aspect of "safety".
- ☐ The shell-and-tube heat exchanger must be immediately shut down when dangers become apparent that could lead to injury to persons or damage to property.
- ☐ Along with the safety notices in this operating manual, the generally applicable safety and accident prevention regulations of the respective host countries must be observed and complied with. The operator must determine the current edition of these regulations.
- ☐ Any downtime and environmental impairments caused by improper usage are to be excluded.

- ☐ Prior to assembly or operation, personnel must read and understand this operating manual. This particularly includes knowledge of how dangers for injury to the operator or third party can be avoided.
- ☐ All safety notices in in this operating manual and in all related documents must be observed and complied with.
- ☐ The operator is responsible to ensure that no unauthorized personnel have access to the heat exchanger. All work on the heat exchanger, such as, for example, assembly, disassembly, transportation, cleaning and maintenance is to be conducted under adherence to the regulations regarding work safety and environmental protection.
- ☐ Spare parts must principally be purchased from NewCool GmbH. NewCool GmbH will not assume any liability for damages resulting from the use of spare parts manufactured by third parties.

2.4 Requirements on personnel



ATTENTION

All work on the shell-and-tube heat exchanger is only to be conducted by trained, instructed and authorized personnel. The areas of responsibility for the respective personnel are to be clearly defined.

Prior to conducting any of the activities the personnel must have been made aware of the dangers that can arise from working with a shell-and-tube heat exchanger. Danger of injury can arise from the heat exchanger if it is operated by untrained personnel.

Any person charged with operating or maintaining the shell-and-tube heat exchanger must have read and understood the entire operating manual and must have knowledge of all safety notices contained therein.

The following must be observed:

- ☐ All safety notices in this operating manual and all related documents must at all times be observed and complied with.
- ☐ The shell-and-tube heat exchanger may only be operated by trained personnel who have also received safety instructions.

- ☐ The personnel must possess profound knowledge of the following operations, regulations, conduct and components:
 - Operations in the interaction between the heat exchanger and the plant
 - Safety features of the heat exchanger and their proper functioning
 - Confining, securing and identifying of the danger zones of the heat exchanger
 - Conduct and actions in case of danger
- ☐ The personnel may not have any physical handicaps, which may temporarily or permanently impair their attentiveness and judgement. Operating the heat exchanger as well as all maintenance, assembly, repair and cleaning work by minors or persons who are fatigued or under the influence of alcohol, drugs or medication is not permitted.
- ☐ Depending upon the work to be conducted, personnel must wear protective clothing, protective gloves and, if necessary, protective goggles and breathing equipment.
- ☐ Should dangers arise which could lead to personal injury, the plant into which the heat exchanger is integrated must be shut down immediately.
- ☐ Eating, drinking, smoking and working with open fires are not permitted at the location of the heat exchanger.

The operating manual must be available to the personnel at all times. It is recommended that the operator obtain written confirmation from the personnel regarding knowledge of the operating manual. A prerequisite for the safe and trouble-free operation of the heat exchanger, for protecting persons from dangers and for avoiding mistakes is the knowledge of this operating manual.

The responsibility for the accident-free operation lies with the operator or the personnel authorized by him.

2.5 Safety notices for technical condition

The following must be observed:

- ☐ No modifications or redesigns may be conducted on the heat exchanger.
- ☐ The heat exchanger must be examined for damages and proper working condition prior to each start-up. The operator is obligated to only operate the heat exchanger in good and operationally safe working condition. The technical condition must always comply with legal requirements.

- ☐ Any changes to the heat exchanger which impact safety must be immediately reported to the operator by the personnel.
- ☐ The heat exchanger may only be connected to the supply lines intended and designed for this purpose.

2.6 Safety notices for transport, assembly and installation

Responsibility for the transport of the shell-and-tube heat exchanger principally rests with the respective transport company.

The following safety requirements must be complied with during transport, assembly and installation of the shell-and-tube heat exchanger:

- ☐ Assembly and installation may generally only be conducted by trained and qualified personnel.
- ☐ Unauthorized assembly and installation is not permitted.
- ☐ Heat exchanger components must be secured during transportation according to the regulations applicable to the means of transportation used.
- ☐ Only adequately dimensioned lifting equipment and lifting accessories may be used for transportation.
- ☐ Standing under suspended loads is prohibited.
- ☐ Wear a safety helmet.

2.7 Safety notices for operations

The following safety notices must be complied with during operation of the shell-and-tube heat exchanger:

- ☐ The heat exchanger may only be operated when all safety features are in place.
- ☐ Depending upon operational demands, the operator must make provisions for safety features, such as, for example, safety valves, heat protection covers, temperature sensors, etc.
- ☐ The proper functioning of the safety features must be checked on a regular basis. Should faults or defects occur they must be rectified immediately.
- ☐ The heat exchanger must be secured with a mechanical protection against unauthorized contact and unauthorized access.

- ☐ The heat exchanger may not be exposed to excess temperature or excess pressure.
- ☐ The operational safety of the heat exchanger must be ensured at all times.
- ☐ The operational conditions must be suitable for the use of the heat exchanger.
- ☐ The plant must be shut down immediately should changes to the heat exchanger, such as, for example, excessive operating temperature be detected during operation.

2.8 Safety notices for maintenance

The personnel responsible for maintenance, inspection and trouble shooting must possess the appropriate qualifications.

All maintenance work is only to be conducted by trained and qualified personnel.

The following must be observed:

- ☐ Work on the heat exchanger may only be conducted after the plant has been shut down. A warning notice that work on the heat exchanger is in progress should be posted by the on/off switch. Secure plant against unauthorized start-up.
- ☐ Only spare parts and wear-and-tear items as well as operating materials and cleaning agents may be used that have been approved by NewCool GmbH.
 - ☐ Do not use aggressive cleaning agents.
- ☐ Use lint-free cleaning cloth.
Only work with dry and filtered compressed air at maximum 2 bar. Conduct a visual and operational inspection following the cleaning work.

2.9 Safety notices handling ancillary and operating materials

All regulations and EU safety data sheets issued by the respective manufacturers regarding storage, handling, use and disposal must be observed regarding lubricants, operating materials as well as cleaning agents used in the operation or maintenance of the heat exchanger.

The following is to be observed regarding handling of ancillary and operating materials as well as cleaning agents:

- ☐ Only use materials approved by manufacturer.
- ☐ Lubricants and operating materials, cleaning agents as well as their containers are not to be disposed of as regular household refuse or seep into the soil. Please observe the notices on the corresponding data sheets.
- ☐ Only use the container approved for use for the respective material. Label each container accordingly.
- ☐ The regulations contained in the safety data sheets regarding handling of approved cleaning agents must also be observed. In the event of skin or eye contact, the following measures must be taken:
 - After skin contact: Clean skin with water and soap
 - After eye contact: Flush eyes with running water for at least 10 minutes, if necessary consult medical specialist
 - After inhalation: provide fresh air or oxygen, if necessary consult medical specialist

3 Technical Data

3.1 Series BNZ oil/water heat exchanger

Description	Value
Max. operating pressure - housing	40 bar
Max. operating pressure - tube	16 bar
Min./max. operating temperature	5 °C/95 °C

Tab. 1: Series BNZ technical data

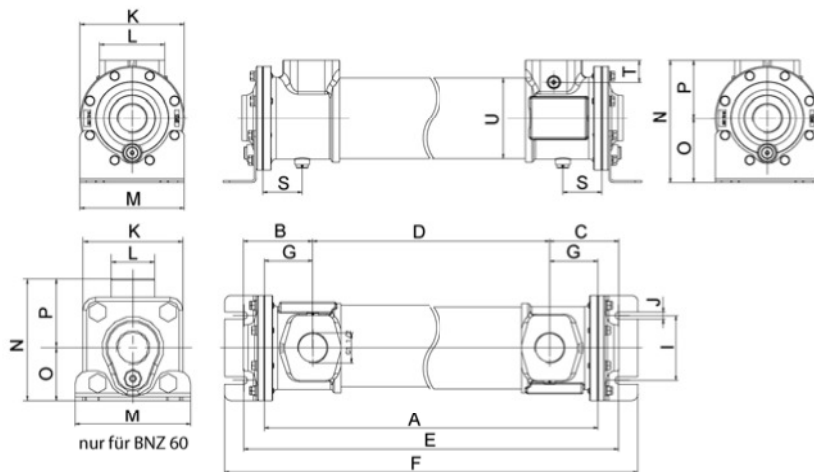


Fig. 4: Dimensions 1-way heat exchanger

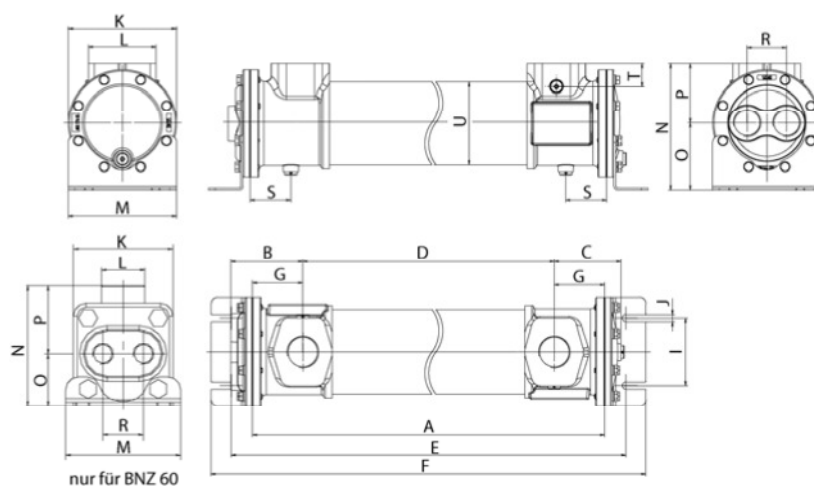


Fig. 5: Dimensions 2-way heat exchanger

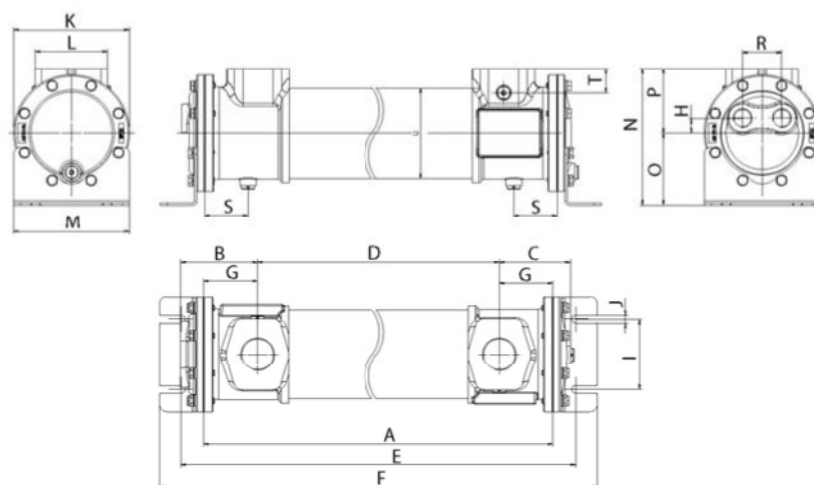


Fig. 6: Dimensions 4-way heat exchanger

Type	A	B			C		
		1-way	2-way	4-way	1-way	2-way	4-way
BNZ 60-131	131	65	65	-	65	65	-
BNZ 60-208	208	82,5	82,5	-	82,5	82,5	-
BNZ 60-259	259	82,5	82,5	-	82,5	82,5	-
BNZ 60-310	310	82,5	82,5	-	82,5	82,5	-
BNZ 60-361	361	82,5	82,5	-	82,5	82,5	-
BNZ 60-463	463	82,5	82,5	-	82,5	82,5	-
BNZ 60-615	614	82,5	82,5	-	82,5	82,5	-
BNZ 60-920	920	82,5	82,5	-	82,5	82,5	-
BNZ 80-208	218	99	91	91	99	91	91
BNZ 80-310	245	99	91	91	99	91	91
BNZ 80-361	361	99	91	91	99	91	91
BNZ 80-463	463	99	91	91	99	91	91
BNZ 80-615	615	99	91	91	99	91	91
BNZ 80-920	920	99	91	91	99	91	91
BNZ 125-310	310	109,5	109,5	109,5	109,5	109,5	109,5
BNZ 125-361	361	109,5	109,5	109,5	109,5	109,5	109,5
BNZ 125-463	463	109,5	109,5	109,5	109,5	109,5	109,5
BNZ 125-615	615	109,5	109,5	109,5	109,5	109,5	109,5
BNZ 125-920	920	109,5	109,5	109,5	109,5	109,5	109,5
BNZ 125-1225	1225	109,5	109,5	109,5	109,5	109,5	109,5
BNZ 175-XXX	X	169	169	169	169	169	169

Tab. 2: Series BNZ dimensions in mm

Type	D	E	F	G	H	I	J	K	L	M
BNZ 60-131	55	181	213	38	-	63,5	9	78	34	90
BNZ 60-208	97	259	290	55,5	-	63,5	9	78	34	90
BNZ 60-259	148	310	341	55,5	-	63,5	9	78	34	90
BNZ 60-310	199	361	392	55,5	-	63,5	9	78	34	90
BNZ 60-361	250	412	443	55,5	-	63,5	9	78	34	90
BNZ 60-463	352	514	545	55,5	-	63,5	9	78	34	90
BNZ 60-615	504	665	696	55,5	-	63,5	9	78	34	90
BNZ 60-920	809	971	1002	55,5	-	63,5	9	78	34	90
BNZ 80-208	86	265	310	66	18	76	11	130	94	127
BNZ 80-310	178	357	402	66	18	76	11	130	94	127
BNZ 80-361	229	408	453	66	18	76	11	130	94	127
BNZ 80-463	331	510	555	66	18	76	11	130	94	127
BNZ 80-615	483	662	707	66	18	76	11	130	94	127
BNZ 80-920	788	967	1012	66	18	76	11	130	94	127
BNZ 125-310	157	375	436	76,5	21	102	11	165	103	165
BNZ 125-361	208	426	487	76,5	21	102	11	165	103	165
BNZ 125-463	310	528	589	76,5	21	102	11	165	103	165
BNZ 125-615	462	680	741	76,5	21	102	11	165	103	165
BNZ 125-920	767	985	1046	76,5	21	102	11	165	103	165
BNZ 125-1225	1072	1290	1351	76,5	21	102	11	165	103	165
BNZ 175-XXX	X-196	X+91	X+174	98	36	140	11	220	152	210

Tab. 2: Series BNZ dimensions in mm (continued)

Type	N	O	P	R		S	T	U
				2-way	4-way			
BNZ 60-131	98	45	53	31,75	-	-	-	65
BNZ 60-208	98	45	53	31,75	-	-	-	65
BNZ 60-259	98	45	53	31,75	-	-	-	65
BNZ 60-310	98	45	53	31,75	-	-	-	65
BNZ 60-361	98	45	53	31,75	-	-	-	65
BNZ 60-463	98	45	53	31,75	-	-	-	65
BNZ 60-615	98	45	53	31,75	-	-	-	65
BNZ 60-920	98	45	53	31,75	-	-	-	65
BNZ 80-208	139	66	73	54	44	53	35	90
BNZ 80-310	139	66	73	54	44	53	35	90
BNZ 80-361	139	66	73	54	44	53	35	90
BNZ 80-463	139	66	73	54	44	53	35	90
BNZ 80-615	139	66	73	54	44	53	35	90
BNZ 80-920	139	66	73	54	44	53	35	90
BNZ 125-310	170	78	92	60	56	62	35	128
BNZ 125-361	170	78	92	60	56	62	35	128
BNZ 125-463	170	78	92	60	56	62	35	128
BNZ 125-615	170	78	92	60	56	62	35	128
BNZ 125-920	170	78	92	60	56	62	35	128
BNZ 125-1225	170	78	92	60	56	62	35	128
BNZ 175-XXX	234	115	119	94	80	80	35	180

Tab. 2: Series BNZ dimensions in mm (continued)

Type	Heat exchange surface in m ²	Oil connector		Drain screw (S)	Test port (T)
		Standard	Optional		
BNZ 60-131	0,335	G 1/2"			
BNZ 60-208	0,597	G 3/4"			
BNZ 60-259	0,838	G 3/4"			
BNZ 60-310	0,931	G 3/4"			
BNZ 60-361	1,091	G 3/4"			
BNZ 60-463	1,425	G 3/4"			
BNZ 60-615	1,902	G 3/4"			
BNZ 60-920	2,902	G 3/4"			
BNZ 80-208	1,173	G 1 1/2"	SAE 1 1/2"	G 1/4"	G 1/4"
BNZ 80-310	1,778	G 1 1/2"	SAE 1 1/2"	G 1/4"	G 1/4"
BNZ 80-361	2,121	G 1 1/2"	SAE 1 1/2"	G 1/4"	G 1/4"
BNZ 80-463	2,763	G 1 1/2"	SAE 1 1/2"	G 1/4"	G 1/4"
BNZ 80-615	3,669	G 1 1/2"	SAE 1 1/2"	G 1/4"	G 1/4"
BNZ 80-920	5,550	G 1 1/2"	SAE 1 1/2"	G 1/4"	G 1/4"
BNZ 125-310	3,683	G 1 1/2"	SAE 2"	G 1/4"	G 1/4"
BNZ 125-361	4,398	G 1 1/2"	SAE 2"	G 1/4"	G 1/4"
BNZ 125-463	5,644	G 1 1/2"	SAE 2"	G 1/4"	G 1/4"
BNZ 125-615	7,677	G 1 1/2"	SAE 2"	G 1/4"	G 1/4"
BNZ 125-920	13,150	G 1 1/2"	SAE 2"	G 1/4"	G 1/4"
BNZ 125-1225	15,270	G 1 1/2"	SAE 2"	G 1/4"	G 1/4"
BNZ 175-XXX	X	SAE 3 1/2"		G 1/4"	G 1/4"

Tab. 3: Heat exchange surfaces, oil connector size

Type	Water connectors			Drain screw (S)
	1-way	2-way	4-way	
BNZ 60-131	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-208	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-259	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-310	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-361	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-463	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-615	G 3/4"	G 3/8"	-	G 1/8"
BNZ 60-920	G 3/4"	G 3/8"	-	G 1/8"
BNZ 80-208	G 1 1/4"	G 1"	G 1/2"	G 1/4"
BNZ 80-310	G 1 1/4"	G 1"	G 1/2"	G 1/4"
BNZ 80-361	G 1 1/4"	G 1"	G 1/2"	G 1/4"
BNZ 80-463	G 1 1/4"	G 1"	G 1/2"	G 1/4"
BNZ 80-615	G 1 1/4"	G 1"	G 1/2"	G 1/4"
BNZ 80-920	G 1 1/4"	G 1"	G 1/2"	G 1/4"
BNZ 125-310	G 1 1/2"	G 1 1/4"	G 3/4"	G 1/4"
BNZ 125-361	G 1 1/2"	G 1 1/4"	G 3/4"	G 1/4"
BNZ 125-463	G 1 1/2"	G 1 1/4"	G 3/4"	G 1/4"
BNZ 125-615	G 1 1/2"	G 1 1/4"	G 3/4"	G 1/4"
BNZ 125-920	G 1 1/2"	G 1 1/4"	G 3/4"	G 1/4"
BNZ 125-1225	G 1 1/2"	G 1 1/4"	G 3/4"	G 1/4"
BNZ 175-XXX	SAE 3/2"	SAE 2"	SAE 1 1/4"	G 1/2"

Tab. 4: Water connector sizes

**NOTICE**

Specifications to the technical data, such as, for example, dimensions and performance data for all Series BNZ heat exchangers, can be found in the corresponding data sheets.

Components	Standard cooler	Sea water cooler	Optional
Tube	CuNi 90/10	CuNi 90/10	Copper/Stainless steel 1.4404 (AISI316L)
Housing, turning vane, angle bracket, bypass valve	Steel	Steel	
Cover	Cast iron GG25	chem. nickel-plated	Stainless steel 1.4408 (AISI316)
Fins	Aluminum	Aluminium	Copper/Stainless steel 1.4301 (AISI304)
Tube bottom	Steel	Steel with CuNi-end plate 90/10	Stainless steel
Gaskets	Flat gasket C4400		

Tab. 5: Materials

BNZ DN	Oil housing l/min	Water l/min								
		1-way			2-way			4-way		
		Cu	CuNi	VA	Cu	CuNi	1.4404 AISI316L	Cu	CuNi	1.4404 AISI316L
60	75	47	70	105	23	35	54	23	35	54
80 G/F	225	90	135	202	45	67	100	45	67	100
125 G	330	206	310	465	103	155	232	103	155	232
125 F	400	206	310	465	103	155	232	103	155	232
175	850	410	614	921	205	307	460	205	307	460

Tab. 6: Maximum flow-through rates

G: Threading
F: Flange (for sizes see Tab. 3)

3.2 Requirements on water quality



NOTICE

All specifications stated on requirements regarding water quality are recommendations.

In exceptional cases unforeseen reactions can occur as a result of certain concentrations of constituents .

Water quality and constituents are important factors in assessing the available cooling water for use in the shell-and-tube heat exchanger.

Water quality is determined by:

- ☐ Water hardness
- ☐ pH value of the Water

3.2.1 Water hardness

The numbers for water hardness specify the content of hardness constituents (carbonates and bicarbonates). Significant deposits of hardness constituents on tube surfaces occur at higher temperatures and result in a loss of heat exchanger performance. A temperature of 63 °C is regarded as critical. When encountering very hard water, such deposits must be taken into account when designing the heat exchanger.

Hardness range	Millimol Calcium-carbonat per liter	Degree of hardness according to "German hardness" (deutsche Härte°dH)
Soft	<1,5	<8,4° dH
Medium	1,5 - 2,5	8,4 – 14° dH
Hard	>2,5	>14° dH

Tab. 7: Classification of water quality in hardness ranges

When converting to German hardness:

- ☐ 10 mg/l hardness constituents equals 1° dH

3.2.2 pH value

The following applies to shell-and-tube heat exchangers with copper and copper-nickel tubes:

- ☐ pH value not <6

Lower values can result in corrosion.

The following applies to alkaline water:

- ☐ Water hardness not <6° dH

Lower values can result in corrosion caused by free carbonic acid.

pH value	Water quality
4,5	highly acidic
4,5 – 6,0	acidic
6,0 – 6,8	low acidic
7,0	neutral
7,2 – 7,7	low alkaline
7,7 – 8,2	alkaline
8,2	highly alkaline

Tab. 8: Classification of water quality according to pH values

3.2.3 Cooling water analysis based on constituents

The following table provides an overview of the resistance of copper tubes against water constituents in non-drinking water.

Characteristic: approximated level range in mg/l assessment

Characteristic	Value	Assessment
pH value	<6	0
	6 bis 9	+
	>9	0
Chloride	to 1000	+
	>1000	0

Sulphate	to 70	+
	70 to 300	0
	>300	-
Nitrate	to 100	+
	>100	0
Free (aggressive) carbonic acid	to 20	+
	20 to 50	0
	>50	-
Oxygen	to 2 ^{*)}	+
	>2	0
Ammonium	to 2	-
	2 to 20	0
	>20	-
Iron (dissolved)	to 10	-
	>10	0
Free chlorine	to 5	+
	>5	0
Sulphide		-
Ammonia		-

Tab. 9: Assessment of cooling water quality according to constituents

Explanation to table column Assessment:

- + : Generally good resistance
- 0 : Corrosion can occur, in particular when several factors are assessed with 0
- : Use is not recommended
- *) : SF copper has proven best with complete absence of oxygen and sulphides dissolved in the water



NOTICE

Generally higher values than those stated in Tab. 9 apply to copper-nickel tubes.

3.2.4 Cooling water types/peculiarities

Industrial water

The following peculiarities must be taken into account:

- ☐ Untreated water (non-drinking water) is often extremely contaminated. A water analysis is required for an assessment.
- ☐ Copper, brass and steel demonstrate good resistance against industrial water.

Creek and river water (fresh water)

- ☐ NewCool GmbH recommends the use of copper-nickel tubes.
- ☐ Cast iron components must be protected against corrosion by a suitable coating.
- ☐ Untreated water (non-drinking water) is often extremely contaminated. A water analysis is required for an assessment.

Sea water

- ☐ High NaCl content, therefore good electrolyte
- ☐ When combining different materials the danger of electrolytic corrosion can result. Select materials that are not far apart in the electrochemical series or use a zinc anode.
- ☐ Brass and copper-nickel alloys demonstrate good resistance against sea water.

Brackish water

- ☐ A mix of fresh and sea water
- ☐ Generally high content of ammonia and chloride, therefore brass should not be used.
- ☐ High NaCl content, therefore good electrolyte
- ☐ When combining different materials the danger of electrolytic corrosion can result. Select materials that are not far apart in the electrochemical series or use a zinc anode.

4 Technical Description

The shell-and-tube heat exchanger is principally comprised of the following components:

- ☐ Cooling unit with one inlet and one outlet port for the medium to be cooled (medium 2)
- ☐ Tube bundle with aluminum fins
- ☐ Removable cap with cooling water inlet and outlet ports (medium 1)
- ☐ Angle brackets for assembly



NOTICE

Specifications to the technical data, such as, for example, dimensions and performance data and calculation examples for all Series BNZ heat exchangers can be found in the corresponding data sheets .

4.1 Design



NOTICE

All Series BNZ heat exchangers comprise the same basic components. They only vary in design and combination of materials (see corresponding data sheets).

The tubes in the tube bundle are tightly rolled in the cooling unit. Two caps are attached with ports to the cooling water inlet and outlet sides of the housing. Sealing is achieved with gaskets between cooling unit and caps. The heat transfer surface is increased by aluminum fins. These are slid over the copper-nickel or stainless steel tubes and are connected metalically to them by expansion.

By means of individual drain ports, the depressurized fluid can be drained from the heat exchanger (for example for maintenance or disassembly).

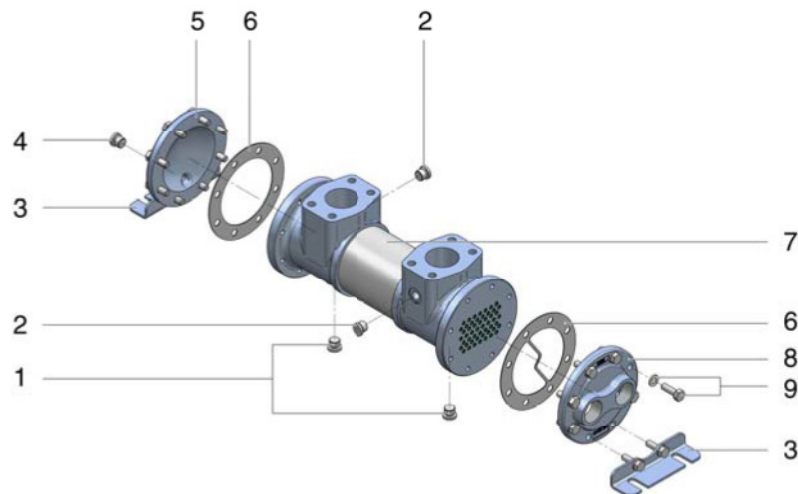


Fig. 7: Design shell-and-tube heat exchanger

- 1 Sealing plug for oil drain G 1/4"
- 2 Sealing plug for test port G 1/4"
- 3 Mounting bracket
- 4 Sealing plug for water drain opening
- 5 Water cap (reversing cap)
- 6 Flat gasket
- 7 Cooling unit with integrated tube bundle with aluminum fins
- 8 Water cap with water connections
- 9 Hexagon screw with spring washer



NOTICE

Series DN 60 heat exchangers are not equipped with a drain port for media 1 and 2.
NewCool GmbH recommends installing a drain port in the respective outlet pipe in order to ensure a proper draining of the fluids.

4.2 Description of functions

The medium to be cooled (medium 2, e.g. hydraulic oil) enters the heat exchanger via an inlet port in the cooling unit, runs through a reversing segment and exists the heat exchanger via an outlet port. Cooling water (medium 1) is fed once or repeatedly through the tube bundle through inlet and outlet ports in the caps. During this process the heat from the medium to be cooled is transferred to the cooling water via the surface of the aluminum fins and tube bundles and exists the heat exchanger with the stream of cooling water.

4.3 Connections

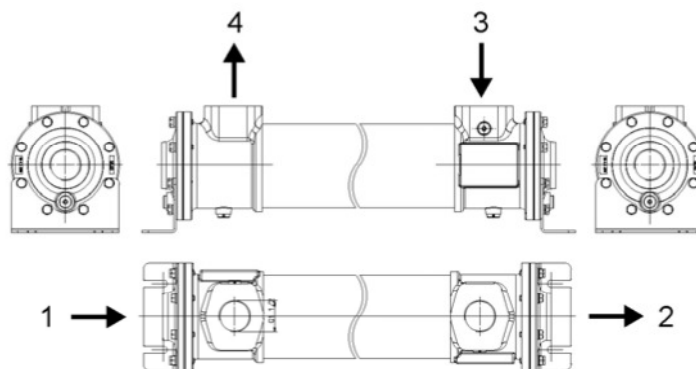


Fig. 8: Connections on 1-way heat exchanger

- 1 Inlet medium 1 (cooling medium)
- 2 Outlet medium 1 (cooling medium)
- 3 Inlet medium 2 (medium to be cooled)
- 4 Outlet medium 2 (medium to be cooled)

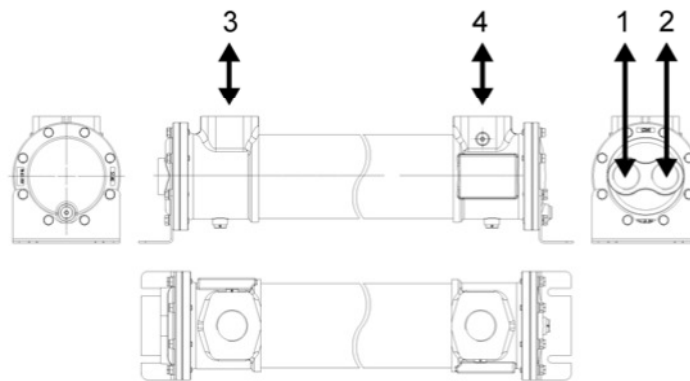


Fig. 9: Connections on 2-way heat exchanger

- 1 Inlet/outlet medium 1 (cooling medium)
- 2 Inlet/outlet medium 1 (cooling medium)
- 3 Inlet/outlet medium 2 (medium to be cooled/cooled medium)
- 4 Inlet/outlet medium 2 (medium to be cooled/cooled medium)

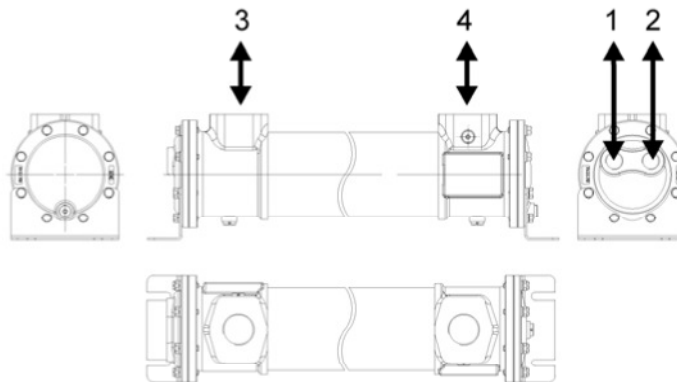


Fig. 10: Connections on 4-way heat exchanger

- 1 Inlet/outlet medium 1 (cooling medium)
- 2 Inlet/outlet medium 1 (cooling medium)
- 3 Inlet/outlet medium 2 (medium to be cooled/cooled medium)
- 4 Inlet/outlet medium 2 (medium to be cooled/cooled medium)

5 Transport, Storage and Conservation



DANGER

Danger of injury caused by improper transportation.
The total weight of Series BNZ heat exchangers can total up to 280 kg. Use sufficiently dimensioned lifting equipment and lifting accessories when transporting the shell-and-tube heat exchanger.
Persons are prohibited from standing under suspended loads.



ATTENTION

Warning of possible leakage due to damage to sealing surfaces.
During transportation attention should be paid that sealing surfaces of the connecting flanges are not scratched.



ATTENTION

Warning of possible damage due to frost.
Drain the cooling water from the heat exchanger in order to prevent frost damage during storage in freezing temperatures .



NOTICE

Danger of contamination caused by conservation materials.
When treating with conservation materials it must be ensured that these do not seep into the soil or sewer system. They must be disposed of in accordance with the applicable environmental protection regulations. The same applies to de-conservation.

Depending upon the weight of the heat exchanger it is either transported in cardboard boxes or on pallets. All openings on the heat exchanger are sealed with plugs.



NOTICE

Contact NewCool GmbH for information on selecting and using conservation materials.

During storage all connections are sealed with plugs and that conservation materials are used to protect the heat exchanger from corrosion.

The conservation materials must be thoroughly removed prior to re-installation.



NOTICE

A storage period of two (2) years may not be exceeded. Exceeding the maximum permissible storage period results in the expiration of warranty and liability claims.

6 Assembly/Disassembly



DANGER

Danger of accident and injury.
Prior to assembly or disassembly of the heat exchanger, the plant must be shut down and secured against being switched on.



DANGER

Danger of accident and injury caused by improper assembly and disassembly work.
The total weight of Series BNZ heat exchangers can total up to 280 kg. Use sufficiently dimensioned lifting equipment and lifting accessories for assembly or disassembly.



NOTICE

Danger of contamination caused by leakage of fluids.
If the heat exchanger is installed in a plant with a tank, it must be examined prior to assembly and disassembly whether the tank level is higher than the installation level of the heat exchanger. If this is the case, the tank must be drained before any work is started.

6.1 Assembly requirements

In order to take advantage of the full heat exchanger performance, several measures must be observed during assembly and installation:

- ☐ In order to ensure a free flow of the fluids, you must check the heat exchanger for contamination and foreign objects in the inlets/outlets.
- ☐ Pipes and fittings used for all connections must be of the same or compatible materials.
- ☐ Any strain on the connecting ports must be avoided when connecting the heat exchanger to the piping system. If necessary, the piping should be supported or hose lines should be used.

- ☐ The heat exchanger is to be connected in such a way that the draining ports for medium 1 point downwards and the draining ports for medium 2 are located on the underside.
- ☐ Should an automatic water throttle valve be used, it should be installed in the inlet of the heat exchanger.
- ☐ Install the cooling water outlet pipe in such a way that the heat exchanger is constantly supplied with cooling water.

6.2 Installing and connecting the heat exchanger



ATTENTION

Danger of damages to the plant.

When connecting the inlet and outlet pipes, ensure that they are connected to the correct ports. Refer to the piping diagrams for proper connections.



ATTENTION

Danger of cracking.

The danger of cracking in the casted components increases as soon as sealing tape is used on the pipe threading, because the resistance between the connecting components increases. The threading is not to be excessively tightened.



ATTENTION

Danger of permanently damaging shell-and-tube heat exchanger components caused by sea and brackish water. A zinc anode must be installed in heat exchangers equipped with sea and brackish water cooling circuit in order to prevent electrolytic corrosion.



ATTENTION

Warning of decline in performance.

A horizontal installation of the heat exchanger with the draining port pointing downwards is recommended. A minor decline in performance must be expected when the heat exchanger is installed either upright or at an angle. The draining port must be mounted on the underside when the heat exchanger is installed upright or at an angle, as otherwise the heat exchanger cannot be emptied.

Proceed as follows when assembling the heat exchanger:



ATTENTION

Danger of cracking.

To prevent the danger of cracking, the assembly screws of the connecting flanges should be tightened evenly in a crosswise manner.

1. Firmly install the shell-and-tube heat exchanger in its proper location and correctly assemble the pipe connections
2. If necessary drain tank
3. Mount the heat exchanger onto a solid foundation or other non-moving foundation by means of the angle brackets
4. Connect the inlet and outlet pipes for medium 1 along with their appropriate seals to the corresponding connection ports on the lids as described in the pipe connection instructions (see Chapter 4.3)
5. Connect the inlet and outlet pipes for the medium to be cooled along with the appropriate seals to the connection ports on the housing (see Chapter 4.3). The assembly screws should be tightened evenly and crosswise on the lids and flanges of the supply pipes



NOTICE

Series DN 60 heat exchangers are not equipped with a water draining port. A drain must be installed at the outlet of medium 1, so that draining medium 1 can be ensured should repair or maintenance work be necessary.

Ensure a proper functioning of the heat exchanger in different facilities by conducting the following measures:

- ☐ To protect the heat exchanger from contamination and silting, NewCool GmbH recommends installation of a filter, should the cooling water not be supplied from the municipal water works or from a closed plant, we. You may want to consider a water analysis prior to operation.
- ☐ In order to avoid contamination, NewCool GmbH recommends that the medium to be cooled should always be filtered before it is fed through the heat exchanger.
- ☐ NewCool GmbH recommends installing safety valves in the inlet pipes for mediums 1 and 2 in order to protect the heat exchanger from excessive flow and pressure fluctuations.
- ☐ Install a zinc anode on the inlet in lid or inlet pipe (see Chapter 3.2.4) in order to prevent electrolytic corrosion of heat exchanger components.



NOTICE

Contact NewCool GmbH for information on selection and installation of safety and throttle valves as well as filters.

6.3 Disassembling heat exchanger



DANGER

Danger of injury by pressurized fluids.
In order to prevent injuries during disassembly, the plant must be depressurized in accordance with the accident-prevention regulations before beginning work.



DANGER

Danger of injury from shell-and-tube heat exchanger falling.
Secure the heat exchanger against falling prior to disassembly by using sufficiently dimensioned lifting equipment and lifting accessories.



DANGER

Danger of burns from hot components.
Burns may result from touching heated/hot components. Allow the components to first cool down before disassembling the heat exchanger and supply pipes.



NOTICE

Danger of contamination from drained fluids.
All drained fluids must be collected in appropriate containers and disposed of properly in accordance with environmental protection regulations. These fluids may not seep into the soil or sewer system.

Proceed as follows when disassembling the heat exchanger:

1. Shut the plant down and properly secure against being switched on.
2. Depressurize heat exchanger and connected system pipes and lock them using the appropriate valves.
3. Completely drain all fluids using the drain plugs or drains provided for this purpose, if necessary drain the tank.
4. Disconnect the inlet and outlet pipes for the medium to be cooled from the ports on the housing side.
5. Disconnect cooling water inlet and outlet pipes from the ports on the lids.
6. Loosen fastening screws on the heat exchanger.
7. Lift the heat exchanger with sufficiently dimensioned lifting equipment and set it down safely.

7 Operation

Provided the heat exchanger has been properly assembled as described under Chapters 6.1 and 6.2, it can be put into operation without any additional preparation. Following start-up the heat exchanger should be inspected for proper functioning.

The following inspections should be conducted for this purpose:

- ☐ Check all connections for any leaks
- ☐ Inspect all filters, valves and fittings for free flow
- ☐ Check proper functioning of the heat exchanger



ATTENTION

Danger of plant damage caused by loss of performance. Calcification on the tube side and oil sludge (e.g. caused by defective filter) on the housing side can lead to a loss of heat exchanger performance. Please refer to Chapter 8.2.



NOTICE

To better schedule service intervals, NewCool GmbH recommends recording all parameters for newly installed heat exchangers in order to reach conclusions on the performance.



NOTICE

Contact NewCool GmbH when disruptions or defects arise during operation which cannot be rectified immediately.

Special features of heat exchangers equipped with sea or brackish water cooling circuits



ATTENTION

Danger of damage to components by aggressive cooling fluids. Sea or brackish water and other corrosive fluids may not be used as cooling mediums in the standard models. Use of these aggressive cooling fluids requires special materials.



ATTENTION

Danger of damage to components by aggressive cooling fluids. Heat exchangers using cooling fluids such as sea or brackish water must be equipped with a zinc anode on the cooling water inlet in order to prevent electrolytic corrosion.

Should sea or brackish water be used as cooling medium for the heat exchanger, special materials must be used. Operations under these conditions should be clarified with NewCool GmbH.

8 Maintenance, Repair, Cleaning



NOTICE

Danger of contamination caused by leakage of fluids.
If the heat exchanger is installed in a plant with a tank, it must be examined prior to assembly and disassembly of the heat exchanger whether the tank level is higher than the installation level of the heat exchanger. If this is the case, the tank must be drained before any work is started.



NOTICE

A repair of the heat exchanger's tube bundles may only to be conducted in case of emergency and only by authorized personnel. As a rule, contact NewCool GmbH in such cases. Analyse disturbances in operations and report them to the manufacturer.



NOTICE

Warranty and liability claims are excluded when spare parts and wear-and-tear items are used that are not approved by the manufacturer.

Contact the manufacturer for ordering spare parts and wear-and-tear items:

NewCool GmbH
Industriestraße 22
61381 Friedrichsdorf/Taunus

8.1 Maintenance

8.1.1 Maintenance intervals



ATTENTION

Danger of loss of performance.
Maintenance intervals must be scheduled in such a way that no loss of performance in the heat exchanger occurs which would endanger the operation of the plant.

The heat exchanger's operating life is dependent upon the quality of the fluids used and their constituents. The performance parameters determined during operation serve in scheduling maintenance intervals. The operator is solely responsible for specifying maintenance intervals.

Observe the following notices:

- ☐ Schedule maintenance intervals based on corrosion damage determined during the first visual inspection. The zinc anode must be replaced should a loss of approximately 70 % of the zinc occur.



ATTENTION

Danger of damage to components by aggressive cooling fluids. When a zinc anode is used to prevent electrolytic corrosion, it must be inspected for wear-and-tear two weeks after initial operation. Specify the operating life and inspection intervals depending upon the wear-and-tear.

8.1.2 Replacing the zinc anode

Replace the zinc anode as follows:

1. Shut down the plant and secured against being switched on.
2. Shut off cooling water inlet and outlet pipes and inlet and outlet pipes for the medium to be cooled on the heat exchanger.
3. Depressurize heat exchanger and drain cooling medium.
4. Unscrew zinc anode, evaluate wear-and-tear, if necessary, replace it.
5. Vent pipes before restarting plant.

8.2 Cleaning



NOTICE

NewCool GmbH does not recommend a regularly scheduled cleaning of Serie BNZ heat exchangers on the housing side, because no adequate cleaning on the housing side is possible.

An interior cleaning of the tube bundles can be carried out on the tube side. The performance parameters and performance specifications determined during operation are to be used in scheduling the cleaning intervals. The intervals are to be scheduled in such a way that a loss of performance of the heat exchanger does not endanger the plant's operation.

8.2.1 Safety notices for cleaning



DANGER

Danger of injury by chemical burns or poisoning.
When cleaning the tube bundles with cleaning agents such as hydrochloric acid or comparable cleaning agents, chemical burns to the body or injuries to eyes can occur when applicable industrial safety regulations are not followed.
Therefore you must at all times adhere to the applicable industrial safety standards when working with those cleaning agents. When working with aggressive cleaning agents wear protective clothing, protective gloves, protective goggles and breathing equipment.



ATTENTION

Danger of damage to shell-and-tube heat exchanger components.
Before restarting the connected plant, it must be properly vented.



ATTENTION

Danger of contaminating the medium.
Experience has shown that a thorough and complete removal of cleaning agents is not possible. For this reason attention must be paid to the compatibility of cleaning agent and medium.



ATTENTION

Danger of permanent damage to heat exchanger components.
As a rule, contact NewCool GmbH before using other aggressive cleaning agents so that damage due to improper treatment can be prevented.



NOTICE

Danger of contamination by cleaning agents.
When using cleaning agents, such as hydrochloric acid, it must be ensured that these cleaning agents are never disposed of improperly. Always adhere to the applicable national environmental protection regulations when disposing of the cleaning agents.

8.2.2 Interior cleaning of the tube bundles



DANGER

Danger of accident and injury.
Always comply with the safety notices in Chapter 8.2.1 regarding interior cleaning of the tube bundles.



ATTENTION

Danger of corrosion caused by scratches.
Scratches on the inner surface of the tube bundles can result in increased corrosion. For this reason use brushes with soft bristles for interior cleaning.



NOTICE

Contact NewCool GmbH for information regarding use of cleaning agents.

Observe the following measures for cleaning:

- ☐ For decalcification of the interior tube side, use a mixture of 50 % hydrochloric acid with inhibitors and 50 % water.
- ☐ Use a brush for interior cleaning of the tube bundles with a diameter of >5 mm. Use a brush with soft bristles so that the surface of the tube walls is not scratched.
- ☐ You should contact NewCool GmbH before using other cleaning agents for decalcification.

- ☐ Following completion of the cleaning, and before the heat exchanger is restarted, ensure that all cleaning agents have been removed from the tubes as thoroughly and completely as possible.

The following steps are required for cleaning:

1. Shut plant down and secure against being switched on.
2. Shut off heat exchanger's cooling water inlet and outlet side.
3. Depressurize heat exchanger and drain cooling water.
4. Remove lids.
5. Conduct cleaning.
6. Reassemble lids together with new gaskets (replacing gaskets refer to Chapter 8.2.3).
7. Vent the pipes before restarting plant.

8.2.3 Re-installation after cleaning



ATTENTION

Danger of fluid leakage when pressurized.
Any damage to sealing surfaces is to be avoided. Never clean sealing surfaces with sharp tools. Grooves in sealing surfaces can result in leaks. Thoroughly clean the sealing surfaces of any residual gasket materials before installing new gaskets. Sealing surfaces not thoroughly cleaned can result in injuries, for example to eyes, when pressurized fluids escape after restarting.

The following steps must be conducted prior to every re-installation after cleaning:

1. Remove old gaskets.
2. Thoroughly clean sealing surface of residual gasket material, do not in any way damage sealing surfaces.
3. Install new gaskets, ensuring that they fit correctly.
4. If necessary replace O-rings.

9 Disposal



NOTICE

Ensure that lubricants and operating materials, cleaning agents as well as their containers are not disposed of as regular household refuse or seep into the soil. Observe the notices on the corresponding data sheets as well as the applicable national environmental protection regulations.

The heat exchanger must be disposed of as special/hazardous refuse.