

CONDENSATORI A FASCIO TUBIERO PER ACQUA DOLCE E MARINA SHELL & TUBE CONDENSERS FOR FRESH AND SEA WATER



TIPOLOGIE DI PRODOTTO

Questa sezione del catalogo si riferisce alle serie di condensatori a fascio tubiero anche per acqua di mare. Gli scambiatori di calore appartenenti a queste serie possono essere utilizzati in un ciclo frigorifero a compressione, con un fluido frigorigeno (CFC – HCFC – HFC – HFO) che condensa all'interno del mantello mentre il fluido secondario acqua, acqua di mare od altro (fluidi anticongelanti) scorre all'interno dei tubi scambiatori.

Il disegno riproduce un condensatore con la descrizione dei suoi componenti principali.

FLUIDI UTILIZZABILI

Gli scambiatori sono progettati in accordo ai limiti di pressione e temperatura e con i materiali descritti in seguito. I dati salienti dello scambiatore, in base all'art. 4 del capo 1 della direttiva 2014/68/UE sono riportati sulla targhetta dati che corredata l'unità.

MATERIALI IMPIEGATI

L'utilizzo dei materiali impiegati nei condensatori è subordinato ai rigidi controlli qualitativi effettuati in base alla normativa PED (Dir. 2014/68/UE) ed alle Norme Europee che regolano e sovrintendono alla costruzione dei recipienti a pressione.

I componenti standard sono:

- acciaio al carbonio: testate, piastre tubiere, setti, mantello e connessioni frigorifere ed idrauliche,
- lega di rame C12200 EN12452/SB359 con rigatura interna ed alettatura esterna per tubi scambiatori,
- guarnizioni esenti amianto idonee all'impiego per refrigeranti CFC, HCFC, HFC, HFO,
- viti di fissaggio in acciaio conforme a ISO 898.

Nel caso di versione marina:

- acciaio al carbonio: setto, mantello e connessioni frigorifere ed idrauliche,
- acciaio inossidabile AISI316L: testate e piastre tubiere,
- lega Cu/Ni-90/10 C70600 EN12449 con rigatura interna ed alettatura esterna per tubi scambiatori,
- anodi in zinco,
- guarnizioni esenti amianto idonee all'impiego per refrigeranti CFC, HCFC, HFC, HFO,
- viti di fissaggio, classe A2-70 o A2-80, in acciaio legato conforme a UNI EN ISO 3506.

TEST, QUALITÀ, RINTRACCIABILITÀ

I controlli vengono effettuati in base al manuale interno di qualità UNI EN ISO 9001 e specificatamente tutti i condensatori vengono sottoposti a:

- prova pressione lato refrigerante e lato acqua (coefficiente x 1,43),
- prova con liquidi penetranti (PT) sulle saldature secondo normativa,
- prova di tenuta con cercafughe a elio (valore max. accettato comparabile a 3 g/anno di R22).

Ogni condensatore viene identificato attraverso un numero di serie riportato sulla targhetta. È importante fare riferimento a questo numero in tutte le comunicazioni con WTK e riguardanti l'unità acquistata al fine di consentire una corretta e veloce rintracciabilità del prodotto.

MODELLI CF – CF /M

I condensatori a fascio tubiero sono progettati impiegando le migliori soluzioni tecniche per l'applicazione nei settori del condizionamento e della refrigerazione. La gamma di potenza, alle condizioni nominali, è compresa tra 10 kW e 2500 kW con solo due lunghezze di mantello (sono comunque possibili allungamenti e riduzioni di lunghezza in base alle varie esigenze). Il fascio tubiero è realizzato con tubi in rame speciali ad elevate prestazioni, alettati esternamente e rigati internamente a basso fattore di sporcamento. Con la combinazione dei due effetti, lato refrigerante e lato acqua, si ottengono dei condensatori ridotti in dimensione e in peso rispetto a quelli che impiegano i tubi tradizionali a parità di potenza scambiata. Tutti i condensatori sono costruiti per funzionamento con acqua di torre, con acqua di pozzo e se con materiali diversi con acqua di mare. I refrigeranti impiegati possono essere tutti gli CFC, HFC, HCFC, HFO. A seconda della portata di fluido, sono disponibili in versione 2 passi, 4 passi, 8 passi.

Le opzioni disponibili sono staffe saldate, spia di liquido, piattaforma di supporto per compressore, connessioni flangiate. Le serie CF è disponibile in versione speciale anche per pressioni pari a 42bar lato refrigerante e 16bar lato acqua.

TYPES OF PRODUCT

This section of the catalogue refers to the shell and tube condensers for fresh and sea water. This series of heat exchangers can be used as condensers in a compressor-driven refrigerating cycle, with a coolant (CFC – HCFC – HFC – HFO) that condensates inside the shell and a secondary fluid water, sea water or others (anti-freezing fluids) that flows inside the exchanger pipes.

The drawing shows a condenser with the description of its main components.

COMPATIBLE FLUIDS

The heat exchangers are designed according to the pressure and temperature limits and with the materials described herebelow. The main data of the heat exchanger, according to Art. 4 of Annex 1 of the European Directive 2014/68/UE, are indicated on the unit's name plate.

MATERIALS

The choice of the materials used in the condensers is the result of strict quality checks carried out in compliance with the PED norm (Dir. 2014/68/UE) and the European norms regulating the construction of pressure vessels.

The standard components are:

- carbon steel: covers, tube sheets, baffle, shell and refrigerant and water connections,
- copper alloy C12200 – EN12452/SB359 with inner striped and outer finned surface suitable for exchanger pipes,
- asbestos free gaskets suitable for the use of CFC, HCFC, HFC, HFO refrigerants,
- steel bolts in compliance with the norm ISO 898.

About the marine version:

- carbon steel: baffle, shell and refrigerant and water connections,
- stainless steel AISI316L: covers and tube sheets,
- Cu/Ni-90/10 alloy C70600 EN12449 with inner striped and outer finned surface suitable for exchanger,
- zinc anodes,
- asbestos free gaskets suitable for the use of CFC, HCFC, HFC, HFO refrigerants,
- bonded steel bolts, class A2-70 or A2-80, in compliance with the norm UNI EN ISO 3506.

TEST, QUALITY AND IDENTIFICATION

All tests comply with the procedures of our internal quality manual UNI EN ISO 9001 and specifically all the condensers undergo the following:

- pressure test refrigerant and water side (coefficient x 1,43),
- test with penetration liquids (PT) on the weldings according to the norms,
- hydrostatic test with the use of a helium leakage detector (accepted max. level of 3 g/year of R22).

Each condenser is identified by a serial number shown on the name plate. Always refer to this number in all communications to WTK regarding the unit purchased, in order to ensure a correct and prompt product identification.

MODELS CF – CF /M

The shell & tube condensers have been designed exploiting the best technical solutions to be suitable for all the air conditioning and refrigeration applications. The range of products at nominal conditions have heat rejection capacities from 10 kW to 2500 kW with only two shell lengths (anyway, if required, it is possible to manufacture also with increase or reduction of such lengths). The bundle is assembled with special high performance copper tubes, externally finned and internally striped for a low fouling factor. Thanks to the combination of these two features, enhancement of the refrigerant and water side, the condensers have a smaller footprint and less weight than the traditional constructions for the same duty. All the condensers can work in tower water and city water configuration and also, if made of different materials, they are suitable for sea water application. The refrigerants to be used are all the CFC, HFC, HCFC, HFO. Upon the water flow rate, the configurations 2 pass, 4 pass, 8 pass on the water side are available. The available options are welded feet, sight glass, support for compressor, flanged connections.

The series CF is available in special version for design pressure equal to 42bar on the refrigerant side and 16bar on the water side.

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INSTALLATION AND APPLICATION OF THE SHELL & TUBE EVAPORATORS

The units must be installed only by qualified personnel, considering that the condensers are pressurised vessels and as such are ruled by the Directive PED 2014/68/UE relating to these appliances. The operator must therefore observe all the active and passive safety requirements defined by the above directive and local regulations.

For a correct functioning of our shell & tube evaporators it is necessary to follow some simple pre-cautions.

STORAGE, HANDLING AND POSITIONING

1. While waiting for the installation, the condenser must be stored in a dry sheltered place, at temperatures no lower than +4°C. Avoid sites where condensation may form inside the heat exchanger, due to temperature variations during the day.

2. The unit can be handled by using the lifting rings located on the shell or using elastic hoisting straps positioned at the sides of the exchanger.

3. Install the condenser in horizontal position as non-horizontal installations may considerably affect the performance.

For outdoor installation, take suitable measures to protect the pressure vessel against atmospheric corrosion and low outside temperatures.

GENERAL INSTRUCTIONS FOR CORRECT OPERATION

1. Check, before the start-up, the torque of the bolts of the head and flat end (see table of tightening torque for screws).

2. Install the condenser in horizontal position to ease the refrigerant exit.

3. Do not reverse the water inlet and outlet based on the number of passes (see catalogue).

4. Do not expose the condenser to excessive vibrations, installing vibration dampers near the refrigerant and water connections of the heat exchanger and of its supports/structure.

5. Take proper precautions (vibration dampers) so to avoid the transmission of the vibrations to the heat exchanger when the exchanger is installed as a support element of the compressor.

6. Avoid foreign particles (particularly debris, dirt or solid particles) to enter into the water circuit by applying suitable filters with a mesh size of max. 1,5mm. Filters must be fitted on the water side to prevent sediments such as welding residues and solid particles from entering and damaging the tubes of the exchanger.

7. Analyze the water checking its compatibility with the materials of the heat exchanger before using the condenser (especially in open circuits) also to reduce accidental corrosion. The quality of the water, for the reasons described above, may significantly influence the operation and the life of the exchanger. Secondary fluids consisting of water and ethylene or propylene glycol solutions are generally not corrosive, unless contaminated by other substances. Before using any other secondary fluid, check with WTK.

8. Always use waters or anti-freezing inhibited mixtures compatible with the materials of the condenser, check the fluids from time to time and do not run the unit with temperatures near the freezing point, otherwise increase the percentage of anti-freezing.

9. Avoid the use of the condenser with waters containing chlorine (max. = 3 p.p.m.) when the unit is manufactured with standard materials.

10. In case of waters rather hard there might be some deposits inside the tubes (fouling): when the performance goes down beyond 10/15% it is necessary to clean the inside part of the tubes in a mechanical or chemical way; in this last case it is necessary to check the compatibility of the chemical agents used for cleaning with the construction materials.

11. Avoid exceeding the max. flow rate "Mm" shown in the catalogue, as this may cause excessive vibrations and erosion of the exchanger tubes.

12. The operating pressure and temperature on the refrigerant side and water side of the system must comply with the maximum values shown on the condenser's name plate.

13. During the filling of the water circuit, pay attention to discharge totally the air by means of the air vent located on one of the covers.

14. Pay attention to discharge all the air from the circuit and condenser, checking the presence of an adequate counter-pressure at the water outlet of the condenser so not to let the drain free and to cause inside the condenser a pressure drop at least equal to the catalogue or calculation value (if in open circuit it is better to install at the water outlet a regulation and calibration valve).

15. In case of complete water drainage be sure that all the water is completely drained from the water drainage socket located on one of the covers; never leave the condenser partially loaded with water.

16. Avoid, in open circuit, the water drainage of the condenser during the pump stop.

17. Avoid the cavitation of the pump and the presence of gas in the hydraulic circuit.

18. Do not exceed the advised velocity inside the tubes (admitted values are in between 1,3 and 3,0 m/s for fresh water; between 1,3 and 2,6m/s for sea water).

CHECK OF THE ANODES ON THE MARINE CONDENSERS

Check regularly the wear of the anodes, removing them from the flat end and verifying the presence and status of the zinc cylinder.

If this last one is totally worn out, change it at once with new anodes.

CLEANING OF THE HEAT EXCHANGERS

1. Condenser mechanical cleaning - with removal of the water boxes

Cleaning operations can help in keeping at high level the efficiency of the heat exchangers. Anyway, cleaning systems which may result in being too aggressive for the tubes have to be avoided.

Dismounting the water boxes, it is possible to have direct access to the exchanger pipes. A specific procedure is available in case this operation should be performed, indicating removal instructions, tightening torque for the screws and torque procedure. New gaskets are required.

Do the mechanical cleaning tube by tube for the whole length using low abrasiveness brushes (plastic brushes). Metal brushes must be avoided.

Clean the inner side of the water boxes.

2. Condenser chemical cleaning - without removal of the water boxes

Excluding the water circuit of the plant from the condenser, you can do some chemical cleaning through the forced circulation of specific products for the removal of deposits or fouling agents; in this case it is important to select the right product for the specific agent to clean and therefore to follow the chemical product indications. If the deposit is non-organic, we recommend a product like P3 T288 by Henkel. If not available or in emergency cases, some soft acids such as formic acid, citric acid, acetic acid, ossalic acid or phosphoric acid can be used as well, as long as their solution in water is about 5%. After the cleaning with such acids, it is extremely important to rinse the heat exchanger with clean water for at least 30 minutes. Then discharge all the water inside the tubes and water boxes.

ATTENTION: never use strong inorganic acids as the nitric acid, sulphuric acid that can corrode the heat exchanger.

MAINTENANCE OF THE CONDENSER

1. For the optimum maintenance of the exchanger components, periodical checks should be carried out by qualified personnel. The necessity and frequency of such checks depends on the operation of the exchanger over time.
2. Use suitable calibrate torque wrenches.

CHECK	FREQUENCY
Condenser water boxes screw tightening torque	Check at the starting of the plant and then at regular time intervals upon the operating time; Max every 2 years
Connection screws tightening torque	
Check the status of the seals on the head	
Check the wear of sacrificial anodes (marine)	

TABLE OF TIGHTENING TORQUE FOR SCREWS

Tipo di vite		M5	M6	M8	M10	M12	M14	M16	M20	M22	M24
 wrench TE- screws	mm	-	-	13	17	19	22	24	30	32	36
 wrench TC screw	mm	5	5	6	8	10	-	14	17	-	-
TIGHTENING TORQUE	Nm	6	10	25,5	35/50	87	130	210	410	600	750
	Kg*m	0,61	1	2,6	3,6/5	8,9	13,2	21,5	42	61	77

SUGGESTIONS FOR A CORRECT SELECTION

In the shell & tube condensers, deposits of various substances inside the tubes (contamination) are an effect that must be necessarily be considered when selecting the product (fouling factor – f.f.), therefore we advise to choose the right value based on the following parametres.

- City fresh water	f.f. = 0,000043 m2 K/W
- Tower water	f.f. = 0,000043 m2 K/W
- Glycol solutions < 30%	f.f. = 0,000043 m2 K/W
- Glycol solutions > 30%	f.f. = 0,000086 m2 K/W
- River and sea water	f.f. = 0,000086 m2 K/W
- Muddy river water	f.f. = 0,000172 m2 K/W

The table herebelow shows, as function of the freezing point, the percentages in weight of the main anti-freezing mixtures.

FREEZING POINT	ETHYLEN GLYCOL	PROPYLEN GLYCOL	TYFOXIT
°C	% (mass)	% (mass)	% (g/cm³)
-10	24	24	40 [1.10]
-20	36	36	50 [1.15]
-30	46	46	68 [1.17]
-40	53	53	80 [1.20]



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MODEL PART. No. SERIAL No.

MODELLO CODICE N° FABBRICA

TUBES SIDE - LATO TUBI

bar bar °C dm³

- Ps - - Pt - - Ts - - V - FLUID

SHELL SIDE - LATO MANTELLO

bar bar °C dm³

- Ps - - Pt - - Ts - - V - FLUID

PERMITTED REF. - REF. AMMESSI

CFC - HCFC - HFC - HFO

PED CATEGORY G1 PED CATEGORY G2 YEAR - ANNO

MADE IN ITALY

CE

NOTIFIED BODY 0948

