



POLYBLOC® HEAT EXCHANGERS

in **GRAPHILOR® 3** (impregnated graphite)

SERIES NC/NF

Applications

POLYBLOC heat exchangers series NC and NF are the most advanced design GRAPHILOR 3 block equipment.

The main features which stand out are their robustness, high mechanical strength, their exceptional long working life and reliability in service.

They are the results of more than 30 years of research. Development and the experience gathered from over 10,000 units in operation in more than fifty countries throughout the world have made CARBONE LORRAINE a world leader in the field of impregnated graphite equipment for the process industry.

High chemical inertness/non-contaminating

Ideal for use in heavy/fine chemical/pharmaceutical/drug and food industries except for highly oxidising conditions.

Wide range of heat transfer areas: from 0.1 m² to 1,500 m².

Main features

- Modular design.
- 2 series NC and NF.
- 8 diameters of graphite blocks.
- 7 diameters of drilled holes.
- High resistance to corrosion: 4 grades of impregnation.
- High heat transfer efficiency.
- High resistance to thermal shock - robustness.
- Easy maintenance.
- Vertical or horizontal operation.
- Multipass operation.
- From vacuum to 16 bars G.
- Four impregnants selected to meet a variety of conditions. By varying the basic treatment, a range of GRAPHILOR 3 materials may be used, operating wall temperature up to 400 °C.



POLYBLOC HEAT EXCHANGER
in GRAPHILOR 3 series NC/NF

- Designs available on request according to the main world-wide construction codes (ASME, AD Merkblätter, Stoomwesen, JIS,...). Test certificates available on request.

High efficiency, space saving and easy maintenance.

- Due to the high efficiency and design of the POLYBLOC modular design there is the flexibility of adding graphite blocks for increased heat transfer area.
- Space saving advantages: units take up very little production space due to their high thermal heat transfer efficiency and the design of the POLYBLOC modular blocks. There is the flexibility of adding graphite blocks for increased heat transfer area if the process or capacity needs to be increased or modified in the future.
- Easy and low maintenance cost: block dismantling, reassembly, easy cleaning, handling. Minimum replacement due to standardised spare parts of modular block design.
- Very long life span.

Designing

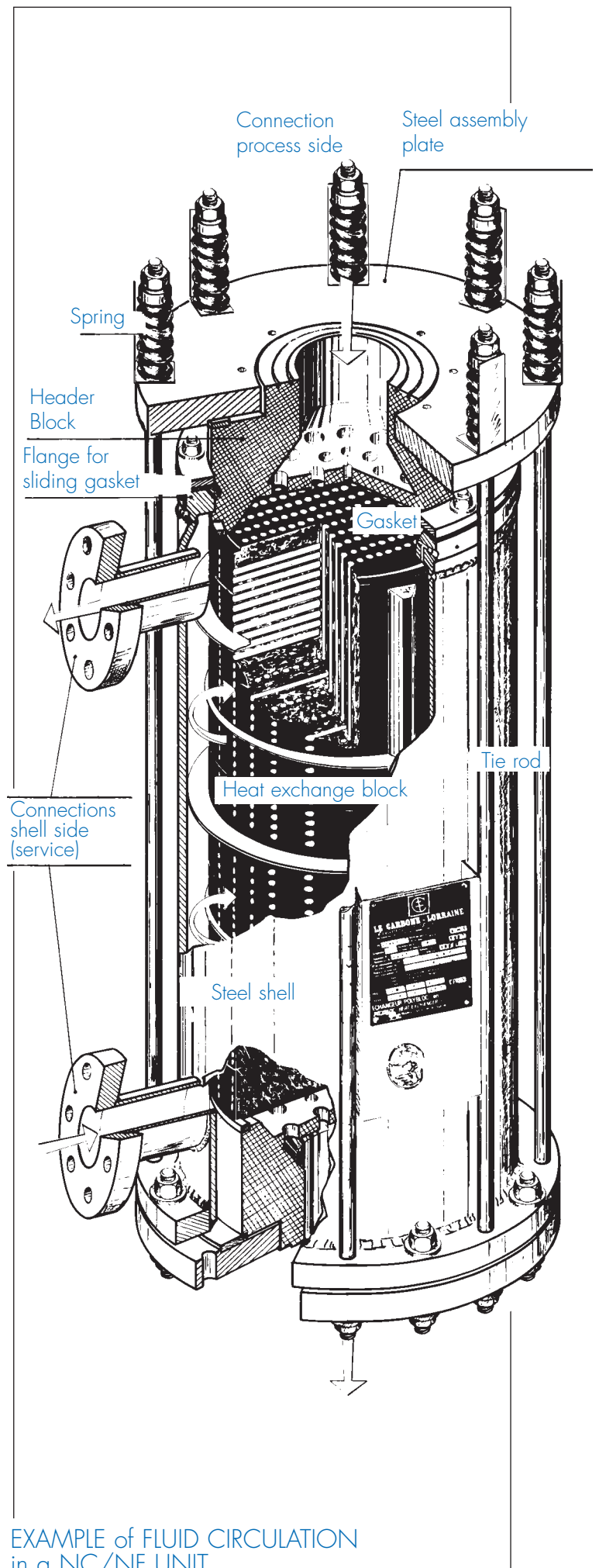
Principle

The POLYBLOC modular design heat exchanger series NC and NF are made of a stack of cylindrical GRAPHILOR 3 blocks.

The graphite blocks have two sets of drilled holes, one set parallel to the axis of the unit is the process side which is usually for the corrosive fluid. The other set is perpendicular to this axis. Radial holes which are on the shell side for the service fluid, water, steam, etc. Both fluids can be corrosive for heat recovery.

Both ends of the unit are fitted with GRAPHILOR 3 headers. The shape of which is designed to ensure a uniform flow distribution through the holes.

The graphite blocks and headers are housed in a steel shell giving complete protection and mechanical strength to the assembly which is under a steady and constant compression by calibrated springs on each of the steel tie bolts, so that sufficient pressure is constantly exerted on all the gaskets of the stacked GRAPHILOR 3 blocks, whatever the operating conditions of the heat exchanger.



EXAMPLE OF FLUID CIRCULATION in a NC/NF UNIT

Both fluids are kept apart by high performance sealing rings separating each graphite block from the next.

In order to ensure the service fluid on the shell side of the unit follows a sinuous pattern baffles are affixed to the outside of the graphite blocks. The baffles have been designed to avoid by-passing to give the maximum thermal efficiency when operating.

Series NC

These units are designed to suit special construction codes of various countries, therefore, some dimensions and details may vary slightly depending on the selected code. It is important in the enquiry stage to specify if any coded regulations are required.

Series NF

These units are suitable for non-coded construction and are lower in price.

Sizing conditions

Heat exchangers series NF are dimensioned to operate at a maximum working pressure of 6 bar effective. Units are tested at 9 bars on both sides.

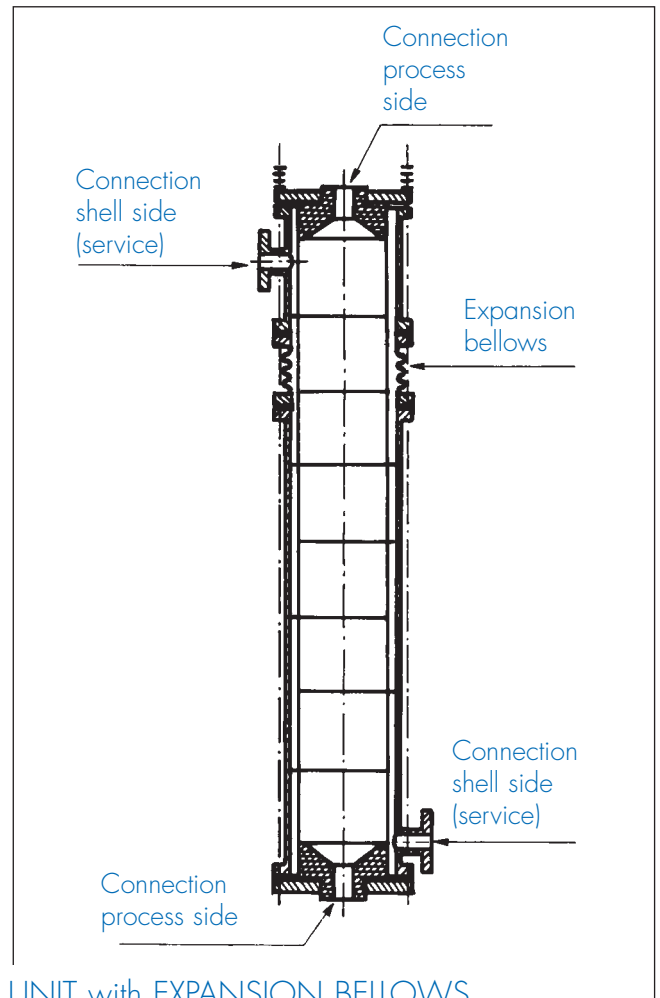
NC units are dimensioned according to requested operating conditions. Maximum design pressure ranges 16 bar effective.

Maximum design temperature varies according to GRAPHILOR 3 impregnation grade (400°C maximum for GRAPHILOR 3 XC).

Units with expansion bellows

POLYBLOC NC/NF units are equipped with standard sliding gaskets either with O'ring or with several rows of braided packing depending on working conditions.

Units may also be equipped with stainless steel expansion bellows.



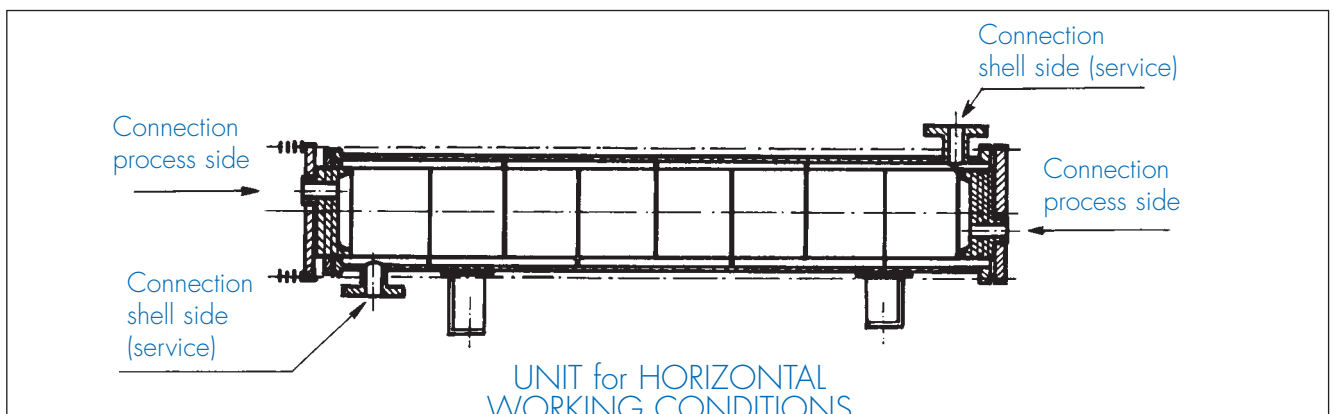
UNIT with EXPANSION BELLOWS

Alternative designs and optional extras

POLYBLOC modular design offers a great versatility to the various applications.

Horizontal working conditions

POLYBLOC NC/NF can be designed to operate in the horizontal position. Special headers allow for easy drainage.

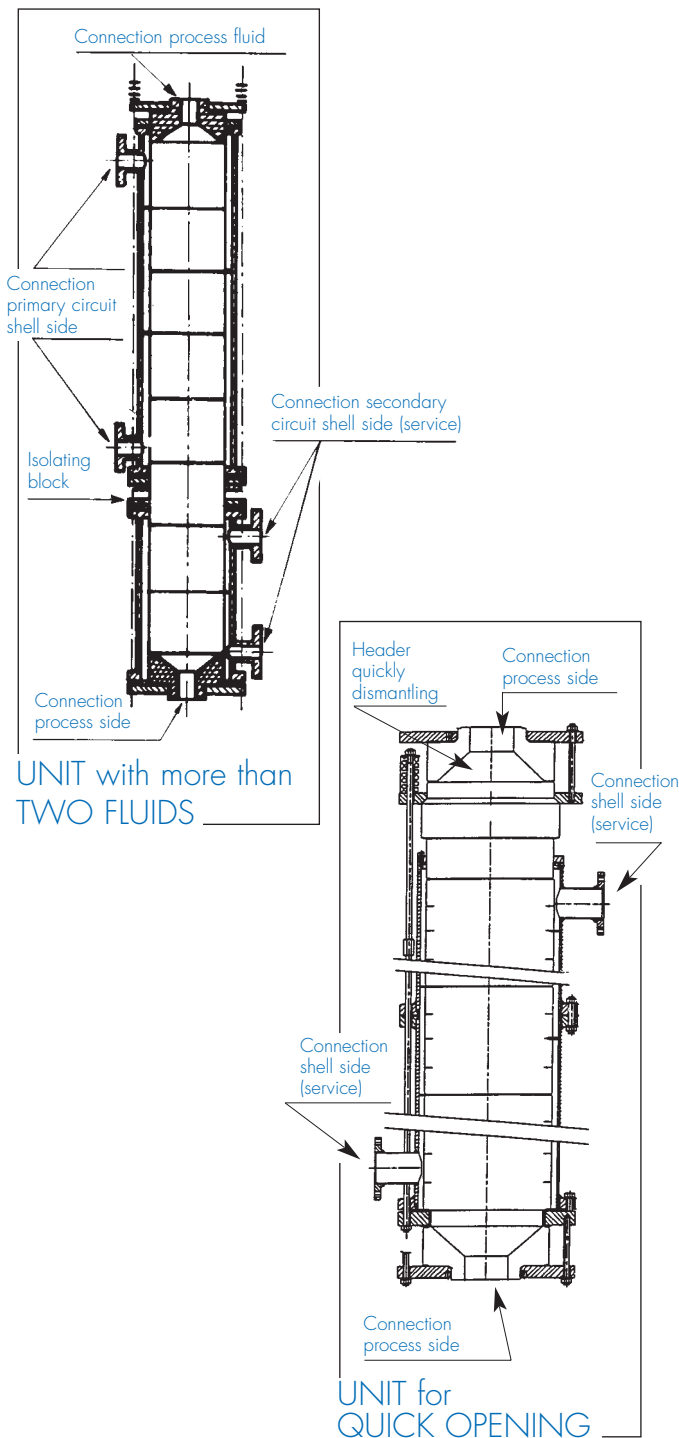


Anti-corrosion lining of steel shell

Steel shells of POLYBLOC heat exchangers series NC/NF can be supplied with a corrosion-resistant lining for corrosive process fluid on the shell side. Epoxy coating, rubber lining, PTFE, stainless steel shell or other materials may be used.

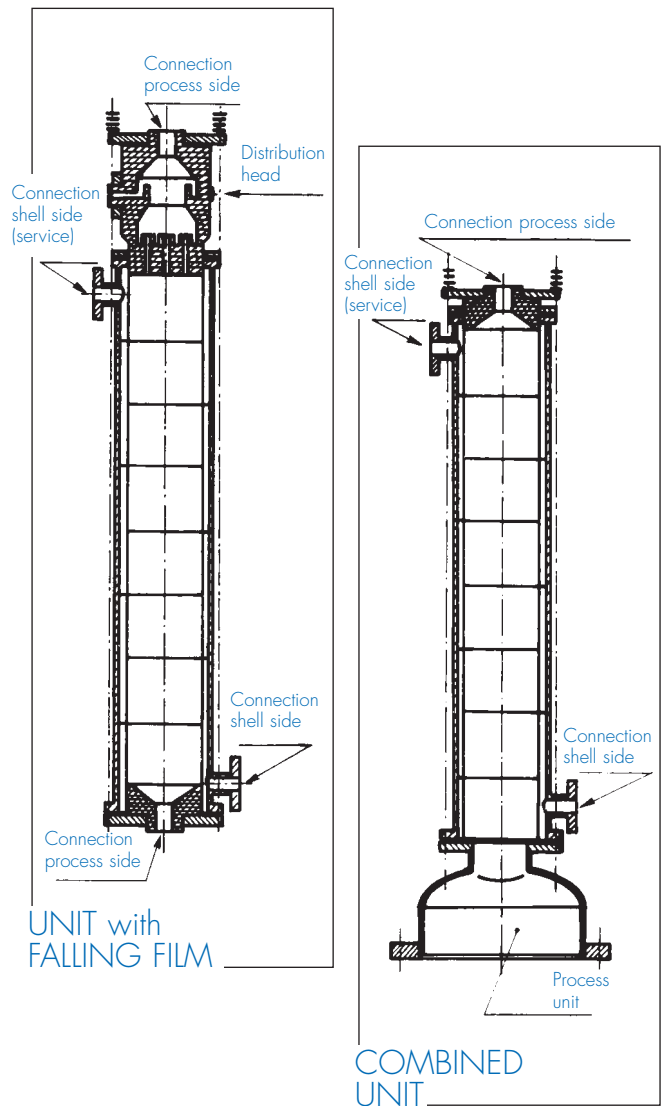
Units with more than two fluids

The stack of graphite blocks may be equipped with an isolating block which separates the service side in two independent and well isolated parts. It is in fact just like two units put together.



Falling film units

POLYBLOC NC/NF units may be equipped with a distribution head transforming the unit to absorbers or evaporators for falling film operation.



Combined units

POLYBLOC heat exchangers series NC/NF may be equipped with several kind of headers or distribution chambers enabling a direct connection to process units.

They may be used in particular, as total flow condensers or as integrated reboilers.

For example reboilers operating as phosphoric acid concentration are often equipped with special rubber lined steel connecting cones for larger size pipework.

Units for quick opening

When the process side of the heat exchanger requires easy access the unit can be fitted with a special process header for quick opening and dismantling without untightening and disturbing the stack of graphite blocks and gaskets.

For larger size units the header can be supplied with a manhole.

Thermal sizing

Computerised methods are used by CARBONE LORRAINE for sizing the equipment best adapted to suit the application. Send full process and service side conditions to enable us to evaluate the size and type of unit for your application. Please remember to send as much information as possible to enable us to provide the most economical unit.

Materials of construction

Standard units are manufactured in the following materials. Other materials can be supplied.

Blocks and headers: GRAPHILOR 3

Shell: Carbon steel

Gaskets between blocks: PTFE

Quality control

All POLYBLOC heat exchangers are submitted to comprehensive CARBONE LORRAINE's quality control at all stages of manufacture. When ordering and on request, NC units can be supplied with most of the inspection certificates stipulated by the well known construction codes or issued by international inspection organisations.

Overall dimensions, heat transfer areas and weights

Total length of standard units

Note: total length of units may vary according to sizing conditions and selected options.

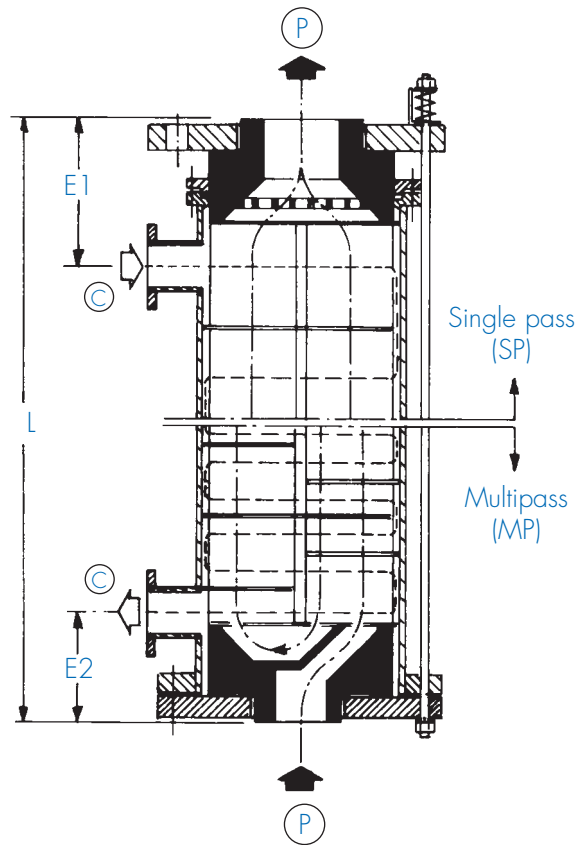
Units in diameter greater than 800 mm are designed on request.

NUMBER of BLOCKS	TOTAL LENGTH of STANDARD UNITS L (mm)						
	NC - NF 113	NC - NF 210-216	NC - NF 310-316	NC - NF 410-416	NC - NF 510	NC - NF 610-616	NC - NF 813-818
2	716	1 016	1 026	1 180	1 454	1 450	1 366
3	938	1 358	1 368	1 574	1 938	1 934	1 708
4	1 160	1 700	1 710	1 968	2 422	2 418	2 050
5	1 382	2 042	2 052	2 362	2 906	2 902	2 392
6	1 604	2 384	2 394	2 756	3 390	3 386	2 734
7	1 826	2 726	2 736	3 150	3 874	3 870	3 076
8	2 048	3 068	3 078	3 544	4 358	4 354	3 418
9	2 270	3 410	3 420	3 938	4 842	4 838	3 760
10	2 492	3 752	3 762	4 332	5 326	5 322	4 102
11	2 714	4 094	4 104	4 726	5 810	5 806	4 444
12	2 936	4 436	4 446	5 120	6 294	6 290	4 786
13	3 158	4 778	4 788	5 514	6 778	6 774	5 128
14	3 380	5 120	5 130	5 908	7 262	7 258	5 470
15	3 602	5 462	5 472	6 302	7 746	7 742	5 812
16	3 824	5 804	5 816	6 696	8 230	8 226	6 154
17	4 046	6 146	6 156	7 090	8 714	8 710	6 496
18	4 268	6 488	6 498	7 484	9 198	9 196	6 838
19	4 490	6 830	6 840	7 878	9 682	9 676	7 180
20	4 712	7 172	7 182	8 272	10 166	10 262	7 522
21							7 864
22							8 206
23							8 548
24							8 890
25							9 232

Heat transfer areas

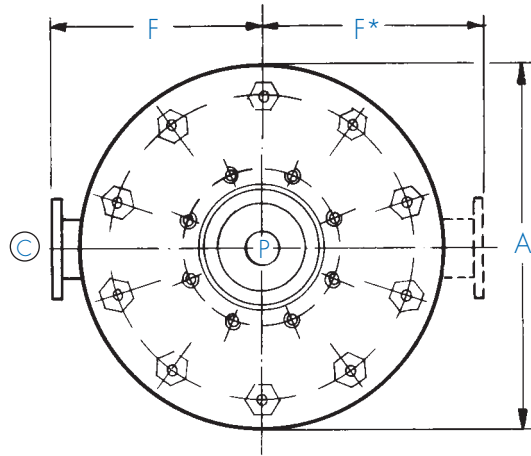
TYPES	Possible areas (m ²)	
	from	to
NC or NF 100	0.8	10.2
NC or NF 200	1.24	30.4
NC or NF 300	3.34	70.8
NC or NF 400	6.3	132.6
NC or NF 500	16.5	268.4
NC or NF 600	14.3	310.2
NC or NF 800	17.3	473

Connections



Following information are suitable for standard units. Connections are in accordance with ISO standards (AFNOR or DIN).

They are likely vary according to selected options and the service for which the unit has been designed. Connections according to standards other than ISO are also possible (ANSI, JIS, BS, ASA, ...).



* In the case of odd number of blocks, nozzles are opposite.

Connection holes are always off axis.

On the process side connection is by threaded holes according to information given in the chart side "P".

GRAPHILOR nozzles have a reinforced thickness in order to offer a great resistance to connection stresses as well as an excellent reliability.

To avoid reducing the cross section in spite of a high thickness for nozzles higher than 80 mm diameter a connection corresponding to the standard DN immediately higher must be used.

To make easy connection to pipework and other equipment connection fittings adapted to heat exchangers can be supplied (connection bellows and sleeves, elbows) in ARMYLOR (PTFE lined steel). (See specification sheet SG 445 231 to SG 445 235 and SA 170 001).

TYPES	AXIAL SIDE $\text{\textcircled{P}}$			RADIAL SIDE $\text{\textcircled{C}}$		A (mm)	E1 (mm)	E2 (mm)	F (mm)	
	CONNECTION PN 10-16		INTERNAL \varnothing of NOZZLES (mm)	DN	CONNECTION					
	DN	DRILLING								
NC/NF 113	80	8xM16x160	80	50	PN 10 or ANSI 150 lbs	345	185	177	180	
NC/NF 210-216	SP	80	8xM16x160	80		390	230	171	250	
	MP	50	8xM16x125	50						
NC/NF 310-316	SP	125	8xM16x240	125		80	535	240	186	345
	MP	80	8xM16x160	80						
NC/NF 410-416	SP	150	8xM16x270	150		100	640	285	206	400
	MP	100	8xM16x210	100						
NC/NF 510	SP	256	16xM20x460	256		150	740	312	300	425
	MP	100	8xM16x210	100						
NC/NF 610-616	SP	200	8xM16x325	200		150	825	319	273	500
	MP	125	8xM16x240	125						
NC/NF 813-818	SP	350	16xM20x515	350	150	1 160	350	300	700	
	MP	200	8xM16x325	200						

Approximate weights (kg)

NUMBER of BLOCKS	113		200			300			400			510		600			800		
	empty	full of water	empty	210 full of water	216 full of water	empty	310 full of water	316 full of water	empty	410 full of water	416 full of water	empty	full of water	empty	610 full of water	616 full of water	empty	813 full of water	818 full of water
2	124	135	175	210	210	355	395	400	625	710	720	925	1071	1230	1400	1460	2260	2650	2500
3	140	158	210	250	250	430	475	480	780	910	910	1127	1333	1500	1760	1810	2610	3080	3100
4	156	175	245	300	290	505	590	590	920	1070	1080	1329	1595	1770	1970	2020	2995	3550	3600
5	172	195	280	330	330	585	685	690	1050	1250	1300	1531	1858	2045	2400	2490	3350	4000	4040
6	188	215	310	370	370	660	780	780	1190	1400	1400	1733	2120	2320	2700	2740	3725	4520	4570
7	204	235	350	430	420	735	875	880	1330	1580	1580	1935	2382	2590	3000	3090	4090	4900	4940
8	220	255	385	470	470	815	975	980	1470	1760	1770	2137	2644	2860	3350	3410	4460	5400	5450
9	236	275	420	520	520	890	1080	1080	1600	1950	1950	2339	2906	3130	3790	3840	4825	5850	5900
10	252	295	450	550	540	970	1170	1170	1740	2090	2090	2541	3168	3400	4120	4180	5190	6200	6260
11	280	326	510	620	620	1045	1275	1280	1875	2225	2230	2743	3430	3680	4420	4460	5560	6800	6860
12	296	346	550	670	670	1120	1380	1380	2015	2400	2400	2945	3693	3950	4760	4800	5930	7300	7365
13	312	366	580	710	700	1195	1490	1490	2150	2590	2590	3147	3955	4220	5200	5260	6280	7680	7750
14	328	386	615	750	750	1275	1585	1590	2290	2790	2790	3349	4217	4500	5540	5600	6655	8150	8200
15	344	406	650	800	800	1350	1670	1670	2430	2940	2950	3551	4480	4770	5870	6020	7025	8625	8700
16	360	426	685	840	830	1475	1775	1680	2560	3060	3070	3753	4742	5040	6240	6300	7390	9080	9150
17	376	446	720	880	880	1550	1880	1880	2695	3130	3130	3955	5004	5415	7460	7520	7745	9530	9610
18	392	466	750	930	930	1630	1965	1970	2895	3370	3370	4157	5266	5685	6780	6800	8120	10000	10100
19	408	486	790	970	960	1700	2075	2080	3030	3540	3550	4359	5528	5960	7130	7170	8490	10450	10550
20	424	506	820	1010	1010	1780	2170	2170	3170	3700	3700	4561	5790	6230	7480	7520	8855	10900	11020
21																	9220	11450	11600
22																	9585	11785	11920
23																	9950	12330	12500
24																	10320	12710	12850
25																	10685	13185	13320

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