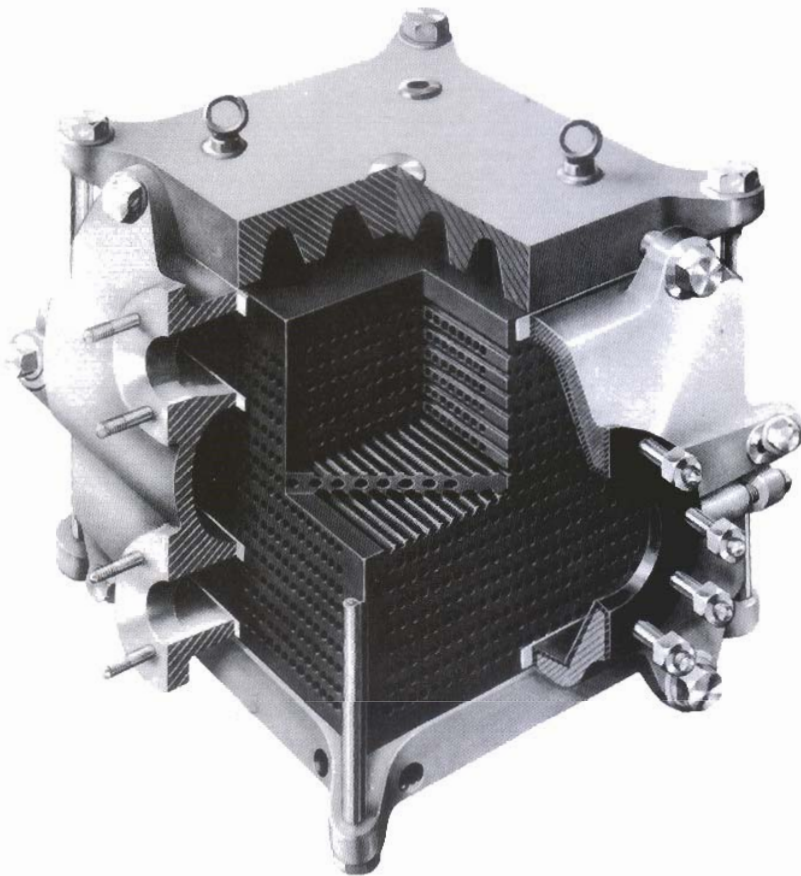


GRAPHILOR

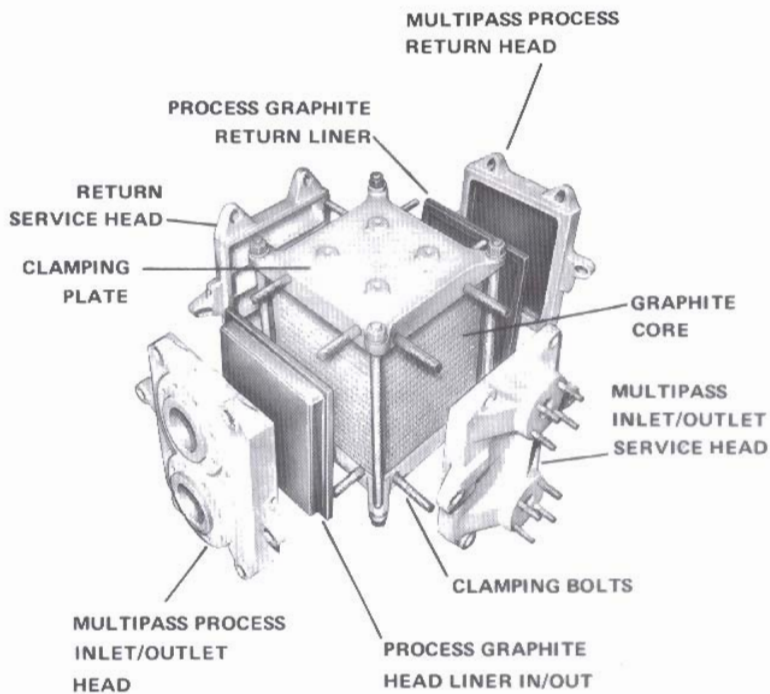
NK SERIES CUBIC HEAT EXCHANGERS



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CARBONE OF AMERICA

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The *BLOCK* type graphite heat exchanger is one of the most maintenance free types ever designed; all graphite is kept in compression.

The *BLOCK* will take overloads without failure which includes thermal, hydraulic and external mechanical shock.

Simplicity of design, ease of disassembly for mechanical cleaning, and a large number of sizes and pass arrangements all contribute to the *BLOCK* versatility.

BLOCKS are manufactured in a size range from 10 ft² to 2,000 ft². H.T.A.* , passes available from single to 60 pass dependent on model.

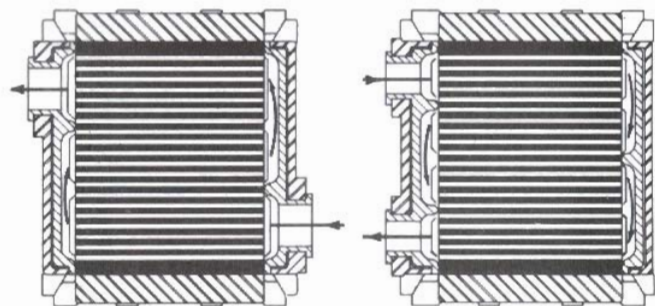
Process side flow passages are either 3/8" diameter or 1/4" diameter. The smaller hole option is generally used for condensation applications although they are applicable to clean liquids as well. Process tubes 3/4" and 1/2" diameter can be furnished for special requirements. They are, however, not standard.

Right angle relationship of process and service side flow patterns provides counter current flow which eliminates temperature correction factors in multipass heat exchangers. H.T.A.s* are thereby greatly reduced.

The physical size of the *BLOCK* design will often be 1/5 the volume of a comparable shell & tube type graphite exchanger.

Selection of the correct pass arrangement, in order to provide the minimum heat transfer resistance is of primary importance. The higher the velocity, the less the resistance, especially in the turbulent range, however, care must be observed concerning excessive pressure drop. In most cases, for a liquid specific gravity of 1, a velocity of 3-4 ft/sec can be used for good efficiency. TFE process gaskets are standard on all models. There are no internal gaskets in the *BLOCK* design.

TYPICAL FLOW PATTERN

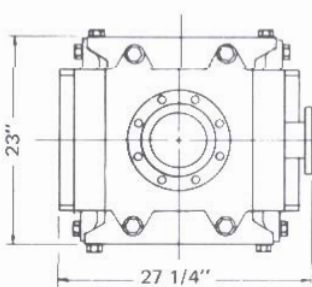


THREE PASS

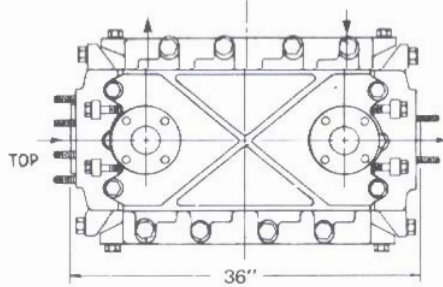
FOUR PASS

NK - 16L, 20L, 24L, 30L Models

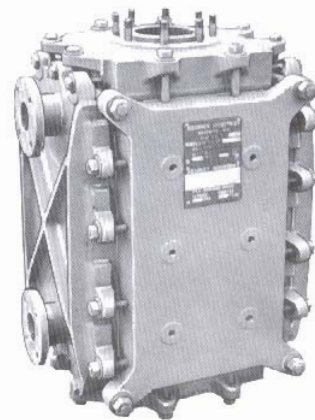
Primarily Designed for use as long vertical tube condensers, particularly if sub-cooling is required.



FRONT ELEV. PROCESS SIDE



SIDE ELEV. SERVICE SIDE

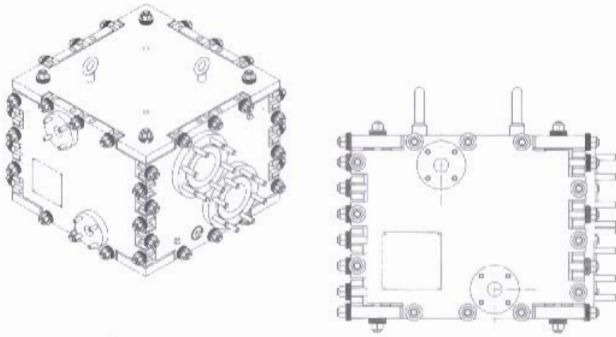


MODEL	TUBE SIZE		H.T.A. (FT. ²)		C.S.A. (FT. ²)		WT.
	PROCESS	SERV.	PROC.	SERV.	PROC.	SERV.	
NK $\frac{100}{100}$ -16L	3/8"	3/8"	100	100	.34	.61	1300
NK $\frac{200}{100}$ -16L	5/32"	3/8"	200	100	.34	.61	1300

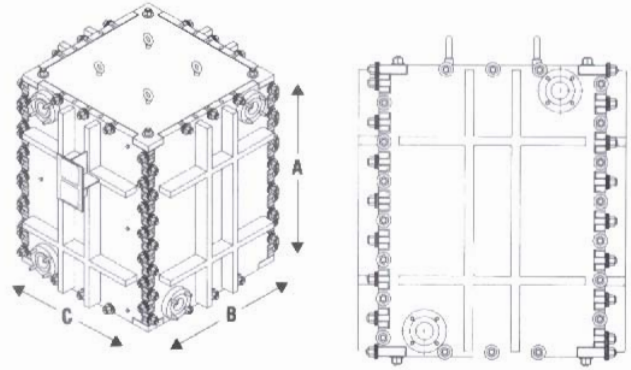
• There are 47 models available from 20 Ft.² to 1200Ft.²

*H.T.A. Heat Transfer Area — C.S.A. Cross Sectional Area — All dimensions and weights are approximate.

**Typical Model NK 110/110-16
with Steel Heads**



**Typical Model NK 500/500-24
with Steel Heads**

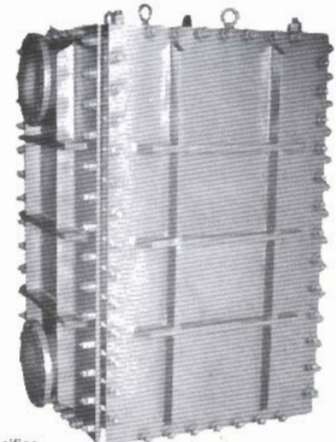


NK MODELS

MODEL	TUBE SIZE BOTH SIDES	H.T.A. (FT. ²) BOTH SIDES	MODEL	TUBE SIZE		H.T.A. (FT. ²)		C.S.A. (FT. ²) BOTH SIDES	APPROX. DRY. WT.	APPROX. DIMENSIONS		
				PROC.	SERV.	PROC.	SERV.			A	B	C
NK 10/10-9	3/8"x3/8"	10	NK 20/10-9	1/4"	1/4"	20	10	.10	250	12 1/2"	18"	15 1/2"
NK 20/20-9	3/8"x3/8"	10	NK 40/20-9	1/4"	1/4"	40	20	.19	400	20"	18"	18 1/2"
NK 30/30-9	3/8"x3/8"	30	NK 60/30-9	1/4"	1/4"	60	30	.29	500	23 1/2"	18"	18 1/2"
NK 45/45-16	3/8"x3/8"	45	NK 90/45-16	1/4"	1/4"	90	45	.26	950	19"	24 1/2"	25"
NK 55/55-16	3/8"x3/8"	57	NK 110/55-16	1/4"	1/4"	114	57	.34	1100	22 1/2"	24 1/2"	25 1/2"
NK 75/75-16	3/8"x3/8"	75	NK 150/75-16	1/4"	1/4"	150	75	.45	1200	27"	24 1/2"	25 1/2"
NK 100/100-16	3/8"x3/8"	100	NK 200/100-16	1/4"	1/4"	200	100	.58	1350	33"	24 1/2"	25 1/2"
NK 110/110-16	3/8"x3/8"	110	NK 220/110-16	1/4"	1/4"	220	110	.64	1400	35 1/2"	24 1/2"	25 1/2"
NK 130/130-16	3/8"x3/8"	130	NK 260/130-16	1/4"	1/4"	260	130	.77	1600	41"	24 1/2"	25"
NK 150/150-16	3/8"x3/8"	150	NK 300/150-16	1/4"	1/4"	300	150	.90	1800	47"	24 1/2"	26 1/2"
NK 175/175-20	3/8"x3/8"	175	NK 350/175-20	1/4"	1/4"	350	175	*	3600	40"	30"	30"
NK 200/200-20	3/8"x3/8"	205	NK 400/200-20	1/4"	1/4"	410	205	*	4000	43"	30"	30"
NK 250/250-20	3/8"x3/8"	270	NK 500/250-20	1/4"	1/4"	540	270	*	4600	50"	30"	30"
NK 300/300-20	3/8"x3/8"	295	NK 600/300-20	1/4"	1/4"	590	300	*	5300	58"	30"	30"
NK 350/350-20	3/8"x3/8"	350	NK 700/350-20	1/4"	1/4"	700	350	*	5800	64"	30"	30"
NK 400/400-20	3/8"x3/8"	400	NK 800/400-20	1/4"	1/4"	800	400	*	6500	72"	30"	30"
NK 450/450-24	3/8"x3/8"	450	NK 900/400-24	1/4"	1/4"	900	450	*	6100	60"	32"	32"
NK 500/500-24	3/8"x3/8"	500	NK 1000/500-24	1/4"	1/4"	1000	500	*	6800	66"	32"	32"
NK 550/550-24	3/8"x3/8"	550	NK 1100/550-24	1/4"	1/4"	1100	550	*	7400	72"	32"	32"
NK 600/600-24	3/8"x3/8"	600	NK 1200/600-24	1/4"	1/4"	1200	600	*	8100	78"	32"	32"
NK 700/700-30	3/8"x3/8"	700	NK 1400/700-30	1/4"	1/4"	1400	700	*	12000	70"	38"	38"
NK 800/800-36	3/8"x3/8"	800	NK 1600/800-36	1/4"	1/4"	1600	800	*	13500	52"	44"	44"
NK 1000/1000-36	3/8"x3/8"	1000	NK 2000/1000-36	1/4"	1/4"	2000	1000	*	16000	63"	44"	44"

NOTES:

- There are 35 additional intermediate models available.
- Process and service hole diameters are 3/8", 1/4" or a combination of both. Other hole sizes optional.
- All models NK 175/175-20 through NK 1000/1000-36 have steel heads and clamping plates.
- Models NK 10/10-9 through NK 150/150-16 have either cast iron or steel heads and clamping plates.
- -9, -16, -20, -24, -36 refers to length and width of the graphite core.
- Design pressure with cast iron heads = 75 psig and full vacuum.
- Design pressure with steel heads = 100 psig and full vacuum.
- A, B, C dimensions and weights are approximate.
- Nozzle sizes and pass arrangements vary to suit process conditions.
- The use of expansion joints on process nozzles is recommended.
- Head bolting includes spring washers to compensate for expansion and contraction during operation.
- Cubic units are well suited for interchanger applications by using graphite lined heads on both process and service sides.



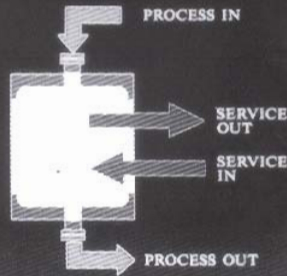
*Depends upon hole size which may vary to suit application. Consult with Carbone Process Design Department for specifics.

TYPICAL APPLICATIONS

CONDENSING SERVICE SINGLE PASS VERTICAL

The process holes are vertical and the service holes are horizontal:

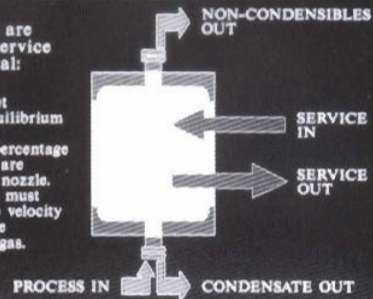
This is generally used for refluxing and provides little or no subcooling of condensate and noncondensibles.



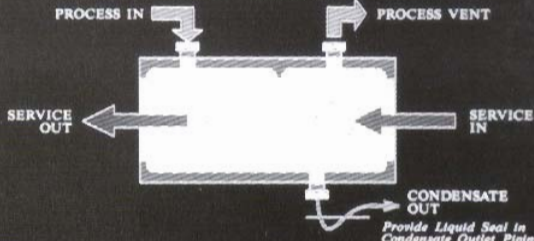
CONDENSING SERVICE SINGLE PASS VERTICAL KNOCKBACK

The process holes are vertical and the service holes are horizontal:

The condensate outlet temperature is in equilibrium with the vapor inlet temperature. Small percentage of non-condensibles are vented from the top nozzle. Proper consideration must be given to tube side velocity to prevent condensate entrainment in vent gas.



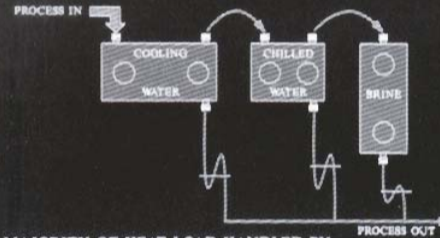
CONDENSING SERVICE 2 X 1 PASS PHASE SEPARATOR



Provide Liquid Seal in Condensate Outlet Piping
This arrangement again provides little or no subcooling of condensate. However, it WILL SEPARATE and SUBCOOL a higher percentage of non-condensibles. This arrangement is commonly used in steam jet vacuum applications and in processes involving vacuum distillations. Vacuum to the reactor can be provided through the vent nozzle on the exchangers.

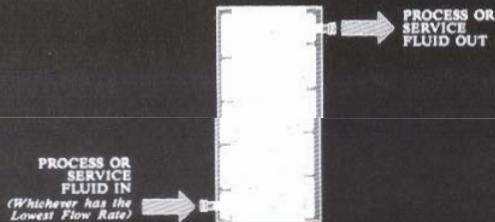
2 X 1 PASS ARRANGEMENT

The 2 X 1 pass arrangement can be useful for reducing utility costs where vent gases are released at low temperatures. Two or three units can be arranged in series, for example:

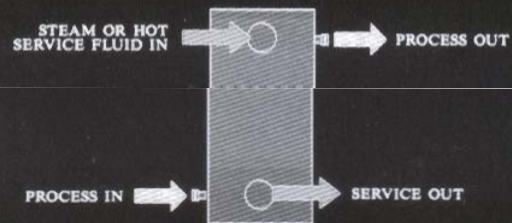


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COOLING SERVICE



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Multiple passes on process and services sides for heating and cooling applications results in higher fluid velocities, higher Reynolds Numbers and higher transfer rates.

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