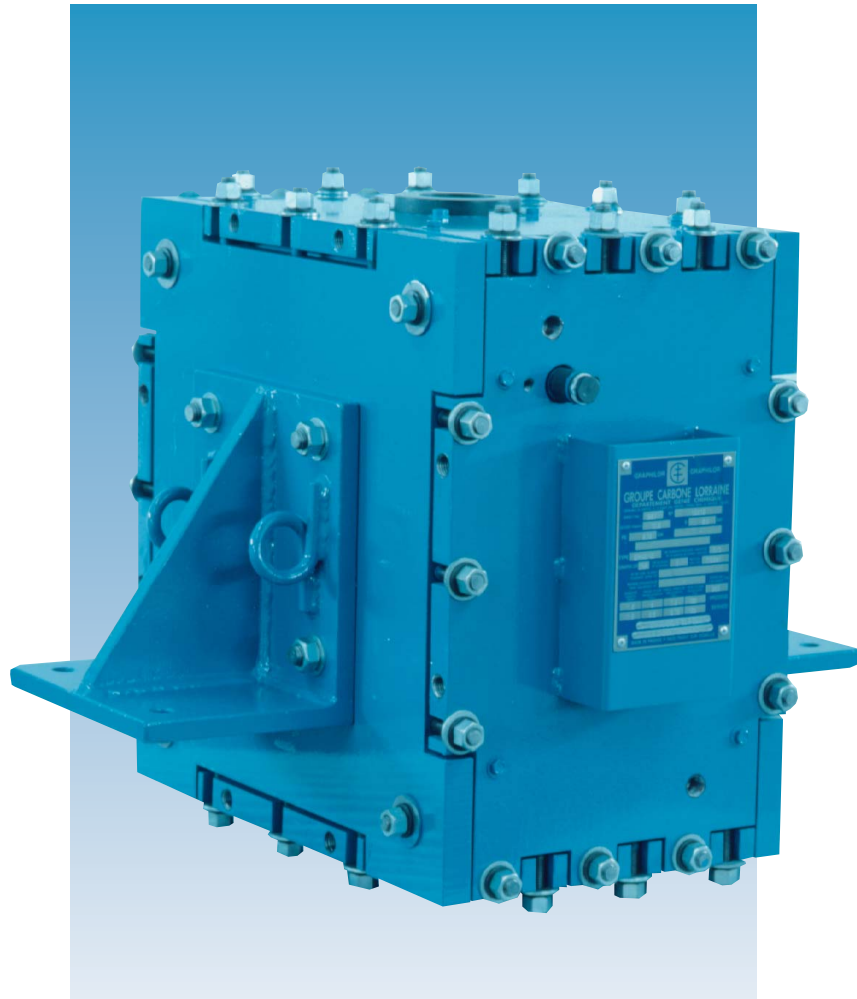




CUBIC EXCHANGERS

made of GRAPHILOR® (impregnated graphite)



N
K MODEL

Applications

Impregnated graphite cubic single block exchangers are used, as are all impregnated graphite heat exchangers, for handling of corrosive fluids.

Their characteristics make cubic exchangers particularly suitable for following applications.

- **co-or countercurrent condensers**, located on top of reactors in the pharmaceutical or fine chemical industry; **with separation and cooling of non-condensables if necessary**,
- **cooling of acids or corrosive fluids**, particularly with low flow rates and high thermal load,
- **heat exchange between 2 corrosive fluids** (interchangers).

Specific characteristics

Reliability and toughness:

they are made of a single block of graphite.

Compactness:

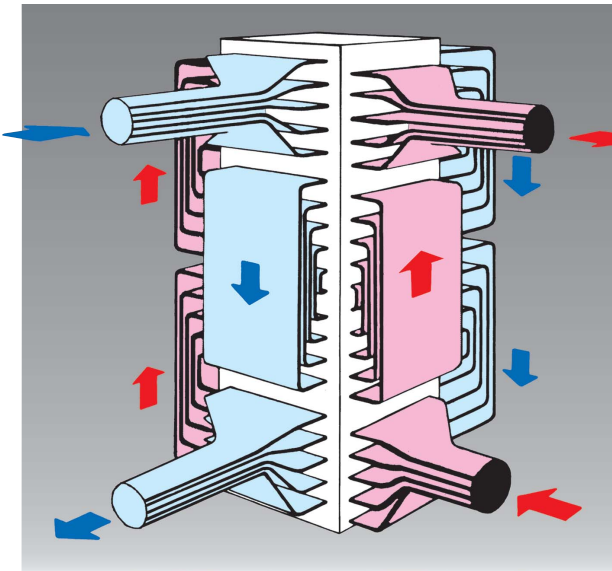
the high drilling density of circuits considerably increases the exchange area per volume unit.

Multipassing and multiple adaptation features to suit exchange area and cross section requirements.

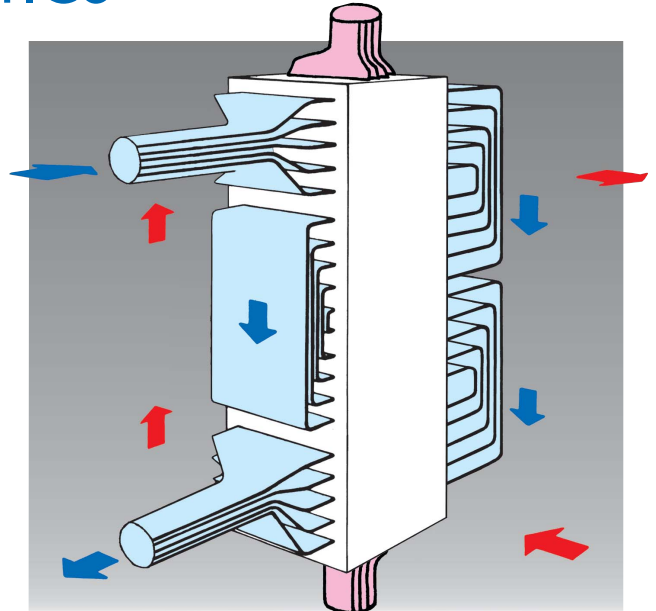
In conformity with ASME and CODAP **codes.**

Homologated by TÜV.

GENERAL CHARACTERISTICS



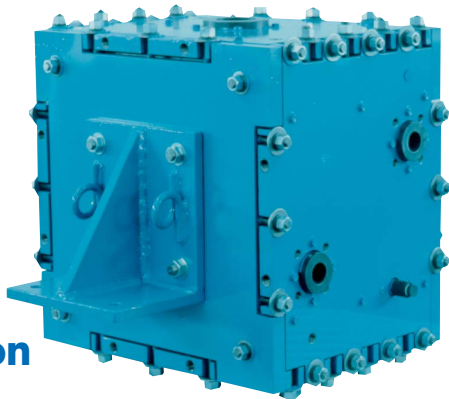
Flow diagram (X drilling)



Flow diagram (L drilling)

High reliability

- Tough construction.
- Resistance to thermal shock.
- Outside protection by metal plates which keep the graphite in compression.
- Easy cleaning because of short channels, simple design and easy dismantling.
- No gaskets or cemented parts inside the equipment.
- Use of high mechanical strength graphite.



Adaptation flexibility

- Materials: GRAPHILOR 3, XBS or XC or XTH
- 4 cross sections:

Block dimensions		Designation
inch	mm	
9 1/2 × 9 1/2	241	10
16 × 16	399	16
20 × 20	492	20
24 × 24	594	24

- 2 drilling patterns:
 - Cross bore or crossed in horizontal projection, designation X,
 - long or crossed in vertical projection, designation L

Compact construction

- Maximum active area for a small volume.
- Cubic exchangers are much smaller than all other types of exchangers. With equivalent overall dimensions, a cubic exchanger provides between 5 to 10 times more exchange area than a shell and tube heat exchanger.

High heat exchange capacity

- Cross flow operation prevents any risk of temperature crossing even when multipassing is used.
- Cross section area on each pass is adaptable to optimise fluids flow rates.
- The short channel length increases turbulence and avoids deposits or fouling.

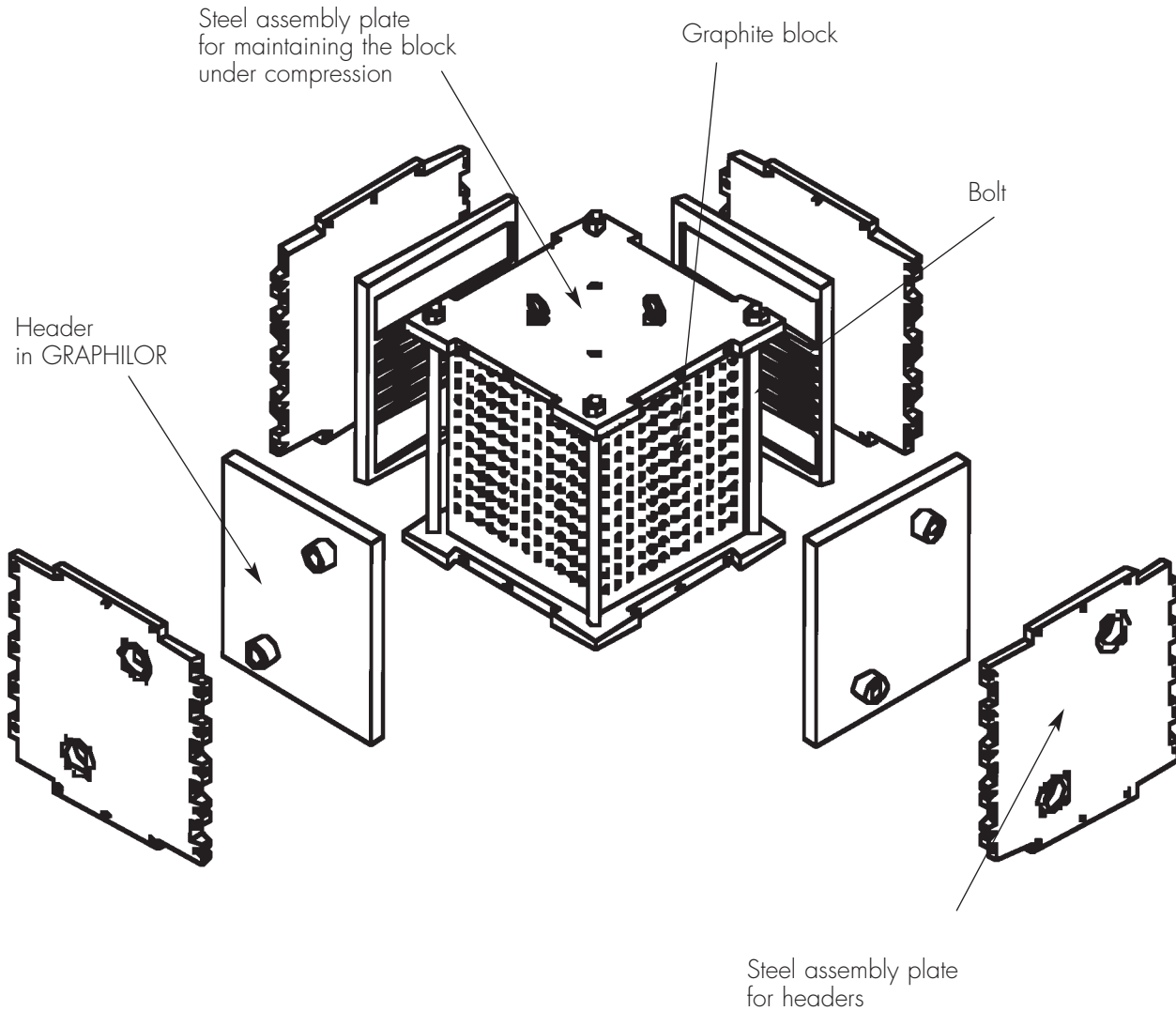


- 5 drilling types

Process side		Service side		Designation
inch	mm	inch	mm	
3/8	9.5	3/8	9.5	A
1/4 double	6.35 double	1/4	6.35	D
19/64 double	7.5 double	3/8	9.5	F
5/16	8.5	5/16	8.5	T
5/8	16	3/8	9.5	Y

- Many multipassing possibilities
- Exchanger height adapted to the exchange area and function requirements.

CONSTRUCTION



Principle

The impregnated graphite block is maintained under compression by two steel assembly plates tightened by four carbon steel tie rods.

Each lateral face of the block is drilled with parallel cylindrical holes to allow fluid flow. The rows of holes are alternated through the thickness of the block.

The headers are made of impregnated graphite with steel assembly plates.

Headers can be equipped with baffle plates to enable adjustment of multipassing to need. This optimises the velocity of the two fluids by making conditions as close as possible to real countercurrent flow. This is particularly useful in energy recovery applications. It is also possible to vary the cross section or to have split flow.

The use of impregnated graphite headers on the four faces of the block allows the treatment of two corrosive fluids.

Tightness between block and headers is achieved with PTFE gaskets. No other gaskets are required.

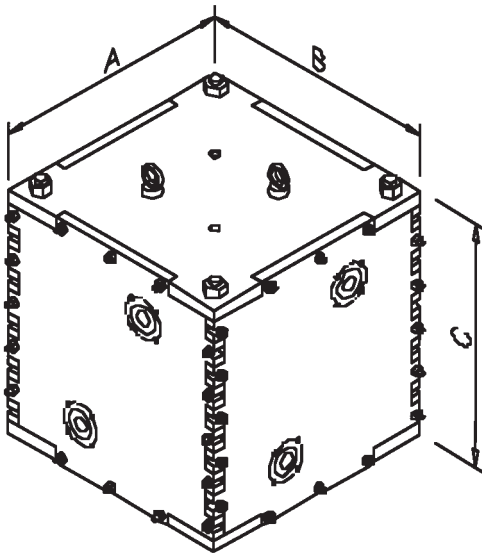
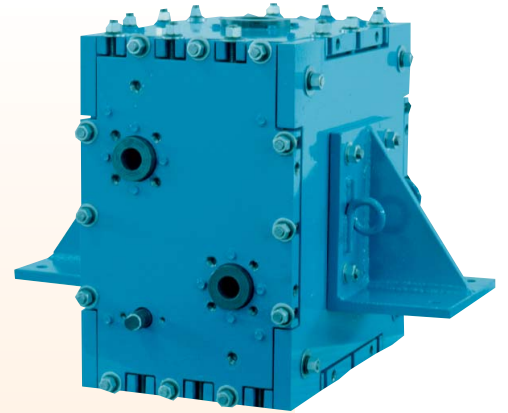
The RANGE

Working conditions

Maximum design pressure: 7 bars (100 psi)

Design temperature: 200°C

For more severe design conditions, it is possible to size the heat exchangers accordingly.



Characteristics

The adaptation flexibility leads to an optimised range of heat exchangers.

Each exchanger is characterised by its nomenclature, i.e.:

Construction type	Cross section of block inch	Height in inch	Drilling pattern	Drilling type	GRAPHILOR
NK	10	Adapted to process	X or L	A or	XBS or XC or XTH
	16			D or	
	20			F or	
	24			T or	
	30			Y	

POSSIBILITIES

The following tables show the many possibilities offered by this range of exchangers.

in GRAPHILOR 3 BS, XBS and XC

Designation	PROCESS SIDE			SERVICE SIDE		
	Hole diameters mm	Cross section area cm ²	Surface m ²	Hole diameters mm	Cross section area cm ²	Surface m ²
NK 10/11-XA	9.5	102	1.04	9.5	102	1.04
NK 10/13-XA	9.5	136	1.38	9.5	136	1.38
NK 10/16-XA	9.5	170	1.73	9.5	170	1.73
NK 10/19-XA	9.5	204	2.07	9.5	204	2.07
NK 10/22-XA	9.5	238	2.42	9.5	238	2.42
NK 10/25-XA	9.5	272	2.76	9.5	272	2.76
NK 16/13-XA	9.5	238	4.07	9.5	238	4.07
NK 16/16-XA	9.5	298	5.09	9.5	298	5.09
NK 16/19-XA	9.5	357	6.11	9.5	357	6.11
NK 16/22-XA	9.5	417	7.12	9.5	417	7.12
NK 16/25-XA	9.5	476	8.14	9.5	476	8.14
NK 16/27-XA	9.5	536	9.16	9.5	536	9.16
NK 16/30-XA	9.5	595	10.18	9.5	595	10.18
NK 16/36-XA	9.5	714	12.21	9.5	714	12.21
NK 16/42-XA	9.5	834	14.25	9.5	834	14.25
NK 16/47-XA	9.5	953	16.29	9.5	953	16.29
NK 16/53-XA	9.5	1072	18.32	9.5	1072	18.32
NK 16/58-XA	9.5	1191	20.36	9.5	1191	20.36
NK 16/64-XA	9.5	1310	22.39	9.5	1310	22.39
NK 16/70-XA	9.5	1429	24.43	9.5	1429	24.43
NK 20/22-XA	9.5	536	11.21	9.5	536	11.21
NK 20/25-XA	9.5	612	12.82	9.5	612	12.82
NK 20/27-XA	9.5	689	14.42	9.5	689	14.42
NK 20/30-XA	9.5	766	16.02	9.5	766	16.02
NK 20/36-XA	9.5	919	19.22	9.5	919	19.22
NK 20/42-XA	9.5	1072	22.43	9.5	1072	22.43
NK 20/47-XA	9.5	1225	25.63	9.5	1225	25.63
NK 20/53-XA	9.5	1378	28.84	9.5	1378	28.84
NK 20/58-XA	9.5	1531	32.04	9.5	1531	32.04
NK 20/64-XA	9.5	1684	35.24	9.5	1684	35.24
NK 24/31-XA	9.5	893	22.37	9.5	893	22.37
NK 24/37-XA	9.5	1072	26.85	9.5	1072	26.85
NK 24/42-XA	9.5	1250	31.32	9.5	1250	31.32
NK 24/48-XA	9.5	1429	35.80	9.5	1429	35.80
NK 24/54-XA	9.5	1608	40.27	9.5	1608	40.27
NK 24/59-XA	9.5	1786	44.75	9.5	1786	44.75
NK 24/65-XA	9.5	1965	49.22	9.5	1965	49.22
NK 24/71-XA	9.5	2143	53.70	9.5	2143	53.70

in GRAPHILOR 3 XTH

Designation	PROCESS SIDE			SERVICE SIDE		
	Hole diameters mm	Cross section area cm ²	Surface m ²	Hole diameters mm	Cross section area cm ²	Surface m ²
NK 10/11-XA	8.5	82	0.93	8.5	82	0.93
NK 10/13-XA	8.5	109	1.24	8.5	109	1.24
NK 10/16-XA	8.5	136	1.54	8.5	136	1.54
NK 10/19-XA	8.5	163	1.85	8.5	163	1.85
NK 10/22-XA	8.5	191	2.16	8.5	191	2.16
NK 10/25-XA	8.5	218	2.47	8.5	218	2.47
NK 16/13-XA	8.5	191	3.64	8.5	191	3.64
NK 16/16-XA	8.5	238	4.55	8.5	238	4.55
NK 16/19-XA	8.5	286	5.46	8.5	286	5.46
NK 16/22-XA	8.5	334	6.37	8.5	334	6.37
NK 16/25-XA	8.5	381	7.29	8.5	381	7.29
NK 16/27-XA	8.5	429	8.20	8.5	429	8.20
NK 16/30-XA	8.5	477	9.11	8.5	477	9.11
NK 16/36-XA	8.5	572	10.93	8.5	572	10.93
NK 16/42-XA	8.5	667	12.75	8.5	667	12.75
NK 16/47-XA	8.5	763	14.57	8.5	763	14.57
NK 16/53-XA	8.5	858	16.39	8.5	858	16.39
NK 20/22-XA	8.5	429	10.03	8.5	429	10.03
NK 20/25-XA	8.5	490	11.47	8.5	490	11.47
NK 20/27-XA	8.5	552	12.90	8.5	552	12.90
NK 20/30-XA	8.5	613	14.33	8.5	613	14.33
NK 20/36-XA	8.5	735	17.20	8.5	735	17.20
NK 20/42-XA	8.5	858	20.07	8.5	858	20.07
NK 20/47-XA	8.5	981	22.93	8.5	981	22.93

Cubic exchangers with X-D double drilling

in GRAPHILOR 3 BS, XBS, XC and XTH

Designation	PROCESS SIDE			SERVICE SIDE		
	Hole diameters	Cross section area	Surface	Hole diameters	Cross section area	Surface
	mm	cm ²	m ²	mm	cm ²	m ²
NK 10/11-XD	6.35	128	1.95	6.35	66	1.00
NK 10/13-XD	6.35	171	2.60	6.35	87	1.33
NK 10/16-XD	6.35	214	3.25	6.35	109	1.66
NK 10/19-XD	6.35	257	3.89	6.35	131	1.99
NK 10/22-XD	6.35	299	4.54	6.35	153	2.32
NK 10/25-XD	6.35	342	5.19	6.35	175	2.65
NK 16/13-XD	6.35	296	7.58	6.35	152	3.89
NK 16/16-XD	6.35	371	9.48	6.35	190	4.86
NK 16/19-XD	6.35	445	11.37	6.35	228	5.83
NK 16/22-XD	6.35	519	13.27	6.35	266	6.80
NK 16/25-XD	6.35	593	15.16	6.35	304	7.78
NK 16/27-XD	6.35	667	17.06	6.35	342	8.75
NK 16/30-XD	6.35	741	18.95	6.35	380	9.72
NK 16/36-XD	6.35	889	22.74	6.35	456	11.66
NK 16/42-XD	6.35	1037	26.53	6.35	532	13.61
NK 16/47-XD	6.35	1186	30.32	6.35	608	15.55
NK 16/53-XD	6.35	1334	34.11	6.35	684	17.49
NK 16/58-XD	6.35	1482	37.90	6.35	760	19.44
NK 16/64-XD	6.35	1630	41.70	6.35	836	21.38
NK 16/70-XD	6.35	1779	45.49	6.35	912	23.33
NK 20/22-XD	6.35	652	20.40	6.35	333	10.41
NK 20/25-XD	6.35	745	23.32	6.35	380	11.90
NK 20/27-XD	6.35	838	26.23	6.35	428	13.38
NK 20/30-XD	6.35	931	29.15	6.35	475	14.87
NK 20/36-XD	6.35	1117	34.98	6.35	570	17.85
NK 20/42-XD	6.35	1304	40.81	6.35	665	20.82
NK 20/47-XD	6.35	1490	46.64	6.35	760	23.80
NK 20/53-XD	6.35	1676	52.47	6.35	855	26.77
NK 20/58-XD	6.35	1862	58.30	6.35	950	29.74
NK 20/64-XD	6.35	2048	64.13	6.35	1045	32.72
NK 24/31-XD	6.35	1121	42.02	6.35	570	21.37
NK 24/37-XD	6.35	1345	50.42	6.35	684	25.64
NK 24/42-XD	6.35	1570	58.83	6.35	798	29.91
NK 24/48-XD	6.35	1794	67.23	6.35	912	34.18
NK 24/54-XD	6.35	2018	75.63	6.35	1026	38.46
NK 24/59-XD	6.35	2242	84.04	6.35	1140	42.73
NK 24/65-XD	6.35	2466	92.44	6.35	1254	47.00
NK 24/71-XD	6.35	2691	100.85	6.35	1368	51.28

Cubic exchangers with X-Y type single drilling

in GRAPHILOR 3 BS, XBS and XC

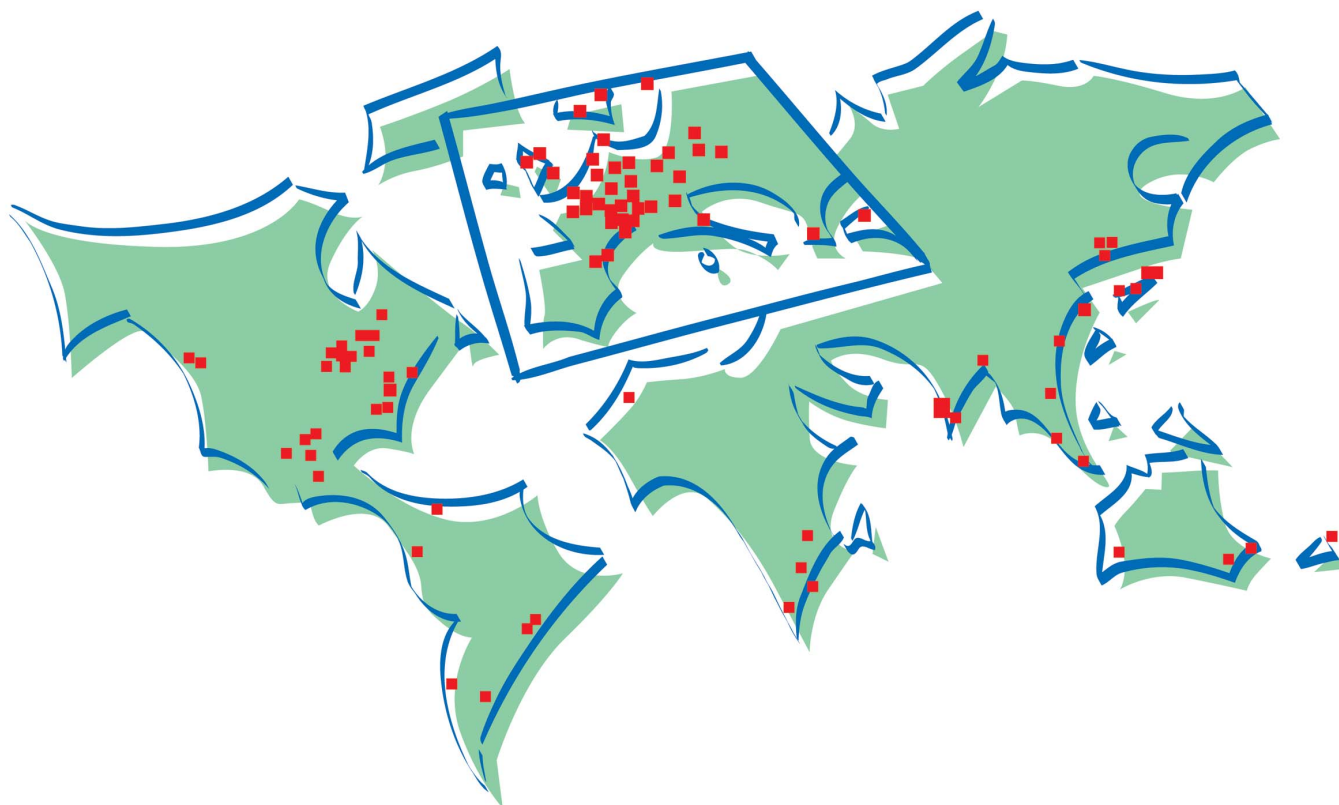
Designation	PROCESS SIDE			SERVICE SIDE		
	Hole diameters	Cross section area	Surface	Hole diameters	Cross section area	Surface
	mm	cm ²	m ²	mm	cm ²	m ²
NK 16/13-X-Y	16	290	2.94	9.5	139	2.37
NK 16/16-X-Y	16	362	3.67	9.5	179	3.05
NK 16/19-X-Y	16	434	4.41	9.5	218	3.73
NK 16/22-X-Y	16	507	5.14	9.5	258	4.41
NK 16/25-X-Y	16	579	5.88	9.5	298	5.09
NK 16/27-X-Y	16	651	6.61	9.5	337	5.77
NK 16/30-X-Y	16	724	7.35	9.5	377	6.45
NK 16/36-X-Y	16	869	8.82	9.5	456	7.80
NK 16/42-X-Y	16	1013	10.29	9.5	536	9.16
NK 16/47-X-Y	16	1158	11.75	9.5	615	10.52
NK 20/30-X-Y	16	885	10.99	9.5	485	10.15
NK 20/36-X-Y	16	1062	13.19	9.5	587	12.28
NK 20/42-X-Y	16	1239	15.39	9.5	689	14.42
NK 20/47-X-Y	16	1415	17.59	9.5	791	16.55
NK 20/53-X-Y	16	1592	19.79	9.5	893	18.69
NK 20/58-X-Y	16	1769	21.98	9.5	995	20.83
NK 20/64-X-Y	16	1946	24.18	9.5	1097	22.96
NK 20/70-X-Y	16	2123	26.38	9.5	1199	25.10
NK 24/42-X-Y	16	1464	21.77	9.5	804	20.14
NK 24/47-X-Y	16	1673	24.88	9.5	923	23.12
NK 24/53-X-Y	16	1882	27.99	9.5	1042	26.10
NK 24/58-X-Y	16	2091	31.10	9.5	1161	29.09
NK 24/64-X-Y	16	2300	34.21	9.5	1280	32.07
NK 24/70-X-Y	16	2509	37.33	9.5	1399	35.05

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