3TK20

Endurance of the main contacts

The characteristic curves show the contact endurance of the contactors when switching inductive AC loads (AC-3) depending on the breaking current and rated operational voltage. It is assumed that the operating mechanisms are switched randomly, i.e. not synchronized with the phase angle of the supply system. The rated operational current I_e complies with utilization category AC-4 (breaking six times the rated operational current) and is intended for a contact endurance of at least 200 000 operating cycles. If a shorter endurance is sufficient, the rated operational current I_e/AC-4 can be increased.

If the contacts are used for mixed operation, i.e. if normal switching (breaking the rated operational current according to utilization category AC-3) in combination with intermittent inching (breaking several times the rated operational current according to utilization category AC-4), the contact endurance can be calculated approximately from the following equation:

$$X = \frac{A}{1 + \frac{C}{100}\left(\frac{A}{B} - 1\right)}$$

Characters in the equation:
X = Contact endurance for mixed operation in operating cycles
A = Contact endurance for normal operation ($I_a = I_e$) in operating cycles
B = Contact endurance for inching (I_a = multiple of I_e) in operating cycles
C = Inching operations as a percentage of total switching operations

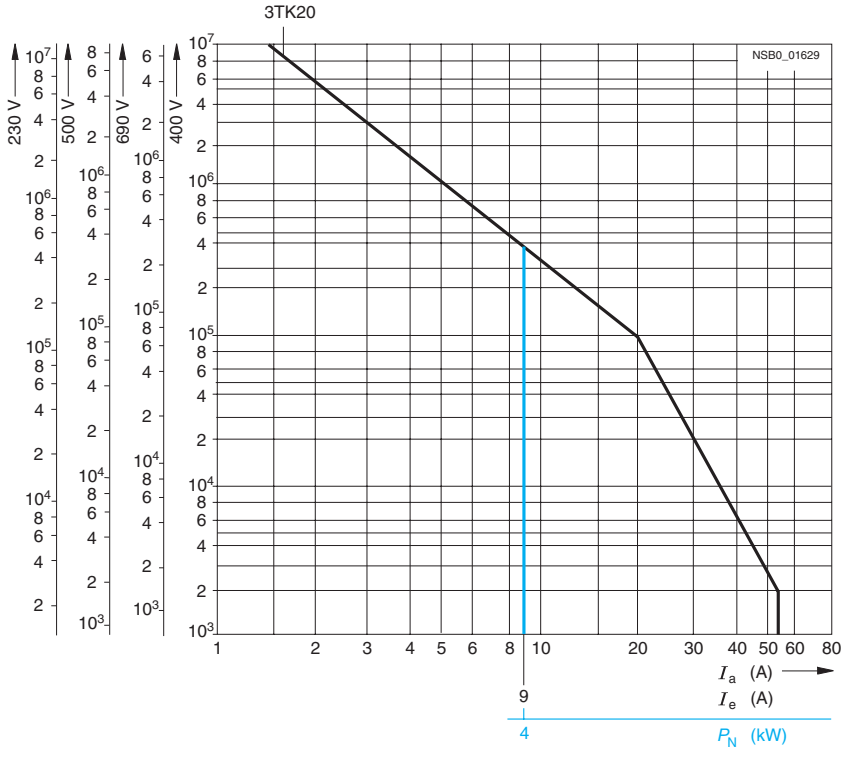

Diagram legend:
P_N= Rated power for squirrel-cage motors at 400 V
I_a= Breaking current
I_e= Rated operational current

3TK20 Contactors

4-pole, 4 kW

Contactors			
Type			**3TK20**
General data			
Permissible mounting position	AC and DC operation		Any
Mechanical endurance	AC operation DC operation Auxiliary switch block	Operating cycles	10 million 30 million 10 million
Rated insulation voltage U_i (degree of pollution 3) • Screw terminal • Flat connector 6.3 mm x 0.8 mm • Solder pin connection		 V V V	 690 500 500
Rated impulse withstand voltage U_{imp} (degree of pollution 3) • Screw terminal • Flat connector 6.3 mm x 0.8 mm • Solder pin connection		 kV kV kV	 8 6 6
Safe isolation between coil and main contacts (according to DIN VDE 0106 Part 101 and A1 [draft 02/89])		V	Up to 300
Permissible ambient temperature[1]	During operation During storage	°C °C	-25 ... +55 -55 ... +80
Degree of protection according to EN 60947-1 Appendix C			IP00 open IP20 for screw terminal IP40 coil assembly
Touch protection according to EN 50274			Finger-safe for screw terminal
Shock resistance			
Rectangular pulse	AC operation DC operation	*g*/ms *g*/ms	8.3/5 and 5.2/10 11.3/5 and 9.2/10
Sine pulse	AC operation DC operation	*g*/ms *g*/ms	13/5 and 8/10 17.4/5 and 12.9/10
Conductor cross-sections			[2]
Short-circuit protection for contactors without overload relays			
Main circuit[3]			
• Fuse links gL/gG LV HRC 3NA, DIAZED 5SB, NEOZED 5SE - According to IEC 60947-4/ DIN VDE 0660, Part 2	 Type of coordination "1" Type of coordination "2"[4] Weld-free	 A A A	 25 10 10
• Miniature circuit breaker with C characteristic		A	10
Auxiliary circuit Short-circuit current $I_k \geq 1$ kA			
• Fuse links gL/gG DIAZED 5SB, NEOZED 5SE		A	6

[1] Applies to 50/60 Hz coil:
At 50 Hz, 1.1 x U_s, , side-by-side mounting and 100 % ON period the max. ambient temperature is +40 °C.

[2] See page 3/114.

[3] According to excerpt from IEC 60947-4/DIN VDE 0660 Part 102
Type of coordination "1"
Destruction of the contactor and the overload relay is permissible.
The contactor and/or overload relay can be replaced if necessary.
Type of coordination "2":
The overload relay must not suffer any damage. Contact welding on the contactor is permissible, however, if the contacts can be easily separated.

[4] A short-circuit current of $I_q \leq 6$ kA applies to type of coordination "2".

Contactors			
Type			**3TK20**
Control			
Magnetic coil operating range[1]			0.8 ... 1.1 x U_s
Power consumption of the magnetic coils (when coil is cold and 1.0 x U_s)			
Standard version			
AC operation, 50 Hz	Closing	VA	15
	• P.f.		0.41
	Closed	VA	6.8
	• P.f.		0.42
AC operation, 60 Hz	Closing	VA	14.4
	• P.f.		0.36
	Closed	VA	6.1
	• P.f.		0.46
AC operation, 50/60 Hz[1]	Closing	VA	16.5/13.2
	• P.f.		0.43/0.38
	Closed	VA	8.0/5.4
	• P.f.		0.48/0.42
For USA and Canada			
AC operation, 50 Hz	Closing	VA	14.6
	• P.f.		0.38
	Closed	VA	6.5
	• P.f.		0.40
AC operation, 60 Hz	Closing	VA	14.4
	• P.f.		0.30
	Closed	VA	6.0
	• P.f.		0.44
DC operation	Closing = Closed	W	3
Permissible residual current of the electronic circuit[2] (for 0 signal)			
	AC operation	mA	≤ 3 x (230 V/U_s)
	DC operation	mA	≤ 1 x (230 V/U_s)
Operating times at 0.8 ... 1.1 x U_s[3] Total break time = Opening delay + Arcing time Values apply with coil in cold state and at operating temperature for operating range			
• AC operation	Closing delay	ms	5 ... 19
	Opening delay	ms	2 ... 22
Dead interval			To use the 3TK20 AC-operated contactor in reversing duty an additional dead interval of 50 ms is required along with an NC contact interlock.
• DC operation	Closing delay	ms	16 ... 65
	Opening delay	ms	2 ... 5
Arcing time		ms	10 ... 15
Operating times at 1.0 x U_s[3]			
• AC operation	Closing delay	ms	5 ... 18
	Opening delay	ms	3 ... 21
Dead interval			To use the 3TK20 AC-operated contactor in reversing duty an additional dead interval of 50 ms is required along with an NC contact interlock.
• DC operation	Closing delay	ms	19 ... 31
	Opening delay	ms	3 ... 4
Arcing time		ms	10 ... 15

1) Applies to 50/60 Hz coil:
At 50 Hz, 1.1 x U_s, side-by-side mounting and 100 % ON period the max. ambient temperature is +40 °C.

2) The 3TX4 490-1J additional load module is recommended for higher residual currents (see Catalog LV 1).

3) The OFF-delay of the NO contacts and ON-delay of the NC contacts increase if the contactor coils are protected against voltage peaks (noise suppression diode 6 to 10 times, diode assemblies 2 to 6 times, varistor +2 to 5 ms).

3TK20 Contactors

4-pole, 4 kW

Contactors	Type			3TK20 ..-0...	3TK20 ..-3..., 3TK20 ..-6..., 3TK20 ..-7...
Size 00					
Main circuit					
AC capacity					
Utilization category AC-1, switching resistive loads					
Rated operational current I_e (at 40 °C)	up to 400/380 V	A		18	18
	690/660 V	A		18	--
Rated operational current I_e (at 55 °C)	400/380 V	A		16	16
	690/660 V	A		16	--
Rated power of AC loads	at 230/220 V	kW		6.0	6.0
P.f. = 1	400/380 V	kW		10	10
	500 V	kW		13	13
	690/660 V	kW		17	--
Minimum conductor cross-section for loads with I_e		mm^2		2.5	2.5
Utilization category AC-2 and AC-3					
Rated operational current I_e	up to 220 V	A		9.0	9.0
	230 V	A		9.0	9.0
	380 V	A		9.0	9.0
	400 V	A		8.4	8.4
	500 V	A		6.5	6.5
	660 V	A		5.2	--
	690 V	A		5.2	--
Rated power for motors with slip ring	at 110 V	kW		1.2	1.2
or squirrel-cage rotors at 50 Hz and 60 Hz and	115 V	kW		1.2	1.2
	120 V	kW		1.3	1.3
	127 V	kW		1.4	1.4
	200 V	kW		2.2	2.2
	220 V	kW		2.4	2.4
	230 V	kW		2.5	2.5
	240 V	kW		2.6	2.6
	380 V	kW		4.0	4.0
	400 V	kW		4.0	4.0
	415 V	kW		4.0	4.0
	440 V	kW		4.0	4.0
	460 V	kW		4.0	4.0
	500 V	kW		4.0	4.0
	575 V	kW		4.0	--
	660 V	kW		4.0	--
	690 V	kW		4.0	--
Utilization category AC-4					
(Contact endurance approx. 200000 operating cycles at I_a = 6 x I_e)					
Rated operational current I_e	up to 400 V	A		2.6	2.6
	690 V	A		1.8	--
Rated power for motors with squirrel-cage rotor	at 110 V	kW		0.32	0.32
at 50 and 60 Hz and	115 V	kW		0.33	0.33
	120 V	kW		0.35	0.35
Max. permissible rated operational current	127 V	kW		0.37	0.37
I_e/AC-4 ≙ I_e/AC-3 up to 500 V, for reduced contact	200 V	kW		0.58	0.58
endurance and reduced switching frequency	220 V	kW		0.64	0.64
	230 V	kW		0.67	0.67
	240 V	kW		0.70	0.70
	380 V	kW		1.10	1.10
	400 V	kW		1.15	1.15
	415 V	kW		1.20	1.20
	440 V	kW		1.27	1.27
	460 V	kW		1.33	1.33
	500 V	kW		1.45	1.45
	575 V	kW		1.30	--
	660 V	kW		1.10	--
	690 V	kW		1.15	--

3TK20 Contactors

4-pole, 4 kW

Contactors	Type		3TK20 ..-0...	3TK20 ..-3..., 3TK20 ..-6..., 3TK20 ..-7...
Size 00				
Main circuit				
AC capacity				
Utilization category AC-5a, switching gas discharge lamps				
Per main current path at 230/220 V				
Rated power per lamp	Rated operational current per lamp (A)			
Uncorrected				
L 18 W	0.37	Units	43	
L 36 W	0.43	Units	37	
L 58 W	0.67	Units	23	
Lead-lag circuit				
L 18 W	011	Units	144	
L 36 W	0.21	Units	76	
L 58 W	0.32	Units	50	
Switching gas discharge lamps with correction, solid-state ballast				
Per main current path at 230/220 V				
Rated power per lamp / Capacitance (µF)	Rated operational current per lamp (A)			
Parallel correction				
L 18 W / 4.5	0.11	Units	22	
L 36 W / 4.5	0.21	Units	22	
L 58 W / 7	0.31	Units	14	
With solid-state ballast (single lamp)				
L 18 W / 6.8	0.10	Units	63	
L 36 W / 6.8	0.18	Units	35	
L 58 W / 10	0.27	Units	23	
With solid-state ballast (two lamps)				
L 18 W / 10	0.18	Units	35	
L 36 W / 10	0.35	Units	18	
L 58 W / 22	0.52	Units	12	
Utilization category AC-5b, switching incandescent lamps		kW	1.6	--
Per main current path at 230/220 V				
Utilization category AC-6a, switching AC transformers				
Rated operational current I_e				
• For inrush current n = 20	at 400 V	A	5.1	5.1
• For inrush current n = 30	at 400 V	A	3.3	3.3
Rated power P				
• For inrush current n = 20	up to 230/220 V	kVA	2.0	2.0
	400/380 V	kVA	3.5	3.5
	500 V	kVA	4.6	4.6
	690/660 V	kVA	6.0	--
• For inrush current n = 30	up to 230/220 V	kVA	1.3	1.3
	400/380 V	kVA	2.3	2.3
	500 V	kVA	3.1	3.1
	690/660 V	kVA	4.0	--
For deviating inrush current factors x, the power must be recalculated as follows: $P_x = P_{n\,30}$ x (30/x)				
Utilization category AC-6b, switching low-inductance (low-loss, metallized dielectric) AC capacitors			No switching capacity	
Utilization category AC-7a, switching low inductive loads in household appliances				
Rated operational current I_e (at 55 °C)	at 400/380 V	A	16	16
	690/660 V	A	16	--
Rated power at 50 and 60 Hz	at 230/220 V	kW	6	6
	400/380 V	kW	10	10
Minimum conductor cross-section for loads with I_e		mm^2	2.5	2.5
Utilization category AC-7b, switching motor loads in household appliances				
Rated operational current I_e	up to 220 V	A	9.0	9.0
	230 V	A	9.0	9.0
	380 V	A	9.0	9.0
	400 V	A	8.4	8.4
Rated power of motors at 50 and 60 Hz and	at 110 V	kW	1.2	1.2
	220 V	kW	2.4	2.4
	230 V	kW	2.5	2.5
	240 V	kW	2.6	2.6
	380 V	kW	4.0	4.0
	400 V	kW	4.0	4.0

3TK20 Contactors

4-pole, 4 kW

Contactors	Type			3TK20 ..-0...	3TK20 ..-3..., 3TK20 ..-6..., 3TK20 ..-7...
Size 00					
Main circuit					
Load rating with DC					
Utilization category DC-1 **Switching resistive loads** (contact endurance 0.1 x 106 operating cycles; $L/R \leq 1$ ms)					
Rated operational current I_e (at 55 °C)					
• 1 conducting path		up to 24 V	A	16	16
		60 V	A	6	6
		110 V	A	2	2
		220/240 V	A	1	1
• 2 conducting paths in series		up to 24 V	A	16	16
		60 V	A	16	16
		110 V	A	6	6
		220/240 V	A	2	2
• 3 conducting paths in series		up to 24 V	A	16	16
		60 V	A	16	16
		110 V	A	16	16
		220/240 V	A	6	6
Utilization category DC-3 and DC-5, shunt-wound and series-wound motors ($L/R \leq 15$ ms)					
Rated operational current I_e (at 55 °C)					
• 1 conducting path		up to 24 V	A	6	6
		60 V	A	3	3
		110 V	A	0.5	0.5
		220/240 V	A	0.1	0.1
• 2 conducting paths in series		up to 24 V	A	10	10
		60 V	A	5	5
		110 V	A	2	2
		220/240 V	A	0.5	0.5
• 3 conducting paths in series		up to 24 V	A	16	16
		60 V	A	16	16
		110 V	A	16	16
		220/240 V	A	2	2
Thermal load capacity		10 s current	A	70	
Power loss per conducting path		at I_e/AC-3	W	0.3	
Switching frequency					
Switching frequency *z* in operating cycles/hour					
• Contactors without overload relays	No-load switching frequency		h^{-1}	10000	
Dependence of the switching frequency z' on the operational current I' and operational voltage U': $z' = z \cdot (I_e/I') \cdot (400\ V/U')^{1.5} \cdot 1/h$	AC-1		h^{-1}	1000	
	AC-2		h^{-1}	500	
	AC-3		h^{-1}	1000	
• Contactors with overload relays (mean value)			h^{-1}	15	
Conductor cross-sections					
Screw terminals	**Main and auxiliary conductors**				
	Solid		mm^2	2 x (0.5 ... 2.5), 1 x 4 2 x (20 ... 14) AWG, 1 x 12 AWG	
	Finely stranded with end sleeve		mm^2	2 x (0.5 ... 1.5), 1 x 2.5	
	Pin-end connector (DIN 46231)		mm^2	1 x 1 ... 2.5	
	Terminal screw			M3	
Prescribed tightening torque for terminal screws			NM lb. in	0.8 ... 1.3 7 ... 11	
Flat connectors					
When using a plug-in sleeve	6.3 ... 1		mm^2	0.5 ... 1	
Finely stranded	6.3 ... 2.5		mm^2	1 ... 2.5	
Solder pin connection				Only for printed circuit boards	

3TK20 Contactors

4-pole, 4 kW

Contactors	Type			3TK20 ..-0...	3TK20 ..-3..., 3TK20 ..-6..., 3TK20 ..-7...
Size 00					
cULus and CSA rated data of the 3TK20 contactors					
Rated insulation voltage U_i			V AC	600	300
Uninterrupted current	Open and enclosed		A	16	16 (10 for solder pin connection)
Maximum horsepower ratings (cULus and CSA approved values)					
Rated power for induction motors at 60 Hz					
1-phase		at 115 V	hp	0.5	--
		200 V	hp	1	1
		230 V	hp	1.5	1
		460/575 V	hp	--	--
3-phase		at 115 V	hp	--	--
		200 V	hp	3	3 (1 for 3TK20 . .-6)
		230 V	hp	3	3 (1 for 3TK20 . .-6)
		460/575 V	hp	5	--
Overload relay	Type/Setting range			3UA7/EB 8 ... 10 A	

Contactors	Type			3TK20
Size 00				
Rated data of the auxiliary contacts according to IEC 60947-5-1/ DIN VDE 0660 Part 200				
Rated insulation voltage U_i (degree of pollution 3)			V	690
Continuous thermal current I_{th} = Rated operational current I_e/AC-12			A	10
AC load Rated operational current I_e/AC-15/AC-14				
for rated operational voltage U_e		24 V	A	4
		110 V	A	4
		125 V	A	4
		220 V	A	4
		230 V	A	4
		380 V	A	3
		400 V	A	3
		500 V	A	2
		660 V	A	1
		690 V	A	1
DC load Rated operational current I_e/DC-12				
for rated operational voltage U_e		24 V	A	4
		48 V	A	2.2
		110 V	A	1.1
		125 V	A	1.1
		220 V	A	0.5
		440 V	A	--
		600 V	A	--
Rated operational current I_e/DC-13				
for rated operational voltage U_e		24 V	A	2.1
		48 V	A	1.1
		110 V	A	0.52
		125 V	A	0.52
		220 V	A	0.27
		440 V	A	--
		600 V	A	--
cULus, CSA and UL rated data of the auxiliary contacts				
Rated voltage, max.			V AC	600
Auxiliary switch blocks, max.			V AC	300
Switching capacity				A 600, Q 300
Uninterrupted current at 240 V AC			A	10