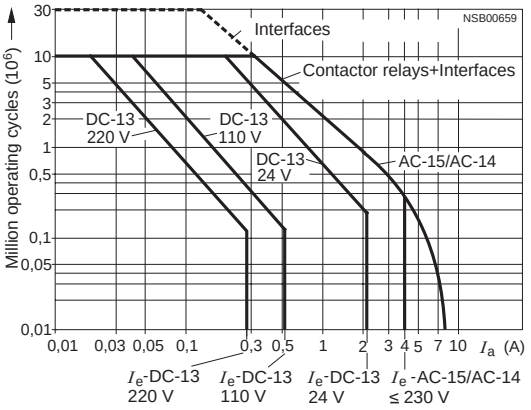
Technical specifications

Contactor	Type	3TF2

Endurance of the auxiliary contacts

The contact endurance for utilization category AC-12 or AC-15/AC-14 depends mainly on the breaking current. It is assumed that the operating mechanisms are switched randomly, i.e. not synchronized with the phase angle of the supply system.
Legend:
I_a = Breaking current
I_e = Rated operational current



Endurance of the main contacts

3TF2

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. 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

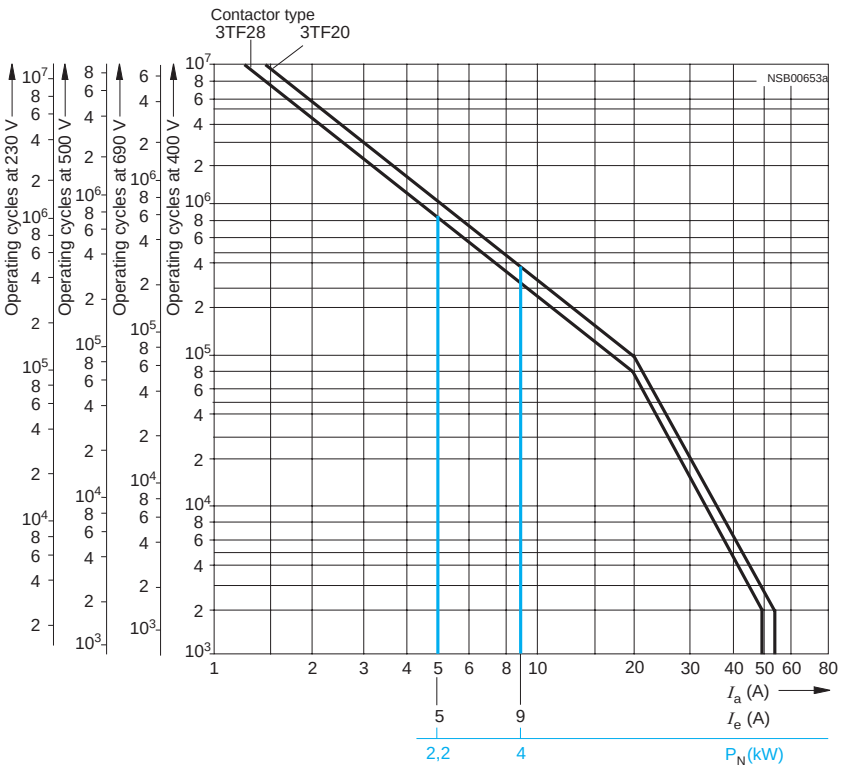


Diagram legend:
P_N= Rated power for squirrel-cage motors at 400 V
I_a= Breaking current
I_e= Rated operational current

3TF2 contactors, 3-pole, 2.2 ... 4 kW

Contactor	Type		3TF20/3TF28	3TF22/3TF29
General data				
Permissible mounting positions	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 terminals		V	690	690[1]
• Flat connector 6.3 mm x 0.8 mm		V	500	--
• Solder pin connections		V	500	--
Rated impulse withstand voltage U_{imp} (degree of pollution 3)				
• Screw terminals		kV	8	8[2]
• Flat connector 6.3 mm x 0.8 mm		kV	6	--
• Solder pin connections		kV	6	--
Safe isolation between coil and main contacts (acc. to DIN VDE 0106 Part 101 and A1 [draft 2/89])		V	Up to 300	
Mirror contacts A mirror contact is an auxiliary NC contact that cannot be closed simultaneously with a NO main contact.			Yes, this applies to both the basic unit as well as to between the basic unit and the mounted auxiliary switch block acc. to EN 60947-4-1, Appendix F	Yes, acc. to EN 60947-4-1 Appendix F SUVA
Permissible ambient temperature[3]	During operation During storage	°C °C	-25 ... +55 -55 ... +80	
Degree of protection acc. to EN 60947-1 Appendix C			IP00 open IP20 for screw terminal IP40 coil assembly	
Touch protection acc. to EN 50274			Finger-safe for screw terminal	
Shock resistance				
Without 3TX44 auxiliary switch block				
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	-- --
With 3TX44 auxiliary switch block				
Rectangular pulse	AC operation DC operation	g/ms g/ms	5/5 and 3.6/10 9/5 and 6.9/10	5/5 and 3.6/10 9/5 and 7.3/10
Sine pulse	AC operation DC operation	g/ms g/ms	7.8/5 and 5.6/10 13.9/5 and 10.1/10	7.8/5 and 5.6/10 14/5 and 11/10
Conductor cross-sections			[4]	
Short-circuit protection for contactors without overload relays				
Main circuit[5]				
• Fuse links gL/gG LV HRC 3NA, DIAZED 5SB, NEOZED 5SE				
- acc. to IEC 60947-4-1 (VDE 0660, Part 102)	Type of coordination "1" Type of coordination "2"[6] 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) Auxiliary contacts 500 V.

2) Auxiliary contacts 6 kV.

3) 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.

4) See conductor cross-sections.

5) According to excerpt from IEC 60947-4-1 (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.

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

3TF2 contactors, 3-pole, 2.2 ... 4 kW

Contactor	Type		3TF2
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 3TF2 AC-operated contactor in reversing 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 3TF2 AC-operated contactor in reversing 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 Accessories and Spare Parts).

[3] The OFF-delay of the NO contact and the ON-delay of the NC contact are increased if the contactor coils are attenuated against voltage peaks (noise suppression diode 6 to 10 times; diode assemblies 2 to 6 times, varistor +2 to 5 ms).

3TF2 contactors, 3-pole, 2.2 ... 4 kW

Contactor	Type			3TF28 3TF29	3TF20 ..-0..., 3TF22 ..-0...	3TF20 ..-3..., 3TF20 ..-6..., 3TF20 ..-7...
	Size			S00	S00	S00
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	18
	690/660 V	A		18	18	--
Rated operational current I_e (at 55 °C)	400/380 V	A		16	16	16
	690/660 V	A		16	16	--
Rated power of AC loads P.f. = 1	at 230/220 V	kW		6.0	6.0	6.0
	400/380 V	kW		10	10	10
	500 V	kW		13	13	13
	690/660 V	kW		17	17	--
Minimum conductor cross-section for loads with I_e		mm^2		2.5	2.5	2.5
Utilization category AC-2 and AC-3						
Rated operational current I_e	up to 220 V	A		5.1	9.0	9.0
	230 V	A		5.1	9.0	9.0
	380 V	A		5.1	9.0	9.0
	400 V	A		5.1	8.4	8.4
	500 V	A		4.8	6.5	6.5
	660 V	A		4.8	5.2	--
	690 V	A		4.8	5.2	--
Rated power for motors with slipring or squirrel cage at 50 and 60 Hz and	at 110 V	kW		0.7	1.2	1.2
	115 V	kW		0.7	1.2	1.2
	120 V	kW		0.7	1.3	1.3
	127 V	kW		0.8	1.4	1.4
	200 V	kW		1.2	2.2	2.2
	220 V	kW		1.3	2.4	2.4
	230 V	kW		1.4	2.5	2.5
	240 V	kW		1.5	2.6	2.6
	380 V	kW		2.2	4.0	4.0
	400 V	kW		2.2	4.0	4.0
	415 V	kW		2.5	4.0	4.0
	440 V	kW		2.5	4.0	4.0
	460 V	kW		2.7	4.0	4.0
	500 V	kW		2.9	4.0	4.0
	575 V	kW		3.2	4.0	--
	660 V	kW		3.8	4.0	--
	690 V	kW		4.0	4.0	--
Utilization category AC-4						
(contact endurance approx. 200 000 operating cycles at I_a = 6 x I_e)						
Rated operational current I_e	up to 400 V	A		1.9	2.6	2.6
	690 V	A		1.4	1.8	--
Rated power for motors with squirrel cage at 50 and 60 Hz and	at 110 V	kW		0.23	0.32	0.32
	115 V	kW		0.24	0.33	0.33
	120 V	kW		0.26	0.35	0.35
Max. permissible rated operational current I_e/AC-4 ≙ I_e/AC-3 up to 500 V, for reduced contact endurance and reduced switching frequency	127 V	kW		0.27	0.37	0.37
	200 V	kW		0.42	0.58	0.58
	220 V	kW		0.47	0.64	0.64
	230 V	kW		0.49	0.67	0.67
	240 V	kW		0.51	0.70	0.70
	380 V	kW		0.81	1.10	1.10
	400 V	kW		0.85	1.15	1.15
	415 V	kW		0.93	1.20	1.20
	440 V	kW		1.0	1.27	1.27
	460 V	kW		1.0	1.33	1.33
	500 V	kW		1.1	1.45	1.45
	575 V	kW		1.0	1.30	--
	660 V	kW		0.86	1.10	--
	690 V	kW		0.89	1.15	--

3TF2 contactors, 3-pole, 2.2 ... 4 kW

Contactor	Type			3TF28 3TF29	3TF20 ..-0..., 3TF22 ..-0...	3TF20 ..-3..., 3TF20 ..-6..., 3TF20 ..-7...
	Size			S00	S00	S00
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** Per main current path at 230/220 V			kW	1.6		--
Utilization category AC-6a, **switching AC transformers**						
Rated operational current I_e						
• For inrush current n = 20		at 400 V	A	2.9	5.1	5.1
• For inrush current n = 30		at 400 V	A	1.9	3.3	3.3
Rated power *P*						
• For inrush current n = 20		up to 230/220 V	kVA	1.14	2.0	2.0
		400/380 V	kVA	2	3.5	3.5
		500 V	kVA	4.1	4.6	4.6
		690/660 V	kVA	5.4	6.0	--
• For inrush current n = 30		up to 230/220 V	kVA	0.74	1.3	1.3
		400/380 V	kVA	1.3	2.3	2.3
		500 V	kVA	2.8	3.1	3.1
		690/660 V	kVA	3.6	4.0	--
For deviating inrush current factors x, the power must be recalculated as follows: $P_x = P_{n30} \times (30/x)$						
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	16
		690/660 V	A	16	16	--
Rated power at 50 and 60 Hz		at 230/220 V	kW	6	6	6
		400/380 V	kW	10	10	10
Minimum conductor cross-section for loads with I_e			mm^2	2.5	2.5	2.5
Utilization category AC-7b **Switching motor loads in household appliances**						
Rated operational current I_e		up to 220 V	A	5.1	9.0	9.0
		230 V	A	5.1	9.0	9.0
		380 V	A	5.1	9.0	9.0
		400 V	A	5.1	8.4	8.4
Rated power of motors at 50 and 60 Hz and		at 110 V	kW	0.68	1.2	1.2
		220 V	kW	1.3	2.4	2.4
		230 V	kW	1.4	2.5	2.5
		240 V	kW	1.5	2.6	2.6
		380 V	kW	2.2	4.0	4.0
		400 V	kW	2.4	4.0	4.0

3TF2 contactors, 3-pole, 2.2 ... 4 kW

Contactor	Type			3TF28 3TF29	3TF20 ..-0..., 3TF22 ..-0...	3TF20 ..-3..., 3TF20 ..-6..., 3TF20 ..-7...
	Size			S00	S00	S00
Main circuit						
DC capacity						
Utilization category DC-1 **Switching resistive loads** (contact endurance 0.1 x 10^6 operating cycles; $L/R \leq 1$ ms)						
Rated operational current I_e (at 55 °C)						
• 1 conducting path		up to 24 V	A	10	16	16
		60 V	A	4	6	6
		110 V	A	1.5	2	2
		220/240 V	A	0.6	1	1
• 2 conducting paths in series		up to 24 V	A	10	16	16
		60 V	A	10	16	16
		110 V	A	4	6	6
		220/240 V	A	1.5	2	2
• 3 conducting paths in series		up to 24 V	A	10	16	16
		60 V	A	10	16	16
		110 V	A	10	16	16
		220/240 V	A	4	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	4	6	6
		60 V	A	1.8	3	3
		110 V	A	0.3	0.5	0.5
		220/240 V	A	--	0.1	0.1
• 2 conducting paths in series		up to 24 V	A	6	10	10
		60 V	A	3	5	5
		110 V	A	1.5	2	2
		220/240 V	A	0.3	0.5	0.5
• 3 conducting paths in series		up to 24 V	A	10	16	16
		60 V	A	10	16	16
		110 V	A	10	16	16
		220/240 V	A	1.5	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': $z' = z \times (I_e/I') \times (400\ V/U')^{1.5}$ 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**			**Screw terminals**		
	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	0.8 ... 1.3 (7 ... 11lb.in)		
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 connections				Only for printed circuit boards		

3TF2 contactors, 3-pole, 2.2 ... 4 kW

Contactor	Type			3TF20 ..-0...	3TF20 ..-3..., 3TF20 ..-6..., 3TF20 ..-7...
	Size			S00	S00
cULus and cULus rated data of the 3TF20 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 cULus 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 3TF20 ..-6)
	230 V		hp	3	3 (1 for 3TF20 ..-6)
	460/575 V		hp	5	--
Overload relays	Type/ Setting range			3UA7/EB 8 ... 10 A	

Contactor	Type Size			3TF2
Rated data of the auxiliary contacts acc. to IEC 60947-5-1 (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, cULus and CSA 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