

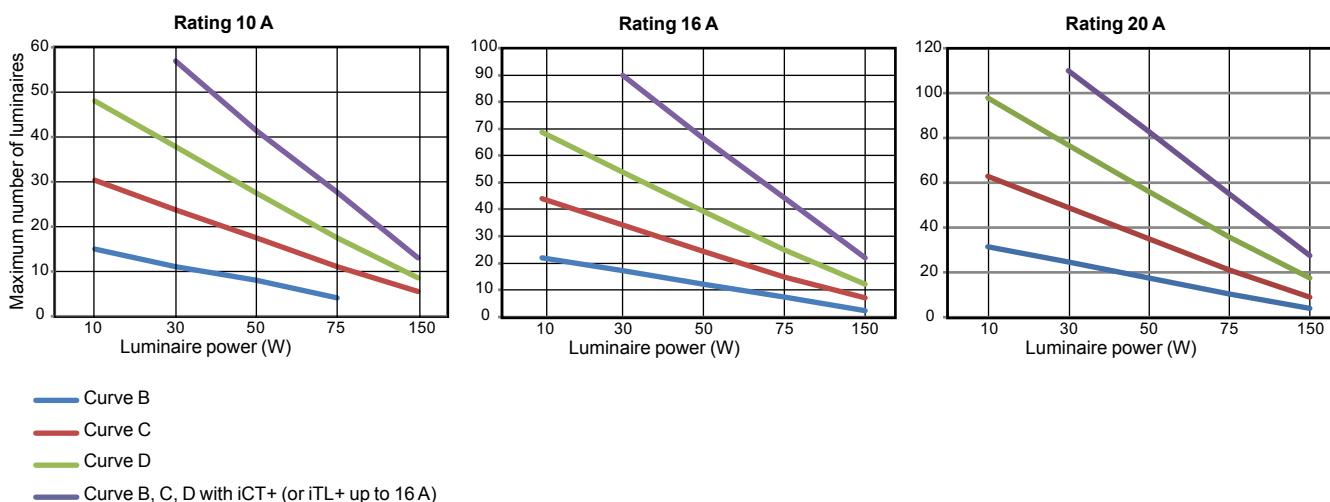
Coordination of switchgear with loads

Circuit breakers

Use of circuit breakers

The new lighting technologies with electronic interfaces (ballasts, drivers) cause a high transient inrush current at power up that can trip the circuit breaker. These phenomena are particularly increased with LED lighting.

Coordination curves between the number of LED luminaires and the circuit breaker rating:



Maximum number of luminaires depending on the circuit breaker rating and curve

Unit power of the luminaire (W)	Circuit breaker rating	10 A				16 A				20 A			
		Curve B	C	D	B, C, D with iCT+ or iTL+	B	C	D	B, C, D with iCT+ or iTL+	B	C	D	B, C, D with iCT+
10		15	30	48	-	22	44	69	-	32	63	98	-
30		11	24	38	57	17	34	54	90	25	49	77	110
50		8	17	27	41	12	25	39	66	18	35	56	83
75		4	11	17	28	7	15	25	44	11	21	36	55
150		-	5	9	13	2	7	12	22	4	9	18	28

According to the control device used, the transient current surge may:

- require the circuit breaker to be derated according to the number of luminaires / circuit breaker rating coordination curves, when using standard control devices: CT, TL (electromechanical control device),
- be reduced by the use of the following technologies:
 - softStart: using a command integrated in the driver or a dimmer switch,
 - controlled contactor (iTL+, iCT+) (closes when the voltage passes through "0", derating is related to the Cos phi of the lighting circuit).

These technologies allow circuit breakers without derating related to the technology of the lamps to be used.

Example:

Circuit rated power = 230 V AC x Circuit breaker rating x Cos phi.

General comment

Modular contactors and impulse relays do not use the same technologies. Their rating is determined according to different standards and does not correspond to the rated current of the circuit. For example, for a given rating, an impulse relay is more efficient than a modular contactor for the control of light fittings with a strong inrush current, or with a low power factor (non-compensated inductive circuit).

Relay rating

■ The table below shows the maximum number of light fittings for each relay, according to the type, power and configuration of a given lamp. As an indication, the total acceptable power is also mentioned.

■ These values are given for a 230 V circuit with 2 active conductors (single-phase phase/neutral or two-phase phase/phase). For 110 V circuits, divide the values in the table by 2.

■ To obtain the equivalent values for the entire 230 V three-phase circuit, multiply the number of lamps and the maximum power output:

□ by $\sqrt{3}$ (1.73) for circuits with 230 V between phases without neutral;

□ by $\sqrt{3}$ for circuits with 230 V between phase and neutral or 400 V between phases.

Note: The power ratings of the lamps most commonly used are shown in bold.

For powers not mentioned, use a proportional rule with the nearest values.

Choice table

Products			iCT contactors						iCT+ contactors		
Type of lamp			Maximum number of light fittings for a single-phase circuit and maximum power output per circuit								
			16 A		25 A		40 A		63 A		20 A
Basic incandescent lamps, LV halogen lamps, replacement mercury vapour lamps (without ballast)											
	40 W	38	1550 W	57	2300 W	115	4600 W	172	6900 W	4660 W x Cos phi	
	60 W	30	to	45	to	85	to	125	to		
	75 W	25	2000 W	38	2850 W	70	5250 W	100	7500 W		
	100 W	19		28		50		73			
ELV 12 or 24 V halogen lamps											
With ferromagnetic transformer	20 W	15	300 W	23	450 W	42	850 W	63	1250 W		
	50 W	10	to	15	to	27	to	42	to		
	75 W	8	600 W	12	900 W	23	1950 W	35	2850 W		
	100 W	6		8		18		27			
With electronic transformer	20 W	62	1250 W	90	1850 W	182	3650 W	275	5500 W		
	50 W	25	to	39	to	76	to	114	to		
	75 W	20	1600 W	28	2250 W	53	4200 W	78	6000 W		
	100 W	16		22		42		60			
Fluorescent tubes with starter and ferromagnetic ballast											
1 tube without compensation ⁽¹⁾	15 W	22	330 W	30	450 W	70	1050 W	100	1500 W		
	18 W	22	to	30	to	70	to	100	to		
	20 W	22	850 W	30	1200 W	70	2400 W	100	3850 W		
	36 W	20		28		60		90			
	40 W	20		28		60		90			
	58 W	13		17		35		56			
	65 W	13		17		35		56			
	80 W	10		15		30		48			
	115 W	7		10		20		32			
1 tube with parallel compensation ⁽²⁾	15 W	5 µF	200 W	20	300 W	40	600 W	60	900 W		
	18 W	5 µF	to	20	to	40	to	60	to		
	20 W	5 µF	800 W	20	1200 W	40	2400 W	60	3500 W		
	36 W	5 µF		20		40		60			
	40 W	5 µF		20		40		60			
	58 W	7 µF		15		30		43			
	65 W	7 µF		15		30		43			
	80 W	7 µF		15		30		43			
	115 W	16 µF		7		14		20			
2 or 4 tubes with series compensation	2 x 18 W	30	1100 W	46	1650 W	80	2900 W	123	4450 W		
	4 x 18 W	16	to	24	to	44	to	68	to		
	2 x 36 W	16	1500 W	24	2400 W	44	3800 W	68	5900 W		
	2 x 58 W	10		16		27		42			
	2 x 65 W	10		16		27		42			
	2 x 80 W	9		13		22		34			
	2 x 115 W	6		10		16		25			
Fluorescent tubes with electronic ballast											
1 or 2 tubes	18 W	74	1300 W	111	2000 W	222	4000 W	333	6000 W		
	36 W	38	to	58	to	117	to	176	to		
	58 W	25	1400 W	37	2200 W	74	4400 W	111	6600 W		
	2 x 18 W	36		55		111		166			
	2 x 36 W	20		30		60		90			
	2 x 58 W	12		19		38		57			

4660 W x
Cos phi

iTL impulse relays				iTL+ impulse relays	Reflex iC60 (C curve)											
Maximum number of light fittings for a single-phase circuit and maximum power output per circuit																
16 A		32 A		16 A	10 A	16 A		25 A		40 A		63 A				
	40	1500 W	106	4000 W	3680 W x Cos phi	28	1120 W	46	1840 W	70	2800 W	140	5600 W	207	8280 W	
	25	to	66	to		23	to	36	to	55	to	103	to	152	to	
	20	1600 W	53	4200 W		29	2175 W	31	2600 W	46	3600 W	80	6800 W	121	9800 W	
	16		42			15		23		33		60		88		
	70	1350 W	180	3600 W			11	220 W	19	380 W	27	540 W	50	1000 W	75	1500 W
	28	to	74	to			8	to	12	to	19	to	33	to	51	to
	19	1450 W	50	3750 W			7	500 W	10	800 W	14	1050 W	27	2200 W	43	3300 W
	14		37				5		8		10		22		33	
	60	1200 W	160	3200 W			47	940 W	74	1480 W	108	2160 W	220	4400 W	333	6660 W
	25	to	65	to			19	to	31	to	47	to	92	to	137	to
	18	1400 W	44	3350 W			15	1200 W	24	2000 W	34	2600 W	64	5100 W	94	7300 W
	14		33				12		20		26		51		73	
	83	1250 W	213	3200 W		16	244 W	26	390 W	37	555 W	85	1275 W	121	1815 W	
	70	to	186	to		16	to	26	to	37	to	85	to	121	to	
	62	1300 W	160	3350 W		16	647 W	26	1035 W	37	1520 W	85	2880 W	121	4640 W	
	35		93			15		24		34		72		108		
	31		81			15		24		34		72		108		
	21		55			9		15		21		43		68		
	20		50			9		15		21		43		68		
	16		41			8		12		19		36		58		
	11		29			6		9		12		24		38		
	60	900 W	160	2400 W		11	165 W	19	285 W	24	360 W	48	720 W	72	1080 W	
	50		133			11	to	19	to	24	to	48	to	72	to	
	45		120			11	640 W	19	960 W	24	1520 W	48	2880 W	72	4080 W	
	25		66			11		19		24		48		72		
	22		60			11		19		24		48		72		
	16		42			8		12		19		36		51		
	13		37			8		12		19		36		51		
	11		30			8		12		19		36		51		
	7		20			4		7		9		17		24		
	56	2000 W	148	5300 W		23	828 W	36	1296 W	56	2016 W	96	3456 W	148	5328 W	
	28		74			12	to	20	to	29	to	52	to	82	to	
	28		74			12	1150 W	20	1840 W	29	2760 W	52	4600 W	82	7130 W	
	17		45			8		12		20		33		51		
	15		40			8		12		20		33		51		
	12		33			7		11		15		26		41		
	8		23			5		8		12		20		31		
	80	1450 W	212	3800 W		56	1008 W	90	1620 W	134	2412 W	268	4824 W	402	7236 W	
	40	to	106	to		28	to	46	to	70	to	142	to	213	to	
	26	1550 W	69	4000 W		19	1152 W	31	1798 W	45	2668 W	90	5336 W	134	8120 W	
	40		106			27		44		67		134		201		
	20		53			16		24		37		72		108		
	13		34			9		15		23		46		70		

Coordination of switchgear with loads

iCT, iCT+, iTL, iTL+, Reflex iC60

Choice table (cont.)

Products			iCT contactors							iCT+ contactors						
Type of lamp			Maximum number of light fittings for a single-phase circuit and maximum power output per circuit													
			16 A		25 A		40 A		63 A		20 A					
Compact fluorescent lamps																
With external electronic ballast	5 W	210	1050 W to 1300 W	330	1650 W to 2000 W	670	3350 W to 4000 W		Non testé	4660 W x Cos phi						
	7 W	150		222		478										
	9 W	122		194		383										
	11 W	104		163		327										
	18 W	66		105		216										
	26 W	50		76		153										
With integral electronic ballast (replacement for incandescent lamps)	5 W	160	800 W to 900 W	230	1150 W to 1300 W	470	2350 W to 2600 W	710	3550 W to 3950 W							
	7 W	114		164		335		514								
	9 W	94		133		266		411								
	11 W	78		109		222		340								
	18 W	48		69		138		213								
	26 W	34		50		100		151								
LED lamps																
With driver	10 W	48	500 W to 1400 W	69	700 W to 1950 W	98	1000 W to 3000 W	200	2000 W to 6200 W							
	30 W	38		54		77		157								
	50 W	27		39		56		114								
	75 W	17		25		36		73								
	150 W	9		12		18		37								
	200 W	7		9		15		31								
Low-pressure sodium vapour lamps with ferromagnetic ballast with external ignitor																
Without compensation ⁽¹⁾	35 W	5	270 W to 360 W	9	320 W to 720 W	14	500 W to 1100 W	24	850 W to 1800 W							
	55 W	5		9		14		24								
	90 W	3		6		9		19								
	135 W	2		4		6		10								
	180 W	2		4		6		10								
With parallel compensation ⁽²⁾	35 W	20 µF	100 W to 180 W	5	175 W to 360 W	10	350 W to 720 W	15	550 W to 1100 W							
	55 W	20 µF		5		10		15								
	90 W	26 µF		4		8		11								
	135 W	40 µF		2		5		7								
	180 W	45 µF		2		4		6								
High-pressure sodium vapour lamps																
Metal-iodide lamps																
With ferromagnetic ballast with external ignitor, without compensation ⁽¹⁾	35 W	16	600 W	24	850 W to 1200 W	42	1450 W to 2000 W	64	2250 W to 3200 W							
	70 W	8		12		20		32								
	150 W	4		7		13		18								
	250 W	2		4		8		11								
	400 W	1		3		5		8								
1000 W	0	1	2	3												
With ferromagnetic ballast with external ignitor and parallel compensation ⁽²⁾	35 W	6 µF	450 W to 1000 W	18	650 W to 2000 W	31	1100 W to 4000 W	50	1750 W to 6000 W							
	70 W	12 µF		9		16		25								
	150 W	20 µF		6		10		15								
	250 W	32 µF		4		7		10								
	400 W	45 µF		3		5		7								
	1000 W	60 µF		2		3		5								
	2000 W	85 µF		1		2		3								
With electronic ballast	35 W	24	850 W to 1350 W	38	1350 W to 2200 W	68	2400 W to 4000 W	102	3600 W to 600 W							
	70 W	18		29		51		76								
	150 W	9		14		26		40								

⁽¹⁾ Circuits with non-compensated ferromagnetic ballasts consume twice as much current for a given lamp power output. This explains the small number of lamps in this configuration.

⁽²⁾ The total capacitance of the power factor correction capacitors in parallel in a circuit limits the number of lamps that can be controlled by a contactor. The total downstream capacitance of a modular contactor of rating 16, 25, 40 or 63 A should not exceed 75, 100, 200 or 300 µF respectively. Allow for these limits to calculate the maximum acceptable number of lamps if the capacitance values are different from those in the table.

iTL impulse relays				iTL+ impulse relays	Reflex iC60 (C curve)										
Maximum number of light fittings for a single-phase circuit and maximum power output per circuit															
16 A		32 A		16 A	10 A	16 A	25 A	40 A	63 A						
	240 171 138 118 77 55	1200 W to 1450 W	630 457 366 318 202 146	3150 W to 3800 W	3680 W x Cos phi	158 113 92 79 49 37	790 W to 962 W	251 181 147 125 80 60	1255 W to 1560 W	399 268 234 196 127 92	1995 W to 2392 W	810 578 463 396 261 181	4050 W to 4706 W	Usage peu fréquent	
	170 121 100 86 55 40	850 W to 1050 W	390 285 233 200 127 92	1950 W to 2400 W		121 85 71 59 36 25	605 W to 650 W	193 137 113 94 58 40	959 W to 1044 W	278 198 160 132 83 60	1390 W to 1560 W	568 405 322 268 167 121	2840 W to 3146 W	859 621 497 411 257 182	4295 W to 4732 W
	69 54 39 25 12 9	700 W to 1950 W	98 77 56 36 18 15	1000 W to 3000 W		30 24 17 11 5 -	300 W to 850 W	44 34 25 15 7 6	450 W to 1250 W	71 55 40 24 11 10	700 W to 2000 W	108 83 61 37 17 15	1050 W to 3050 W	146 113 83 50 23 20	1450 W to 4150 W
	Non testé, utilisation peu fréquente					4 4 3 2 1	153 W to 253 W	7 7 4 3 2	245 W to 405 W	11 11 8 5 4	385 W to 792 W	17 17 11 8 7	595 W to 1198 W	29 29 23 12 10	1015 W to 2070 W
	38 24 15 10 7	1350 W	102 63 40 26 18	3600 W		3 3 2 1 0	88 W to 169 W	4 4 3 2 1	140 W to 270 W	7 7 5 3 2	245 W to 450 W	12 12 8 5 4	420 W to 720 W	19 19 13 9 8	665 W to 1440 W
	Non testé, utilisation peu fréquente					12 7 3 2 0 0	416 W to 481 W	19 11 5 3 1 0	400 W to 750 W	28 15 9 5 3 1	980 W to 1350 W	50 24 15 10 6 2	1750 W to 2500 W	77 38 22 13 10 3	2695 W to 4000 W
	34 17 8 5 3 1 0	1200 W to 1350 W	88 45 22 13 8 3 1	3100 W to 3400 W		14 8 5 3 2 0 0	490 W to 800 W	17 9 6 4 3 1 0	595 W to 1200 W	26 13 9 5 4 2 1	910 W to 2200 W	43 23 14 10 7 4 2	1505 W to 4400 W	70 35 21 14 9 7 3	2450 W to 7000 W
	38 29 14	1350 W to 2200 W	87 77 33	3100 W to 5000 W		15 11 6	525 W to 844 W	24 18 9	840 W to 1350 W	38 29 14	1330 W to 2100 W	82 61 31	2870 W to 4650 W	123 92 48	4305 W to 7200 W

Note: **Reflex iC60**

High-pressure sodium vapour lamp with electronic ballast

For the 10 A and 16 A B-curve ratings, the number of lamps should be reduced by 10 % to limit unwanted magnetic tripping.

LED lamp

B-curve ratings, the number of lamps should be reduced by 50 %.

D-curve ratings, the number of lamps should be increased by 50 %.

Coordination of switchgear with loads

iTL, iCT

Heating application

■ Impulse relay rating to be chosen according to the power to be controlled.

230 V heating		
Type	Maximum power for a given rating iTL impulse relays	
Single-phase circuit	16 A	32 A
Heating (AC1)	3.6 kW	7.2 kW

■ Contactor rating to be chosen according to the power to be controlled and the number of operations a day.

230 V heating				
Type of heating application	Maximum power for a given rating iCT contactors			
Number of operations / day	25 A	40 A	63 A	100 A
25	5.4 kW	8.6 kW	14 kW	21.6 kW
50	5.4 kW	8.6 kW	14 kW	21.6 kW
75	4.6 kW	7.4 kW	12 kW	18 kW
100	4 kW	6 kW	9.5 kW	14 kW
250	2.5 kW	3.8 kW	6 kW	9 kW
500	1.7 kW	2.7 kW	4.5 kW	6.8 kW

400 V heating				
25	16 kW	26 kW	41 kW	63 kW
50	16 kW	26 kW	41 kW	63 kW
75	14 kW	22 kW	35 kW	52 kW
100	11 kW	17 kW	26 kW	40 kW
250	5 kW	8 kW	13 kW	19 kW
500	3.5 kW	6 kW	9 kW	14 kW

Small motor application

Contactor rating to be chosen according to the power to be controlled.

Asynchronous single-phase motor with capacitor			
Small motor application type	Maximum power for a given rating iCT contactors		
Voltage	25 A	40 A	63 A
230 V	1.4	2.5	4

Asynchronous three-phase motor			
400 V	4	7.5	15

Universal motor			
230 V	0.9	1.4	2.2



2.1	11/06/2014	Add iCT+, iTL+, Reflex iC60, LED	Sedoc
2.0	23/05/2011	InDesign CS5	Sedoc
1.0	22/11/2010	Creation	Sedoc
Indice	Date	Modification	Name