

Why does my contactor overheat ?

I- Type of publication

☐	Typical application
☐	Best know Method (BKM)
☒	Troubleshooting guide

☐	Level 2 use
☐	Internal use
☒	Customer

II- Product

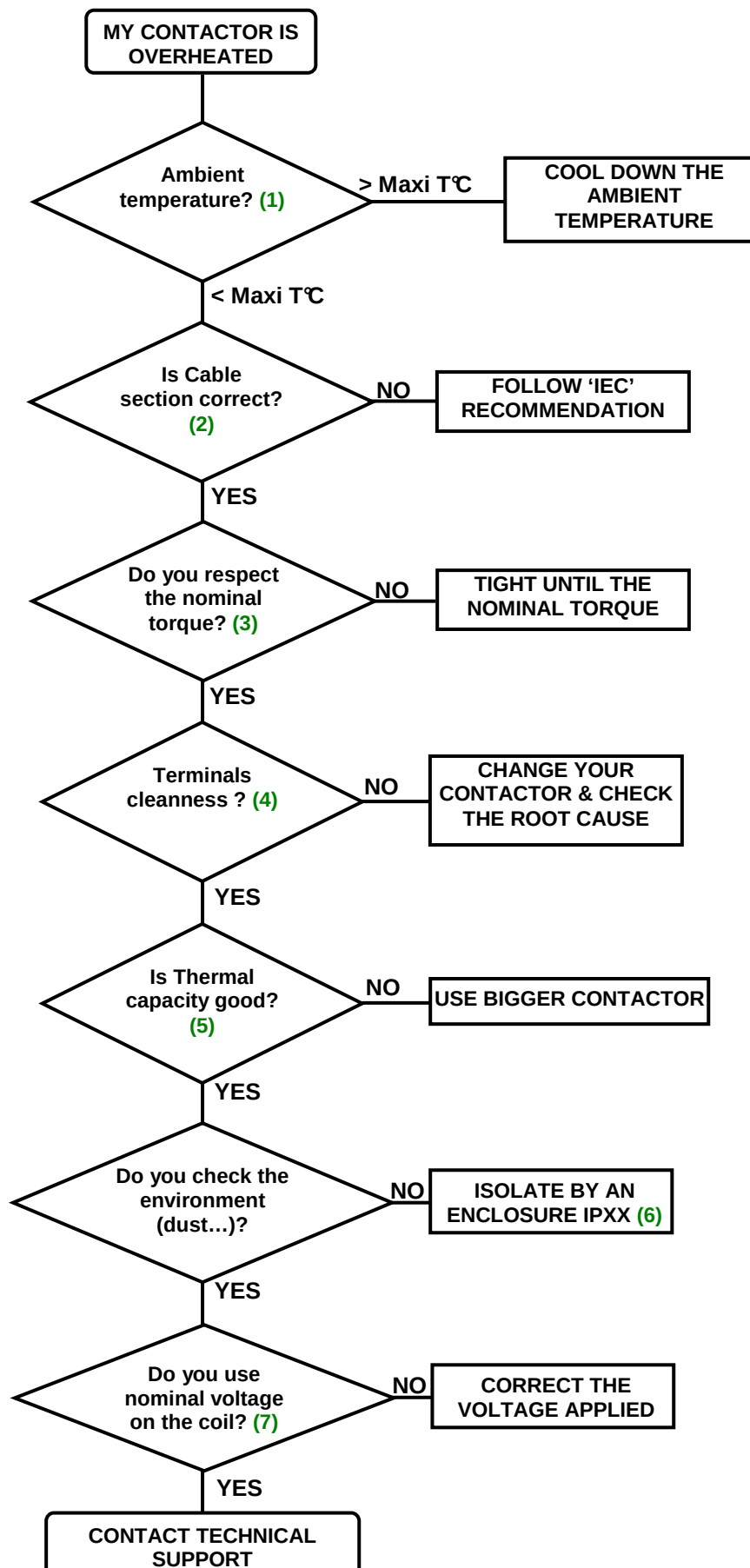
- Product range :

- Product family :

III- Introduction

Use this troubleshooting guide in this case: contactor is overheated. The flow chart will describe you different possible root cause for this behaviour in order to understand why the contactor is overheated into your application.

IV- Description



(1) Ambient Temperature

The IEC standard 60947 defines temperature raise regarding the ambient temperature. The maximum ambient temperatures allowed for our contactors are:

For K range + 50°C

For D range + 60°C

For F range + 55°C

For Bar contactor (LC1B** or CV1/3*) + 55°C

In case the contactor is overheating, you will have to sum the ambient temperature and the temperature raise allowed (See table below for temperature raise allowed on our contactor).

Example for terminals connections:

Ambient temperature: + 35°C

Terminals temperature raise allowed + 65

=> If your terminal temperature is less than 35 + 65 = 100°C your contactor is not overheating.

Table 2 – Temperature-rise limits of terminals
(see 7.2.2.1 and 8.3.3.3.4)

Terminal material	Temperature-rise limits ^{1) 3)} K
Bare copper	60
Bare brass	65
Tin plated copper or brass	65
Silver plated or nickel plated copper or brass	70
Other metals	²⁾
¹⁾ The use in service of connected conductors significantly smaller than those listed in Tables 9 and 10 could result in higher terminals and internal part temperatures and such conductors should not be used without the manufacturer's consent since higher temperatures could lead to equipment failure. ²⁾ Temperature-rise limits to be based on service experience or life tests but not to exceed 65 K. ³⁾ Different values may be prescribed by product standards for different test conditions and for devices of small dimensions, but not exceeding by more than 10 K the values of this table.	

60947-1 © IEC:2004

– 195 –

Table 3 – Temperature-rise limits of accessible parts
(see 7.2.2.2 and 8.3.3.3.4)

Accessible parts	Temperature-rise limits ¹⁾ K
Manual operating means:	
Metallic	15
Non-metallic	25
Parts intended to be touched but not hand-held:	
Metallic	30
Non-metallic	40
Parts which need not be touched during normal operation²⁾:	
Exteriors of enclosures adjacent to cable entries:	40
Metallic	50
Non-metallic	200 ²⁾
Exterior of enclosures for resistors	
Air issuing from ventilation openings of enclosures for resistors	200 ²⁾
¹⁾ Different values may be prescribed by product standards for different test conditions and for devices of small dimensions but not exceeding by more than 10 K the values of this table. ²⁾ The equipment shall be protected against contact with combustible materials or accidental contact with personnel. The limit of 200 K may be exceeded if so stated by the manufacturer. Guarding and location to prevent danger is the responsibility of the installer. The manufacturer shall provide appropriate information, in accordance with 5.3.	

(2) Cable Section

An incorrect cable section choice in regards of current level creates cable overheating. The consequence is contactor overheated.

You can find recommendation regarding IEC standard for cable section regarding current level.

60947-1 © IEC:2004

– 203 –

Table 9 – Test copper conductors for test currents up to 400 A inclusive*
(see 8.3.3.3.4)

Range of test current ¹⁾		Conductor size ^{2), 3), 4)}	
A		mm ²	AWG/kcmil
0	8	1,0	18
8	12	1,5	16
12	15	2,5	14
15	20	2,5	12
20	25	4,0	10
25	32	6,0	10
32	50	10	8
50	65	16	6
65	85	25	4
85	100	35	3
100	115	35	2
115	130	50	1
130	150	50	0
150	175	70	00
175	200	95	000
200	225	95	0000
225	250	120	250 kcmil
250	275	150	300 kcmil
275	300	185	350 kcmil
300	350	185	400 kcmil
350	400	240	500 kcmil

* See notes following Table 11.

Table 10 – Test copper conductors for test currents above 400 A and up to 800 A inclusive*
(see 8.3.3.3.4)

Range of test current ¹⁾		Conductors ^{2), 3), 4)}			
		Metric		kcmil	
		Number	Size mm ²	Number	Size kcmil
400	500	2	150	2	250
500	630	2	185	2	350
630	800	2	240	3	300

* See notes following Table 11.

(3) Nominal Torque

Loose connection on terminal creates overheat condition (check torque level on terminals). You can find these values on the product's sticker.

Example:

Schneider Electric

I_{th} : 25A U_i : 690V U_{imp} : 6kV
 3~ V 230 400 500-690
 AC3 kW 2,2 4 5,5

IEC/EN 60947-4-1
 IEC/EN 60947-5-1

ME25
 V 200-220 440
 kW 1,5 4

JIS C8201-4-1
 JIS C8201-5-1

NOM 117

	(mm ²)	(mm)	(N.m)
1...4 x1	1...4 x2	8	1,7
1...4 x1	1...2,5 x2	8	1,7
1...4 x1	1...4 x2	8	1,7
1...4 x1	1...2,5 x2	8	1,7

600V a.c. max.

UL LISTED 170M IND. CONT. EQ. **SP**

Vac	1ph	3ph
200	.	2HP
240	1HP	2HP
480	.	5HP
600	.	7.5HP

Cont. current: 25A
 AWG10 - 18 CU 75 °C
 6.35mm terminal :
 Max short circuit
 current rms ratings:
 5KA, 600V when
 protected by K-5
 Class fuses or
 circuit breakers.
 Auxiliary Contacts:
 A600-P600

Indonesia W4 1645534 0341 09
 Authors right reserved registered 2000

Telemecanique

Maximum torque level

Auxiliary contact

Power poles

(4) Terminals cleanness

Unclean terminals (dust, pollution...) increases connection resistance and in this case creates overheat effect.

(5) Thermal capacity

Please choose your contactor correctly regarding the current flows. If you are at the performance limit use a bigger contactor.

Example (Web catalogue page June 2009):

Characteristics (continued)

TeSys contactors

TeSys F contactors (115 to 2100 A)

Control circuit: a.c. or d.c.

Pole characteristics				
Contactor type		LC1 F115	LC1 F150	LC1 F185
Number of poles		3 or 4	3 or 4	3 or 4
Rated operational current (I _e)(U _e ≤ 440 V)	In AC-3, θ ≤ 55 °C	A	115	150
	In AC-1, θ ≤ 40 °C	A	200	250
Rated operational voltage (U _e)	Up to	V	1000	1000
Frequency limits	Of the operational current (f)	Hz	16 ²³ ...200	16 ²³ ...200
Conventional thermal current	θ ≤ 40 °C	A	200	250
Rated making capacity	I rms conforming to IEC 60947-4-1	A	Making current: 10 x I in AC-3 or 12 x I in AC-4	
Rated breaking capacity	I rms conforming to IEC 60947-4-1	A	Making and breaking current: 8 x I in AC-3 or 10 x I in AC-4	
Maximum permissible current No current flowing for previous 60 minutes, at θ ≤ 40 °C	For 10 s	A	1100	1200
	For 30 s	A	640	700
	For 1 min	A	520	600
	For 3 min	A	400	450
	For 10 min	A	320	350
Short-circuit protection by fuses U ≤ 440 V	Motor circuit (type aM)	A	125	160
	With thermal overload relay (type gG)	A	200	200
	gG fuses	A	200	250

AC1 and AC3
current rating
for contactors

(6) IPxx of enclosure

Dust or other pollution can increase contact resistance and create an overheating situation. We recommend to use IP6* enclosure (sealed) or for alternative solution IP5* enclosure in association with pressurization system, this will not allow pollution to enter in the enclosure.

In order to understand what IP code means, we put below the description (from Web page catalogue June 2009):

IP *** code					
The IP code comprises 2 characteristic numerals (e.g. IP 55) and may include an additional letter when the actual protection of personnel against direct contact with live parts is better than that indicated by the first numeral (e.g. IP 20C). Any characteristic numeral which is unspecified is replaced by an X (e.g. IP XXB).					
1st characteristic numeral: corresponds to protection of the equipment against penetration of solid objects and protection of personnel against direct contact with live parts.		2nd characteristic numeral: corresponds to protection of the equipment against penetration of water with harmful effects.		Additional letter: corresponds to protection of personnel against direct contact with live parts.	
Protection of the equipment	Protection of personnel	Protection of the equipment	Protection of personnel		
0 Non-protected	Non-protected	0 Non-protected		A	With the back of the hand.
1  Protected against the penetration of solid objects having a diameter greater than or equal to 50 mm.	Protected against direct contact with the back of the hand (accidental contacts).	1  Protected against vertical dripping water, (condensation).		B	With the finger.
2  Protected against the penetration of solid objects having a diameter greater than or equal to 12.5 mm.	Protected against direct finger contact.	2  Protected against dripping water at an angle of up to 15°.		C	With a Ø 2.5 mm tool.
3  Protected against the penetration of solid objects having a diameter greater than or equal to 2.5 mm.	Protected against direct contact with a Ø 2.5 mm tool.	3  Protected against rain at an angle of up to 60°.		D	With a Ø 1 mm wire.
4  Protected against the penetration of solid objects having a diameter > 1 mm.	Protected against direct contact with a Ø 1 mm wire.	4  Protected against splashing water in all directions.			
5  Dust protected (no harmful deposits).	Protected against direct contact with a Ø 1 mm wire.	5  Protected against water jets in all directions.			
6  Dust tight.	Protected against direct contact with a Ø 1 mm wire.	6  Protected against powerful jets of water and waves.			
		7  Protected against the effects of temporary immersion.			
		8  Protected against the effects of prolonged immersion under specified conditions.			

(7) Coil Nominal Voltage

Incorrect voltage applied on coil can increase coil temperature and create contactor overheating. Check the nominal coil voltage (Uc) on your contactor and your power supply should have a level between 0.85 and 1.1 x Uc.