

Railway applications



TeSys D S207 Contactors

TECHNICAL CATALOGUE

DIFFUSION

- Schneider Electric :
- Marc De Maere - Belgium
 - Benoit Tupler - France
 - Ramon Solaz - Spain
 - Jochen Breidenbach - Germany
 - PCP GHD

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1 SELECTION GUIDE

In addition to IEC 947-4-1 standard (Low voltage switchgear and controlgear : contactors and motor starters) , Tesys D S207 products have been developed in order to meet Railways applications requirements :

- General rules according to IEC 60-077-1 & 2 standards

(Railway applications : Electric equipment for rolling stock)

- operating from 0,7 to 1,25 times the nominal DC voltage , from –25°C to 70°C
- shock and vibration withstand , according to IEC 61-373 , category 1 class B

- Fire & smoke withstand according to NF 16 101 & 16 102 standards

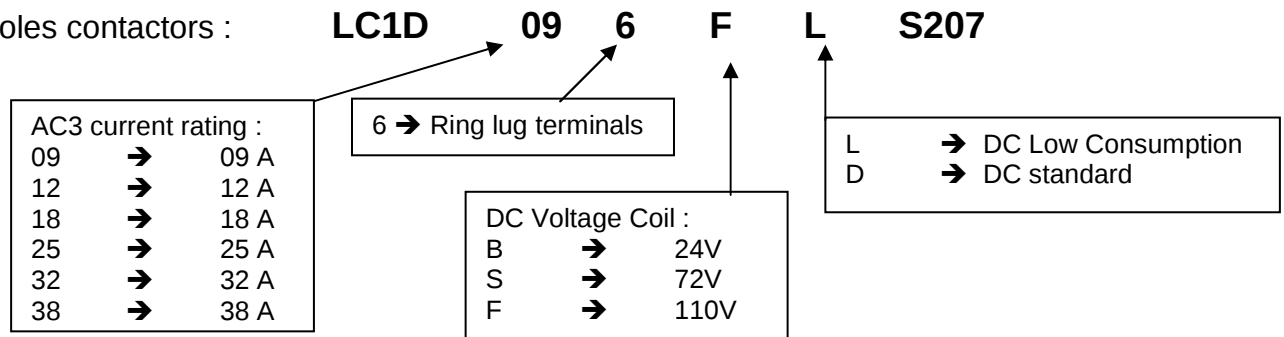
- Severity 3

- Railway applications installation habits

- Ring lugs terminals
- Mounting on Rail or direct fixing on solid plate with 2 screws

COMMERCIAL REFERENCE SYSTEM :

3 poles contactors :



4 poles contactors :

4P : LC1D T 206FLS207
2 P + 2R : LC1D 09 8 6FLS207

Control Relays :

3 NO + 2 NC : CAD 32 6FLS207
5 NO : CAD 50 6FLS207

1.1 3 poles contactors, DC low consumption coil selection guide :

LC1D096xLS207 to LC1D386xLS207 (3P + 1NO + 1NC)

Contactor type	LC1D09	LC1D12	LC1D18	LC1D25	LC1D32	LC1D38
Ie max AC-3 ($U_e \leq 440$ V)	9 A	12 A	18 A	25 A	32 A	38 A
Ie max AC-1 (Temp $\leq 60^\circ\text{C}$)	25 A	25 A	32 A	40 A	50 A	50 A

Rated operational voltage	690 V
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AC3 rated operational power						
220/240 V	2,2 kW	3 kW	4 kW	5,5 kW	7,5 kW	9 kW
380/400 V	4 kW	5,5 kW	7,5 kW	11 kW	15 kW	18,5 kW
415/440 V	4 kW	5,5 kW	9 kW	11 kW	15 kW	18,5 kW
500 V	5,5 kW	7,5 kW	10 kW	15 kW	18,5 kW	18,5 kW
660/690 V	5,5 kW	7,5 kW	10 kW	15 kW	18,5 kW	18,5 kW

Voltage Coil X	B	S	F			
Ex : LC1D096FLS207 = 110V	24V	72V	110V			

Coil consumption at 20°C & at U_c	4 W - L/R = 37 ms
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Operating ranges From -25 to +70°C	0,7...1,25 U_c Even if side by side mounting
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Operating time at 20°C & at U_c	
Closing	Closing of contacts NO : 55 to 75 ms Opening of contacts NC : 45 to 65 ms

Opening	Opening of contacts NO : 16 to 32 ms Closing of contacts NC : 27 to 42 ms
Opening without diode	Opening of contacts NO : 12 to 22 ms Closing of contacts NC : 18 to 28 ms

Mechanical durability In millions of operating cycles	30
Maximum operating rate At temperature $\leq 60^\circ\text{C}$	3 600 operating cycles / hour

Auxiliary Contacts	1 NO & 1 NC instantaneous contacts incorporated in the contactors with add-on blocks included up to 2 NC or 2 NO contacts : LADN026 , ..116 & ..206
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Interference suppressor	Side Clip on Bidirectional peak limiting diode
Suppression voltage	47 V for control voltage of 24 V (voltage code BL) 150 V for control voltage of 72 V (voltage code SL) 250 V for control voltage of 96 V (voltage code DL) 250 V for control voltage of 110 V (voltage code FL)

1.2 4 poles contactors, DC low consumption coil selection guide :**LC1DT206xLS207 to LC1DT406xLS207** (4P + 1NO + 1NC)**LC1D0986xLS207 to LC1D2586xLS207** (2P + 2R + 1NO + 1NC)

Contactor type	LC1DT20 LC1D098	LC1DT25 LC1D128	LC1DT32 LC1D188	LC1DT40 LC1D258
Ie max AC-3 ($U_e \leq 440$ V)	9 A	12 A	18 A	25 A
Ie max AC-1 ($Temp \leq 60^\circ C$)	25 A	25 A	32 A	40 A

Rated operational voltage	690 V
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AC3 rated operational power				
220/240 V	2,2 kW	3 kW	4 kW	5,5 kW
380/400 V	4 kW	5,5 kW	7,5 kW	11 kW
415/440 V	4 kW	5,5 kW	9 kW	11 kW
500 V	5,5 kW	7,5 kW	10 kW	15 kW
660/690 V	5,5 kW	7,5 kW	10 kW	15 kW

Voltage Coil X	B	S	F	
Ex : LC1D0986FDS207 = 110V	24V	72V	110V	

Coil consumption At 20°C & at U_c	4,7 W - L/R = 37 ms
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Operating ranges From -25 to +70°C	0,7...1,25 U_c Even if side by side mounting
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Operating time at 20°C & at U_c	
Closing	Closing of contacts NO : 50 to 70 ms Opening of contacts NC : 40 to 60 ms

Opening	Opening of contacts NO : 16 to 32 ms Closing of contacts NC : 27 to 42 ms
Opening without diode	Opening of contacts NO : 12 to 22 ms Closing of contacts NC : 18 to 28 ms

Mechanical durability In millions of operating cycles	30
Maximum operating rate At temperature $\leq 60^\circ C$	3 600 operating cycles / hour

Auxiliary Contacts	1 NO & 1 NC instantaneous contacts incorporated in the contactors with add-on blocks included up to 2 NC or 2 NO contacts : LADN026 , ..116 & ..206
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Interference suppressor	Side Clip on Bidirectional peak limiting diode
Suppression voltage	47 V for control voltage of 24 V (voltage code BL) 150 V for control voltage of 72 V (voltage code SL) 250 V for control voltage of 96 V (voltage code DL) 250 V for control voltage of 110 V (voltage code FL)

1.3 Control Relays , DC low consumption coil selection guide :

CAD326xLS207 (3NO+2NC) & CAD506xLS207 (5NO)

Control Relay type	CAD32xx or CAD50xx			
Conventional thermal rating	10 A			
Ith (Temp ≤ 60°C)				
Rated operational voltage	690 V			
Voltage Coil X	B	S	F	
Ex : CAD326FLS207 = 110V	24V	72V	110V	
Coil consumption at 20°C & at U _c	4 W - L/R = 37 ms			
Operating ranges From -25 to +70°C	0,7...1,25 U _c Even if side by side mounting			
Operating time at 20°C & at U _c				
Closing	Closing of contacts NO : 50 to 70 ms Opening of contacts NC : 40 to 60 ms			
Opening	Opening of contacts NO : 16 to 32 ms Closing of contacts NC : 27 to 42 ms			
Opening without diode	Opening of contacts NO : 12 to 22 ms Closing of contacts NC : 18 to 28 ms			
Mechanical durability In millions of operating cycles	30			
Maximum operating rate At temperature ≤ 60°C	3 600			
Auxiliary Contacts	with add-on blocks included up to 2 NC or 2 NO contacts : LADN026 , ..116 & ..206			
Interference suppressor	Side Clip on Bidirectional peak limiting diode			
Suppression voltage	47 V for control voltage of 24 V (voltage code BL) 150 V for control voltage of 72 V (voltage code SL) 250 V for control voltage of 96 V (voltage code DL) 250 V for control voltage of 110 V (voltage code FL)			

1.4 3 poles contactors, DC standard coil selection guide :

LC1D096xDS207 to LC1D386xDS207 (3P + 1NO + 1NC)

Contactor type	LC1D09	LC1D12	LC1D18	LC1D25	LC1D32	LC1D38
Ie max AC-3 ($U_e \leq 440$ V)	9 A	12 A	18 A	25 A	32 A	38 A
Ie max AC-1 (Temp $\leq 60^\circ\text{C}$)	25 A	25 A	32 A	40 A	50 A	50 A

Rated operational voltage	690 V
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AC3 rated operational power						
220/240 V	2,2 kW	3 kW	4 kW	5,5 kW	7,5 kW	9 kW
380/400 V	4 kW	5,5 kW	7,5 kW	11 kW	15 kW	18,5 kW
415/440 V	4 kW	5,5 kW	9 kW	11 kW	15 kW	18,5 kW
500 V	5,5 kW	7,5 kW	10 kW	15 kW	18,5 kW	18,5 kW
660/690 V	5,5 kW	7,5 kW	10 kW	15 kW	18,5 kW	18,5 kW

Voltage Coil X	B	S	F			
Ex : LC1D096FDS207 = 110V	24V	72V	110V			

Coil consumption at 20°C & at U_c	5, 4 W - L/R = 28 ms
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Operating ranges from -25 to +70°C	0,7..1,25 U_c with 8mm spacing between products
from -25 to +70°C	0,7..1,1 U_c side by side mounting
from -25 to +50°C	0,7..1,25 U_c side by side mounting

Operating time at 20°C & at U_c	
Closing	Closing of contacts NO : 55 to 75 ms Opening of contacts NC : 45 to 65 ms

Opening	Opening of contacts NO : 16 to 32 ms Closing of contacts NC : 27 to 42 ms
Opening without diode	Opening of contacts NO : 12 to 22 ms Closing of contacts NC : 18 to 28 ms

Mechanical durability In millions of operating cycles	30
Maximum operating rate At temperature $\leq 60^\circ\text{C}$	3 600 operating cycles / hour

Auxiliary Contacts	1 NO & 1 NC instantaneous contacts incorporated in the contactors with add-on blocks included 2 contacts LADN026, ...116 & ...206 or 4 contacts LADN226, ...136, ...406, ...046
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Interference suppressor	Side Clip on Bidirectional peak limiting diode
Suppression voltage	47 V for control voltage of 24 V (voltage code BL) 150 V for control voltage of 72 V (voltage code SL) 250 V for control voltage of 96 V (voltage code DL) 250 V for control voltage of 110 V (voltage code FL)

1.5 4 poles contactors, DC standard coil selection guide :**LC1DT206xDS207 to LC1DT406xDS207** (4P + 1NO + 1NC)**LC1D0986xDS207 to LC1D2586xDS207** (2P + 2R + 1NO + 1NC)

Contactor type	LC1DT20 LC1D098	LC1DT25 LC1D128	LC1DT32 LC1D188	LC1DT40 LC1D258
Ie max AC-3 ($U_e \leq 440$ V)	9 A	12 A	18 A	25 A
Ie max AC-1 (Temp $\leq 60^\circ\text{C}$)	25 A	25 A	32 A	40 A

Rated operational voltage	690 V
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AC3 rated operational power				
220/240 V	2,2 kW	3 kW	4 kW	5,5 kW
380/400 V	4 kW	5,5 kW	7,5 kW	11 kW
415/440 V	4 kW	5,5 kW	9 kW	11 kW
500 V	5,5 kW	7,5 kW	10 kW	15 kW
660/690 V	5,5 kW	7,5 kW	10 kW	15 kW

Voltage Coil X	B	S	F	
Ex : LC1D096FDS207 = 110V	24V	72V	110V	

Coil consumption at 20°C & at U_c	5, 4 W - L/R = 28 ms
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Operating ranges	
from -25 to +70°C	0,7..1,25 U_c with 8mm spacing between products
from -25 to +70°C	0,7..1,1 U_c side by side mounting
from -25 to +50°C	0,7..1,25 U_c side by side mounting

Operating time at 20°C & at U_c	
Closing	Closing of contacts NO : 55 to 75 ms Opening of contacts NC : 45 to 65 ms
Opening	Opening of contacts NO : 16 to 32 ms Closing of contacts NC : 27 to 42 ms
Opening without diode	Opening of contacts NO : 12 to 22 ms Closing of contacts NC : 18 to 28 ms

Mechanical durability In millions of operating cycles	30
Maximum operating rate At temperature $\leq 60^\circ\text{C}$	3 600 operating cycles / hour

Auxiliary Contacts	1 NO & 1 NC instantaneous contacts incorporated in the contactors with add-on blocks included 2 contacts LADN026, ...116 & ...206 or 4 contacts LADN226, ...136, ...406, ...046
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Interference suppressor	Side Clip on Bidirectional peak limiting diode
Suppression voltage	47 V for control voltage of 24 V (voltage code BL) 150 V for control voltage of 72 V (voltage code SL) 250 V for control voltage of 96 V (voltage code DL) 250 V for control voltage of 110 V (voltage code FL)

1.6 Control Relays , DC standard coil selection guide :

CAD326xDS207 (3NO+2NC) & CAD506xDS207 (5NO)

Control Relay type	CAD32xx or CAD50xx			
Conventional thermal rating	10 A			
Ith (Temp ≤ 60°C)				
Rated operational voltage	690 V			
Voltage Coil X	B	S	F	
Ex : CAD326FDS207= 110V	24V	72V	110V	
Coil consumption at 20°C & at Uc	5, 4 W - L/R = 28 ms			
Operating ranges from -25 to +70°C	0,7..1,25 Uc with 8mm spacing between products			
from -25 to +70°C	0,7..1,1 Uc side by side mounting			
from -25 to +50°C	0,7..1,25 Uc side by side mounting			
Operating time at 20°C & at Uc				
Closing	Closing of contacts NO : 55 to 75 ms Opening of contacts NC : 45 to 65 ms			
Opening	Opening of contacts NO : 16 to 32 ms Closing of contacts NC : 27 to 42 ms			
Opening without diode	Opening of contacts NO : 12 to 22 ms Closing of contacts NC : 18 to 28 ms			
Mechanical durability In millions of operating cycles	30			
Maximum operating rate At temperature ≤ 60°C	3 600			
Auxiliary Contacts	with add-on blocks included 2 contacts LADN026, ...116 & ...206 or 4 contacts LADN226, ..136, ..406 , ..046			
Interference suppressor	Side Clip on Bidirectional peak limiting diode			
Suppression voltage	47 V for control voltage of 24 V (voltage code BL) 150 V for control voltage of 72 V (voltage code SL) 250 V for control voltage of 96 V (voltage code DL) 250 V for control voltage of 110 V (voltage code FL)			

2 MAIN CHARACTERISTICS

2.1 Pole characteristics

Contactor type	LC1		D09	DT20 D098	D12	DT25 D128	D18	DT32 D188	D25	DT40 D258	D32	D38
Rated operational current (Ie) (Ue ≤ 440 V)	In AC-3, θ = < 60 °C In AC-1, θ = < 60 °C	A	09	09	12	12	18	18	25	25	32	38
Rated operational voltage (Ue)	Up to	V	690	690	690	690	690	690	690	690	690	690
Frequency limits	Of the operating current	Hz	25... 400	25... 400	25... 400	25... 400	25... 400	25... 400	25... 400	25... 400	25... 400	25... 400
Conventional thermal current (Ith)	θ = < 60 °C	A	25	20	25	25	32	32	40	40	50	50
Rated making capacity (440 V)	Conforming to IEC 60947		250	250	250	250	300	300	450	450	550	550
Rated breaking capacity (440 V)	Conforming to IEC 60947		250	250	250	250	300	300	450	450	550	550
Permissible short time rating	For 1 s	A	210	210	210	210	240	240	380	380	430	430
No current flowing for preceding 15 min with θ = < 40 °C	For 10 s	A	105	105	105	105	145	145	240	240	260	310
	For 1 min	A	61	61	61	61	84	84	120	120	138	150
	For 10 min	A	30	30	30	30	40	40	50	50	60	60
Protection by fuses contre les courts-circuits (U ≤ 690 V)	Without thermal overload relay	type 1	A	40	40	40	50	50	63	63	63	63
		type 2	A	25	25	25	35	35	40	40	63	63
Average impedance per pole	At Ith and 50 Hz	mΩ	2,5	2,5	2,5	2,5	2,5	2,5	2	2	2	2
Power dissipation per pole	AC-3	W	0,2	0,2	0,36	0,36	0,8	0,8	1,25	1,25	2	3
For the above operational currents	AC-1	W	1,56	1,56	1,56	1,56	2,5	2,5	3,2	3,2	5	5

2.2 Characteristics of auxiliary contacts incorporated in the contactor

Mechanically linked contacts IEC 60 947-5-1	Each contactor has 2 NO and NC contacts mechanically linked on the same Contact older		
Mirror contacts IEC 60 947-4-1	The NC contact on each contactor represents the state of the power contacts and Can be connected to a PREVENTA safety module		
Rated operational voltage (Ue)	Up to	V	690
Rated insulation voltage (Ui)	Conforming to IEC 60947-1	V	690
	Conforming to UL, CSA	V	600
Conventional thermal current (Ith)	For ambient temperature = < 60 °C	A	10
Frequency of the operational current		Hz	25...400
Minimum switching capacity	U min	V	17
λ = 10 ⁻⁸	I min	mA	5
Short circuit protection	Conforming to IEC 60947-5-1		fusible gG : 10 A
Rated making capacity	Conforming to IEC 60947-5-1 I rms	A	~ : 140, 250
Short time rating	Permissible for		
	1 s	A	100
	500 ms	A	120
	100 ms	A	140
Insulation resistance		MΩ	> 10
Non overlap time	Garanteed between NO and NC contacts	ms	1,5 on energisation and on de-energisation

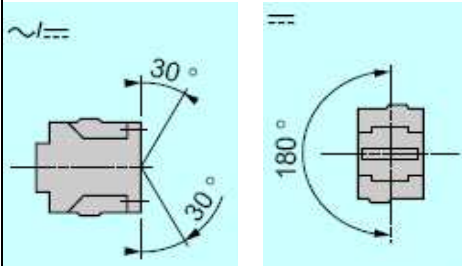
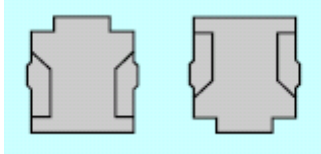
Operational power of contacts Conforming to IEC 60947-5-1

a.c. supply , categories AC-14 et AC-15
electrical durability (valid for up to 3600 operating cycles /hour) on an inductive load such as the coil of an electromagnet : making current (cos φ 0,7)
= 10 times the power broken (cos φ 0,4).

d.c. supply , categories DC-13
electrical durability (valid for up to 1200 operating cycles/hour) on an inductive load such as the coil of an electromagnet , without economy resistor , the time constant increasing with the load.

	V	24	48	115	230	400	440	600	V	24	48	125	250	440
1 million operating cycles	VA	60	120	280	560	960	1050	1440	W	96	76	76	76	44
3 million operating cycles	VA	16	32	80	160	280	300	420	W	48	38	38	32	
10 million operating cycles	VA	4	8	20	40	70	80	100	W	14	12	12		

2.3 Environment

Rated insulation voltage (Ui)	Conforming to IEC 60947-4-1, overvoltage category III degree of pollution : 3	V	690
	Conforming to UL, CSA	V	600
Rated impulse withstand voltage (Uimp)	Conforming to IEC 60947	kV	6
Conforming to standards			IEC 60947-1, 60947-4-1, NFC 63-110, VDE 0660, BS 5424, JEM 1038, EN 60947-1, EN 60947-4-1 IEC 60077 & NF 16 101 - 102
Products certifications			Complies with SNCF, Sichere Trennung recommendations
Separation insulation	Conforming to VDE 0106 part 101 et A1 (draft 2/89)	V	400
Degree of protection (1) (front face only)	Conforming to IEC60529 & VDE 0106 Power connection		protection against direct finger contact IP 2X
	Coil connection		protection against direct finger contact IP 2X
Protective treatment	Conforming to IEC 60068		"TH"
Ambient air temperature Around the device	storage	°C	-60...+ 80
	operation	°C	- 25...+ 70
	permissible	°C	-40...+ 70, for operation at Uc
Maximum operating altitude	Without derating	m	3000
Operating positions	Without derating in the Following positions Positions that are not permissible		 
Flamme resistance	Conforming to UL 94		V 1
	Conforming to IEC 60695-2-1	°C	960
Shock resistance (2) 1/2 wave = 11ms			LC1D09 ...D18 LC1DT20 & DT25
			LC1D25...D38 LC1DT32...DT40
Vibration resistance (2) 5...300 Hz	contactor open		10 gn
	contactor closed		8 gn
	contactor open		15 gn
	contactor closed		15 gn
	contactor open		2 gn
	contactor closed		4 gn
	contactor open		4 gn
	contactor closed		4 gn

2.4 Fire & smoke withstand according to NF 16 101 & 16 102 standards

Classification of rolling stock

The NF F 16-101 standard identifies 3 categories of rolling stock.

Category A1: equipment frequently running in tunnels.

Category A2: equipment seldom running in tunnels, motor coaches and trailers, main line trains with sleeper cars.

Category B: main line train equipment for seated passengers seldom running in tunnels, locomotive driver cabs.

requirements according to rolling stock categories

Installation situation, location		Requirements for		
		category A1	category A2	category B
Outside	$m \leq 300 \text{ g}$	0	0	0
	$m > 300 \text{ g}$	2	1	1
Inside	technical premises			
	$m \leq 300 \text{ g}$	0	0	0
	$m > 300 \text{ g}$	2	2	2
	passenger premises, driver's cab			
	$m < 10 \text{ g}$	0	0	0
	$10 \text{ g} \leq m \leq 100 \text{ g}$	2	2 ⁽¹⁾	2 ⁽¹⁾
	$m > 100 \text{ g}$	3	3	3
Inside or outside	- part subjected to electric arc	4	3	3
	- on special specification, other part exposed			
In closed enclosure	$v \leq 0.5 \text{ m}^3$	0	0	0
	$v > 0.5 \text{ m}^3$	(2)	(2)	(2)

(1) : no smoke classification is required (2) : requirement depends on the location
 m = part weight ; v = inside volume

Definition of the requirements

Based on the I and F classifications the NF F 16-102 standard defines a variety of authorised and forbidden combinations for the "fire" classification (classes I0 to I4) and for the "smoke" classification (classes F0 to F5) for each requirement from 1 to 4 read in table 5.

authorised classifications (white boxes), forbidden classifications (grey boxes) for each level of requirement

Exigence				
0	1	2	3	4
No prescription	I0 I1 I2 I3 I4 NC F0  F1  F2  F3  F4  F5 	I0 I1 I2 I3 I4 NC F0  F1  F2  F3  F4  F5 	I0 I1 I2 I3 I4 NC F0  F1  F2  F3  F4  F5 	I0 I1 I2 I3 I4 NC F0  F1  F2  F3  F4  F5 

TeSys D S207 products answer to **Severity 3** (I2F3 for most of plastic parts) and **Severity 4** (I2F1 for Arc shield) requirements (see certificates here under) .

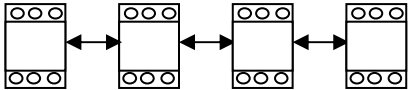
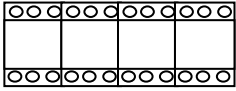
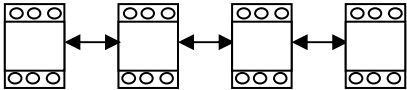
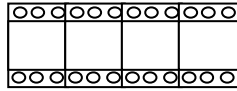
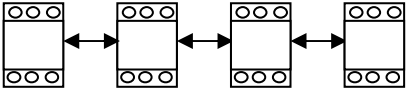
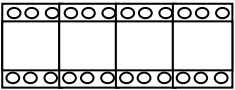
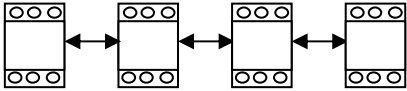
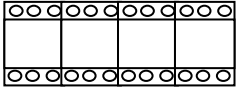
This means that **TeSys D S207** products can be installed on rolling stock equipments without any constraints, even if the products are close together.

OUTSIDE



INSIDE



Category B (Main line train) or Category A2 (City train)	 100g for one product, with 100mm spacing → $m < 300g$ → Severity 0  100g for one product, without spacing → $m > 300g$ → Severity 1	 100g for one product, with 100mm spacing → $m < 100g$ → Severity 2  100g for one product, without spacing → $m > 100g$ → Severity 3
Category A1 (Metro/Subway)	 100g for one product, with 100mm spacing → $m < 300g$ → Severity 0  100g for one product, without spacing → $m > 300g$ → Severity 2	 100g for one product, with 100mm spacing → $m < 100g$ → Severity 2  100g for one product, without spacing → $m > 100g$ → Severity 3

TESYS: LC1D 09-12-18 A S207**FLAMMABILITY AND TOXICITY CERTIFICATE ACCORDING TO NF F16-101 AND NF F 16-102 NORMS**

weight (g)	material	designation	NFF 16-101 et 16-102			
			Results	certificate	Laboratory	date
11,3	PBT GF30	Crastin SK655 FR naturel	I3F3	12506-5	SNPE	oct-05
12,3	PA66 GF25	Latamid 66H2G25V0CT 1 blanc 9001	I2F3	C020493	LNE	juin-02
40,2	PA66 GF25	Latamid 66H2G25V0CT 1 noir 9005	I2F3	C020493	LNE	juin-02
25,7	PA66 GF25	Latamid 66H2G25V0CT 4 gris	I2F1	LSF/C05036	LSF	juil-05

TESYS: LC1D 25-32-38 A S207**FLAMMABILITY AND TOXICITY CERTIFICATE ACCORDING TO NF F16-101 AND NF F 16-102 NORMS**

weight (g)	material	designation	NFF 16-101 et 16-102			
			Results	certificate	Laboratory	date
11,3	PBT GF30	Crastin SK655 FR naturel	I3F3	12506-5	SNPE	oct-05
12,3	PA66 GF25	Latamid 66H2G25V0CT1 blanc 9001	I2F3	C020493	LNE	juin-02
49,0	PA66 GF25	Latamid 66H2G25V0CT1 noir 9005	I2F3	C020493	LNE	juin-02
31,7	PA66 GF25	Latamid 66H2G25V0CT4 gris	I2F1	LSF/C05036	LSF	juil-05

TESYS: CAD 32-50 A S207**FLAMMABILITY AND TOXICITY CERTIFICATE ACCORDING TO NF F16-101 AND NF F 16-102 NORMS**

weight (g)	material	designation	NFF 16-101 et 16-102			
			Results	certificate	Laboratory	date
11,3	PBT GF30	Crastin SK655 FR naturel	I3F3	12506-5	SNPE	oct-05
14,1	PA66 GF25	Latamid 66H2G25V0CT1 blanc 9001	I2F3	C020493	LNE	juin-02
26,9	PA66 GF25	Latamid 66H2G25V0CT1 noir 9005	I2F3	C020493	LNE	juin-02
25,7	PA66 GF25	Latamid 66H2G25V0CT4 gris	I2F1	LSF/C05036	LSF	juil-05

2.5 Shock and vibration withstand , according to IEC 61-373 standards

Caterory 1 , Class B



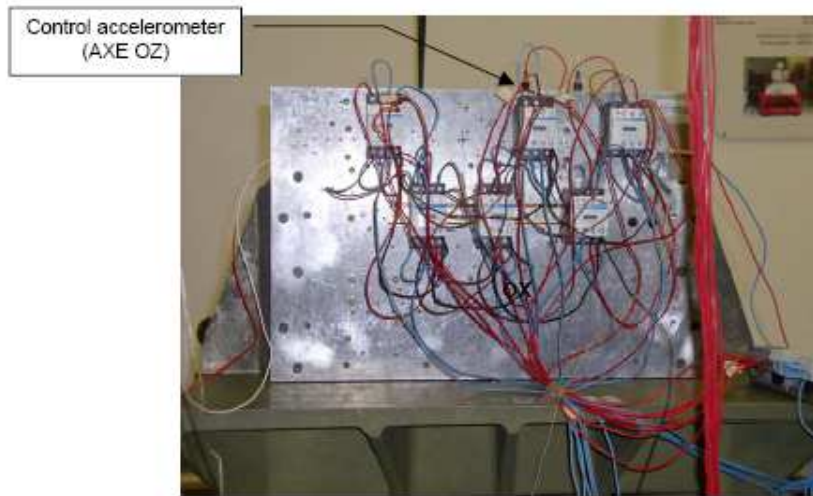
Tel : +33 (0)4 76 57 35 10
 Fax : +33 (0)4 76 57 35 14
 E-mail : jean-marie.babouling@schneider-electric.com
 laurent.yvroud@schneider-electric.com
 pascal.privet@schneider-electric.com

Postal address Schneider Electric Industries S.A.
 L2E / Pôle environnement /
 Vibrations
 37, quai Paul Louis Merin
 F 38050 Grenoble Cedex 9

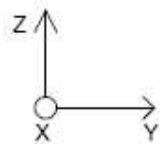
L2E / Environment pole / Vibrations

Mechanical testing report		no : 2007-0118-00A
page : 1 / 20		
Testing period: from 20/02/07 to 21/02/07		Publication date: 5/03/2007
Identification of tested equipment Two contactors TELEMECANIQUE reference LC1D096SDS207 (3-pole size 1); Two contactors TELEMECANIQUE reference LC1D256SDS207 (3-pole size 2); Two contactors TELEMECANIQUE reference LC1D0986SD207 (4-pole size 1).		
Qualification test program Functional random vibrations test according to CEI 61373 standard (category 1 class B) Devices in « closed » position 5 - 150 Hz --> 1 ms ⁻² R.M.S. as per OX axe / 10 minutes (= OZ, see §7.2). 5 - 150 Hz --> 1 ms ⁻² R.M.S. as per OY axe / 10 minutes (= OZ, see §7.2). 5 - 150 Hz --> 1 ms ⁻² R.M.S. as per OZ axe / 10 minutes. Endurance random vibrations test according to CEI 61373 standard (category 1 class B) Devices in « opened » position 5 - 150 Hz --> 5,50 ms ⁻² R.M.S. as per OX axe / 5 hours 5 - 150 Hz --> 3,50 ms ⁻² R.M.S. as per OY axe / 5 hours 5 - 150 Hz --> 7,90 ms ⁻² R.M.S. as per OZ axe / 5 hours. Withstand to shocks test as per CEI 61373 standard (category 1 class B) Devices in « opened » and « closed » position 5g / 30 ms / 3 shocks per direction, in OX axe 3g / 30 ms / 3 shocks per direction, in OY and OZ axes. Verification of mechanical withstand and of absence of milli-opening and milli-closing on the devices (≥ 1ms). Uncertainty of the measurement line concerning acceleration is ± 5% from 3 to 500Hz		
Results The specimens were subjected to testing in compliance with the program defined above. The two contactors TELEMECANIQUE reference LC1D096SDS207 (one mounted on DIN rail and one screwed onto the interface), the two contactors TELEMECANIQUE reference LC1D256SDS207 (one mounted on DIN rail and one screwed onto the interface) and the two contactors TELEMECANIQUE reference LC1D0986SD207 (one mounted on DIN rail and one screwed onto the interface), exhibited no apparent mechanical defect. To be noted the absence of milli-opening and milli-closing ≥ 1ms on the devices.		
Requesting party REBOULET J. B.U. POWER / PCP ELECTROPOLE EYBENS	Author Testing manager : P. Privet Reviewer : Technical responsible : L. Yvroud	
Additional recipients		
This test report is for the above-defined and tested object alone. This report may only be copied in its entirety. It contains 20 pages. "SEULE LA VERSION FRANCAISE FAIT FOI / ONLY THE FRENCH VERSION IS LEGALLY BINDING"		

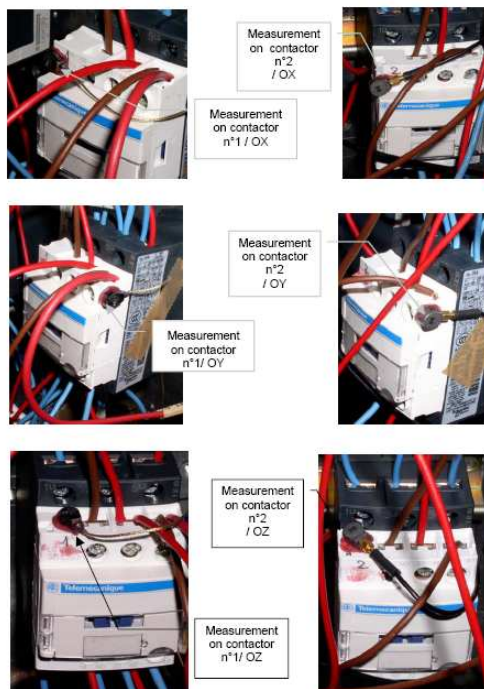
- ASSEMBLY OF EQUIPMENT TO BE TESTED -



Excitation axes



- LOCATION OF MEASUREMENT POINTS-



2.6 Type test , according to IEC 60-077-2 standards

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General characteristics

72 V wide range – non-interchangeable coil - Low consumption : 4 W

Contactors, all contact configurations

- 3 NO power poles + 2 aux (1 NO + 1 NC) : LC1 D09/12/18/25/32/38SL
- 4 NO power poles + 2 aux (1 NO + 1 NC) : LC1DT20/25/32/40SL
- 2 NO & 2 NC power poles + 2 aux (1 NO + 1 NC) : LC1D098/128/188/258SL

Auxiliary contact blocks

LADN20 or LADN11 or LADN02

Rated voltage:	72 V	
Operating range:	50 to 90 V	
Average coil resistance:	1336 Ohms	
Cold coil power	4 W	
Operating limit temperatures:	- 25°C to 70 °C	
Resistance to vibration:	Cat. 1 class B according to std. IEC 61373	
Dielectric strength:	2500 V 50 Hz for 1 minute	
Mechanical endurance strength:	> 10 million operating cycles	
Insulation strength (Ui) :	690 V as per EN 60947-1	
Maximum operating current for AC1: at 40°C	LC1DT20, LC1D098	Ie = 20 A
	LC1D09, LC1 D12	Ie = 25 A
	LC1DT25, LC1D128	Ie = 25 A
	LC1D18	Ie = 32 A
	LC1DT32, LC1D188	Ie = 32 A
	LC1D25	Ie = 40 A
	LC1DT40, LC1D258	Ie = 40 A
	LC1D32	Ie = 50 A
Weight	LC1 D09SL	500 g
		
	LC1 D32SL	560 g

General characteristics

72 V wide range – non-interchangeable standard coil - consumption : 5,4 W

Contactors, all contact configurations

- 3 NO power poles + 2 aux (1 NO + 1 NC) : LC1 D09/12/18/25/32/38SD
- 4 NO power poles + 2 aux (1 NO + 1 NC) : LC1DT20/25/32/40SD
- 2 NO & 2 NC power poles + 2 aux (1 NO + 1 NC) : LC1D098/128/188/258SD

Auxiliary contact blocks

LADN.. 2 or 4 poles (LADN.., LADC.., LA1DX/Y/Z..)

Additional blocks

LADT.. – LADR.. – LAD6K10

Rated voltage:	72 V	
Operating range:	50 to 90 V	
Average coil resistance:	820 Ohms	
Cold coil power	6,3W	
Operating limit temperatures:	- 25°C to 70 °C	
Resistance to vibration:	Cat. 1 class B according to std. IEC 61373	
Dielectric strength:	2500 V 50 Hz for 1 minute	
Mechanical endurance strength:	> 10 million operating cycles	
Insulation strength (Ui) :	690 V as per EN 60947-1	
Maximum operating current for AC1: at 40°C	LC1DT20, LC1D098	Ie = 20 A
	LC1D09, LC1 D12	Ie = 25 A
	LC1DT25, LC1D128	Ie = 25 A
	LC1D18	Ie = 32 A
	LC1DT32, LC1D188	Ie = 32 A
	LC1D25	Ie = 40 A
	LC1DT40, LC1D258	Ie = 40 A
	LC1D32	Ie = 50 A
Weight	LC1 D09SD	500 g
		
	LC1 D32SD	560 g

1. TESTED EQUIPMENT

Contactors: LC1D09SD/SL - LC1D12SD/SL - LC1D18SD/SL - LC1D25SD/SL – LC1D32SD/SL -

Auxiliary contact blocks: LADN11 - LADN22

2. TYPES OF TESTS

Type tests according to standard EN 60077-1.

3. MECHANICAL TESTS

3.1. CHECK OF MECHANICAL OPERATION

according to paragraph 9.3.1 of standard EN 60077-1.

Test temperature (°C)	Electric supply prior to operating test (V)	Operation power supply voltage	No. of maneuvers	Operation
70	72	50	20	Correct
40	90	50	20	Correct
70	90	57.6	20	Correct
- 25	no	50	20	Correct
20	no	72	20	Correct

These tests are performed on contactors LC1D09 to LC1D38 with their additional blocks.

3.2. RUGGEDNESS TEST:

Mechanical according to 9.3.4.1 of standard EN 60077-1, and B.2 of standard EN 60947-4-1

3.2.1. TEST CONDITIONS

- Ambient temperature: $25^{\circ} \pm 5^{\circ}\text{C}$
- Power supply voltage: 72 V DC
- Test rate: 4 maneuvers / second

3.2.2. RESULTS

- The equipment carried out 20 million operating cycles.
- According to paragraph B2.2.6 of standard EN 60947-4-1 Appendix B.

The "single eight" test enables us to affirm that the mechanical endurance of all the equipment referred to totaled 20 million operations.

3.3. VIBRATION RESISTANCE TESTS

- According to standards EN 60077-1 and IEC 61373.

4. ELECTRICAL TESTS

4.1. MEASUREMENT OF COIL RESISTANCES

according to paragraph 9.3.2.2 of Standard EN 60077-1.

	Rmin (20°C)	Rave (20°C)	Rmax (20°C)
Coil of LC1D..SL	1233	1336	1440
Coil of LC1D..SD..	762.5	819.9	877.3

Note:

In addition, these coils are calculated to allow for the tolerances on the enameled wires and on the winding facilities and are tested to 100% on the manufacturing line according to these criteria:

Any equipment containing a coil outside these limits will be rejected automatically.

4.2. HEATING TESTS

according to paragraph 9.3.2 of standard EN 60077-1.

paragraph 8.3.3.3 of standard EN 60947-4-1

4.2.1. INSULATED WINDINGS

4.2.1.1. TEST CONDITIONS

The test is performed at ambient temperature with the control coil powered at the maximum voltage of the action field (90 V DC).

Coil heating is determined by the resistance variation method: $\Delta\theta = \frac{R_2 - R_1}{R_1} (T_1 + 234.5)$

4.2.1.2. RESULTS

	LC1D12 coil SL	LC1D12 Coil SD
R at 20°(Ohms)	1336	846.5
Coil R powered at 90V (Ohms)	1698	1240
Coil θ(°C) at 20°C ambient	89	118
$\Delta\theta$ (K)	69	98

The temperature rise is below the limit allowed to our enameled wire, which is of thermal class H (insulation temperature index 180 °C). The temperature rise limit is 125 K for maximum air ambient temperature of 70 °C (§ 8.2.2.4 & table 1 of EN 60077-1)

4.2.2. OVERHEATING TESTS ON THE MAIN CONTACT AND FLEXIBLE CONNECTIONS

4.2.2.1. TEST CONDITIONS

The poles are connected in series by flexible cables 1 m long.

Cable sections correspond to the contactors under test.

LC1 D09	1.5 mm ²
LC1 D12	1.5 mm ²
LC1 D18	2.5 mm ²
LC1 D25	4 mm ²
LC1 D32	6 mm ²

The coil is powered at 72V DC.

The test is performed at ambient temperature for the operating current in category AC3.

The contactor is associated with the appropriate thermal relay:

LC1 D09SD + LRD14	Ie AC3 = 10 A
LC1 D12SD + LRD16	Ie AC3 = 13 A
LC1 D18SD + LRD21	Ie AC3 = 18 A
LC1 D25SD + LRD22	Ie AC3 = 24 A
LC1 D32SD + LRD32	Ie AC3 = 32 A

4.2.2.2. RESULTS

Position of thermocouples

1	Output L1	Contacteur
2	Output T1	Thermal relay
3	Output L2	Contacteur
4	Output T2	Thermal relay
5	Output L3	Contacteur
6	Output T3	Thermal relay

The contactor – thermal relay junction is therefore not measured. This is a rigid link

$\Delta\theta$	POLE 1		POLE 2		POLE 3	
	1	2	3	4	5	6
LC1 D09	23.3	52.2	36.8	50.8	32.4	45.5
LC1 D12	34.5	61	42.8	60.5	33.2	57
LC1 D18	41.5	58.1	43.7	61.8	36.9	51.4
LC1 D25	44.5	61.2	48	64	50.3	59.4
LC1 D32	55.2	61.7	56.8	64.8	56.3	59.7

The other way in which the contactors can be used dispenses with a thermal relay but uses the thermal current in the poles. The control circuit is still supplied at 72 V ---.

4.2.2.3. TEST CONDITIONS

The poles are connected in series by flexible cables 1 m long.

Cable sections corresponding to the contactors being tested :

LC1 D09	→	I _{th} = 25 A	→	4 mm ²
LC1 D12	→	I _{th} = 25 A	→	4 mm ²
LC1 D18	→	I _{th} = 32 A	→	6 mm ²
LC1 D25	→	I _{th} = 40 A	→	10 mm ²
LC1 D32	→	I _{th} = 50 A	→	10 mm ²

4.2.2.4. RESULTS

Thermocouple positions :

1	Output L1	Contacteur
2	Output T1	Contacteur
3	Output L2	Contacteur
4	Output T2	Contacteur
5	Output L3	Contacteur
6	Output T3	Contacteur

$\Delta\theta$	POLE 1		POLE 2		POLE 3	
	1	2	3	4	5	6
LC1 D09	34.9	36.4	42	37.5	35.3	38.3
LC1 D12	34.4	37.5	41.3	36.7	34.2	35.5
LC1 D18	46.5	45.2	52.7	46.5	43.7	47.6
LC1D25	32	30.9	38	37.3	34.5	32.8
LC1 D32	49.3	46.9	54.5	52.9	45.8	44.2

On the contact supports, whatever the test, temperature rise remains less than respectively 60 K and 65 K, which are the permitted limits for terminals of copper and copper-alloys as per standard EN 60077-1, § 8.2.2.7 & table 2 (maximum air ambient temperature of 40°C), and standard EN 60947-4-1

Coil resistance after heating

LC1 D09		Coil SD	Cold resistance= 822.5Ω (20°C)
LC1 D12			Hot resistance = 1042 Ω (20°C)
LC1 D18			$\Delta\theta$ = 68 K
LC1D25		Coil SD	Cold resistance = 807.6 Ω (22°C)
LC1 D32			Hot resistance = 1030 Ω (22°C)
			$\Delta\theta$ = 70 K

The coil heating is less than the temperature class of our enameled wires (Class F: 155°C)

4.3. CHECK OF RESISTANCE TO BRIEF POWER SUPPLY BREAKS

After the closing of the contactor at nominal voltage for 1 hour, the voltage is decreased to 0.5 U_n for 5 s.

Results :

There is no apparent change in the state of the contacts or of the contactor. The drop out voltage of the Télémécanique equipment is between 0.13 U_n and 0.20 U_n thus prohibiting a change of state at 0.5 U_n .

4.4. TESTING OF ELECTRICAL ENDURANCE AS PER STANDARD

4.4.1. MAKING AND BREAKING ENDURANCE (CATEGORY AC3 AS PER STANDARD EN 60947-4-1)

4.4.1.1. TEST CONDITIONS

TEST CIRCUIT		Making	Breaking
Voltage (V)		400	67
Current (A)	LC1 D09	54	9
	LC1 D12	72	12
	LC1 D18	108	18
	LC1 D25	150	25
	LC1 D32	192	32
Cosine φ		0.65 ← LC1 D09, LC1 D12	0.65 ← LC1 D09, LC1 D12
		0.35 ← LC1 D18, LC1 D25, LC1 D32	0.35 ← LC1 D18, LC1 D25, LC1 D32,
Overvoltage factor		/	1.1
Conduction time		70 ms	70 ms
Rate		1200 cycles / hour	
Coil voltage (V0		72	
Ambient temperature (°C)		25 ± 5	

4.4.1.2. RESULTS

- The number of operations performed by the contactors under test (whatever their caliber) is in excess of 1,000,000 operating cycles.

4.4.2. MAKING AND BREAKING TESTS

(According to paragraph 9.3.3.5 of standard EN 60947-4-1).

4.4.2.1. TEST CONDITIONS (CATEGORY AC4)

Making: alone	IC/Ie = 12 U/Ue = 1.1 Cos φ = 0.45	Making: IC/Ie = 10 and Ur/Ue = 1.1 Breaking Cos φ = 0.45
------------------	--	--

Test current conduction time: 70 ms for making and breaking

Interval between 2 cycles: 10 s for making

10 to 140 s for making and breaking (depending on broken current)

4.4.2.2. RESULT

	No. of cycles	Coil supply voltage	Operation
Making	25	72 x 0.85 = 61.2 V	Correct
	25	72 x 1.1 = 79.2 V	Correct
Making and breaking	50	72 V	Correct

4.4.3. APTITUDE FOR OPERATION IN SERVICE

(as per paragraph 9.336 of standard EN 60947-4-1).

4.4.3.1. TEST CONDITIONS (CATEGORY AC4)

Ic/Ie = 6
 Ur/Ue 1.05
 Cos φ = 0.45

Test current conducting time: 70 ms
 Idle time: 10 to 60 s (depending on broken current)

4.4.3.2. RESULT

No. of operations	Control supply voltage	Operation
6,000	72 V	Correct

4.4.4. MAXIMUM MAKING AND BREAKING CAPACITY

Obtained by a searching method, and according to the prescriptions of standard EN 60947-4-1.

	LC1 D09	LC1 D12	LC1 D18	LC1 D25	LC1 D32
Making capacity I rms. (1)	250 [108]	250 [144]	300 [216]	450 [300]	550 [384]
Breaking capacity 220 to 440 V I rms. (1) (Making and breaking)	250 [90]	250 [120]	300 [180]	450 [250]	550 [320]

90% of the units obtain the indicated value with a level of confidence of 60%.

[Value] required by standard EN 60947-4-1

4.5. VERIFICATION OF IMPULSE WITHSTAND VOLTAGE

As per paragraph 8.3.3.4.1-2) Standard EN 60947-1
 paragraph 9.3.3.2 Standard EN 60077-1

Tested devices:

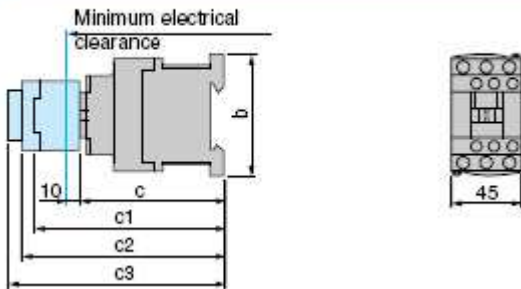
LC1D09 , LC1D12 , LC1D18 , LC1D25 , LC1D32 for Uimp = 6 kV

Note: The Telemecanique contactors were put through individual tests at the output of the manufacturing line (testing to 100%) and the applied dielectric test voltage is for one second.

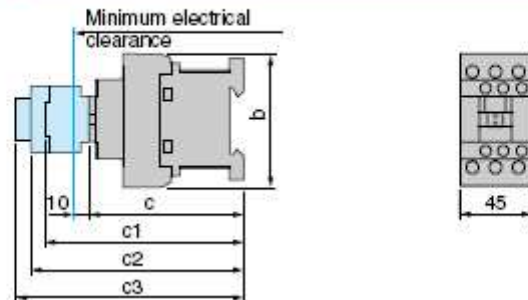
3 INSTALLATION

3.1 Dimensions

LC1 D09...D18 (3-pole)



LC1 D25...D38 (3-pole)



LC1

b	
c	without cover or add-on blocks
	with cover, without add-on blocks
c1	with LAD N or C (2 or 4 contacts)
c2	with LA6 DK10
c3	with LAD T, R, S
	with LAD T, R, S and sealing cover

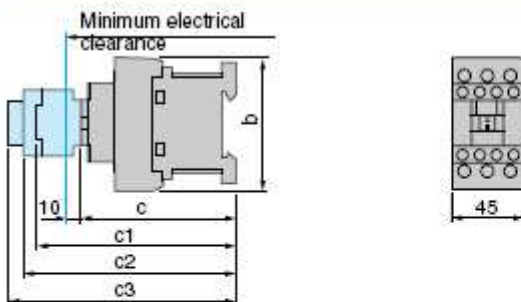
LC1D 09 to 18

80
93
95
126
138
146
150

LC1D 25 to 38

85
99
101
132
144
152
156

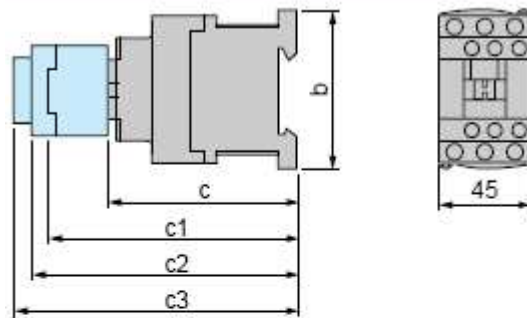
LC1 DT20 to DT40 (4-pole)



LC1

	DT20 & DT25 D098 & D128	DT32 & DT40 D188...D258
b	85	91
c	99	107
c1	123	131
c2	135	143
c3	143	151
	147	155

CAD --- or LC (low consumption)

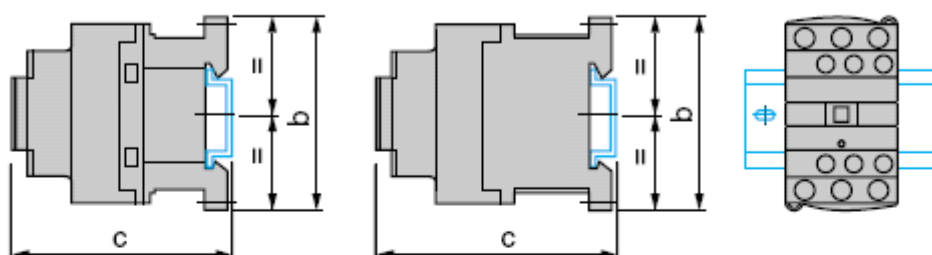


CAD-	32
	50
b	77
c without cover or add-on blocks	93
with cover, without add-on blocks	95
c1 with LAD-N or C (2 or 4 contacts)	126
c2 with LAD-6K10	138
c3 with LAD-T, R, S	146
with LAD-T, R, S and sealing cover	150

3.2 Mounting on rail or plate

LC1 D09...D38, DT20...DT40

On mounting rail AM1 DP200, DR200 or AM1 DE200 (width 35 mm)



LC1	D09...D18	D25...D38	DT2 & DT25	DT32 & DT40
b	77	85	85	100
c (AM1 DP200 or DR200) (1)	88	94	94	109
c (AM1 DE200) (1)	96	102	102	117

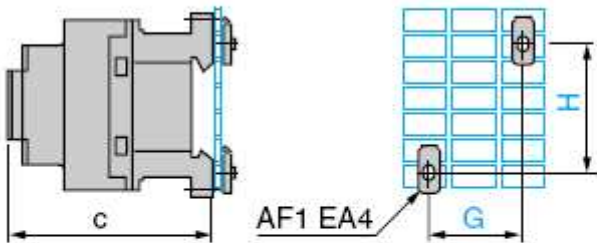
Control circuit: d.c.

b	77	85	94	109
c (AM1 DP200 or DR200) (1)	97	103	103	118
c (AM1 DE200) (1)	105	110	111	123

(1) with safety cover.

LC1 D09...D38 and LC1 DT20...DT40

On pre-slotted mounting plate AM1 PA, PB, PC



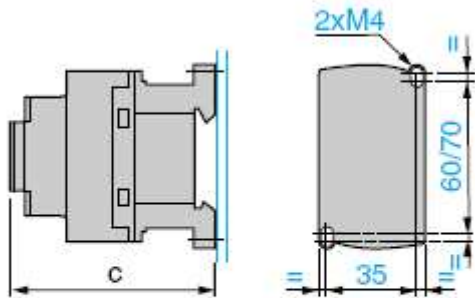
Control circuit:

LC1
c with cover
G
H
LC1
c with cover
G
H

d.c.	
D09...D18	D25...D38
95	101
35	35
70	70
DT20 & DT25	DT32 & DT40
118	132
35	35
60	60

LC1 D09...D38

Panel mounted



! 1,5Nm max

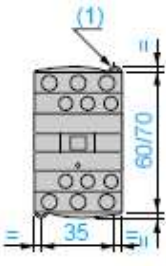
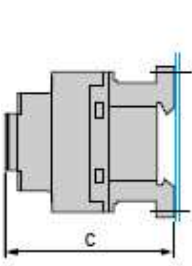
Control circuit:

LC1
c with cover
4-pole contactors
LC1
c with cover

d.c.	
D09...D18	D25...D38
95	101
DT20 & DT25	DT32 & DT40
90	98

CAD

Panel mounted



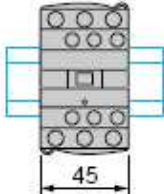
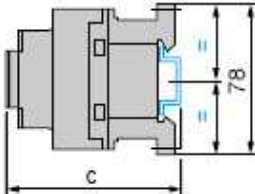
c with cover

(1) 2 elongated holes 4.5 x 9

CAD --- or LC

95

Mounted on rail AM1-DP200 or DE200



c (AM1-DP200) (1)

c (AM1-DP200) (1)

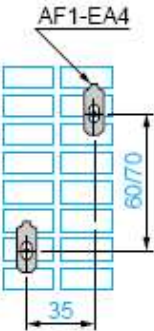
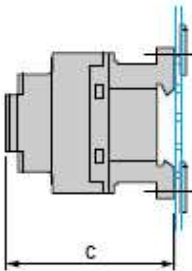
(1) With cover

CAD --- or LC

97

105

Mounted on plate AM1-P



! 1,5Nm max

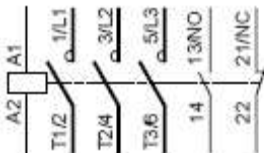
c with cover

CAD --- or LC

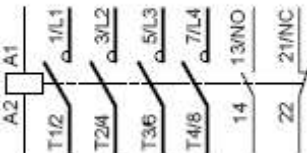
95

3.3 Shemes

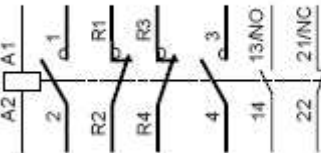
LC1 D09 à D150



LC1 DT20 à DT40



LC1 D098 à D258



3.4 Connections

3.4.1 Power connections

Contactor type		LC1		D09 and D12 DT20 and DT25	D18 (3P)	D25 (3P)	D32	D38	D18 and D25 (4P) DT32 and DT40
Power circuit connections									
Lug external Ø		mm		8	8	10	10		8 (2)
Ø of screw		mm		M3.5	M3.5	M4	M4		M3.5
Screwdriver	Philips			N° 2	N° 2	N° 2	N° 2		N° 2
	Flat screwdriver Ø			Ø 6	Ø 6	Ø 6	Ø 6		Ø 6
Key for hexagonal headed screw				–	–	–	–		–
Tightening torque		N.m		1.7	1.7	2.5	2.5		1.8

3.4.2 Control circuit connections

Contactor type		LC1		D09 and D12 DT20 and DT25	D18 (3P)	D25 (3P)	D32	D38	D18 and D25 (4P) DT32 and DT40
Control circuit connections									
Connection by bars or lugs									
Lug external Ø		mm		8	8	8	8		8
Ø of screw		mm		M3.5	M3.5	M3.5	M3.5		M3.5
Screwdriver	Philips			N° 2	N° 2	N° 2	N° 2		N° 2
	Flat screwdriver Ø			Ø 6	Ø 6	Ø 6	Ø 6		Ø 6
Tightening torque		N.m		1.7	1.7	1.7	1.7		1.7