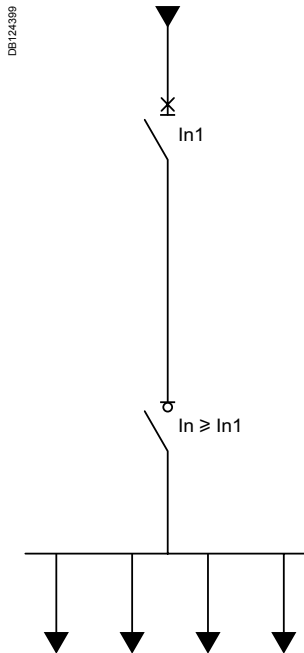


Coordination

Switches and residual current circuit breakers protection



Like all the components of the electrical installation, switches must be protected:

- against overloads;
- against short circuits.

Coordination between the switches and its protection device must be guaranteed and proved by the manufacturer.

Moreover, in a TN earthing, it must be ensured that the protection devices are capable of interrupting earth fault currents of high amplitude.

Overload protection

- The current rating of the switches is the maximum current that it can withstand without being damaged.

- It is protected against overloads by the circuit breaker located upstream on its power supply line⁽¹⁾.

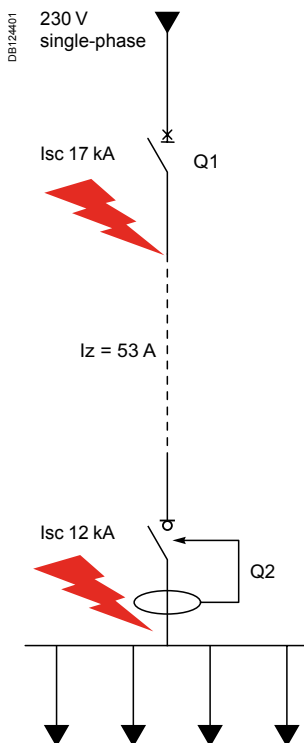
As a consequence:

The rating of the switches must be equal to or greater than the rating of the circuit breaker located upstream.

Be careful: only the circuit breaker ensure the protection against overloads.

For example: on a circuit protected by an 32 A iC60 circuit breaker, an iSW-NA switches of rating 40 A or 63 A must be installed.

(1) In some countries, the installation standards consider that overload protection can be provided by all the downstream circuit breakers, if the sum of their ratings is less than or equal to the rating of the residual current circuit breaker.



Short-circuit protection

- The switches is protected against short circuits by the circuit breaker (or fuse) located upstream on its power supply line⁽²⁾.

- To prevent any damage, the circuit breaker must sufficiently limit any short-circuit current that could pass through the switches (up to the max. short-circuit current Isc at its installation point).

The short-circuit withstand of the switches and residual current circuit breaker is given in the following tables, as a function of the upstream circuit breaker. It must be greater than or equal to the prospective short-circuit current Isc at its installation point.

(2) Exemption in case of special installation described at the end of this document, page 8.

Example

Choice of protection devices Q1 and Q2 in the diagram opposite:

Circuit breaker Q1		
Rated current	Less than or equal to the cable withstand Iz	50 A
Breaking capacity	Greater than or equal to the short-circuit current Isc (17 kA)	iC60N 2P or C120N 2P (20 kA under 230 V)
Residual current circuit breaker Q2		
Rated current	Greater than or equal to that of circuit breaker Q1	63 A
Short-circuit withstand (Inc)	Greater than or equal to the short-circuit current Isc (12 kA)	Based on the tables opposite: ■ with iC60N: 20 kA: is suitable ■ with C120N: 20 kA: is suitable

Coordination

Residual current circuit breakers protection

Protection against earth fault currents

In the event of an insulation fault in a TN system, the phase-to-earth fault current is equal to the phase-to-neutral fault current.

- The residual current circuit breaker interrupts this current, if it does not exceed its specific breaking capacity $I_{\Delta m}$.
- If the fault current exceeds this value, it must be interrupted by the circuit breaker located upstream.

Therefore, the magnetic threshold (instantaneous tripping threshold) of the circuit breaker must always be less than or equal to the breaking capacity of the residual current circuit breaker ($I_{\Delta m}$).

Breaking and making capacity ($I_{\Delta m}$) of iLD residual current circuit breakers

Rating (A)	iLD type AC, A, SI	RCCB-ID type B
16	1500	-
25	1500	500
40	1500	500
63	1500	630
80	1500	800
100	1500	-
125	1250	1250

The combination of an iLD residual current circuit breaker and an iC60 circuit breaker of appropriate rating naturally satisfies this condition.

Example:

- iLD RCCB, rating 63 A: $I_{\Delta m} = 1500$ A;
- iC60N circuit breakers of rating 63 A:
 - B curve: magnetic threshold 189 to 315 A;
 - C curve: magnetic threshold 315 to 630 A;
 - D curve: magnetic threshold 630 to 882 A.

The condition is satisfied whatever the iC60 circuit breaker (of rating at most equal to 63 A).

For protection by fuse, the user should check that the fuse blowing time is less than the residual current circuit breaker's response time for a fault current of amplitude superior than $I_{\Delta m}$, i.e.: type : 40 ms.

Coordination

Switches and residual current circuit breakers protection

Using the coordination tables

This table takes in account:

■ all types of faults: between phases, phase and neutral and between phase and earth.

■ all earthing systems except IT.

See comment here below.

Depending on the network and the type of protection, the selection table below indicates which table should be consulted to find out the coordination value.

Selection table

		Upstream network					
		DB123995 eps L1 ———— N ————		DB123998 eps L1 ———— L2 ———— L3 ———— N ————		DB123997 eps L1 ———— L2 ———— L3 ————	
Type of Downstream network	Type of protection device	Ph/N 110-130 V	Ph/N 220-240 V	Ph/N 110-130 V Ph/Ph 220-240 V	Ph/N 220-240 V Ph/Ph 380-415 V	Ph/Ph 220-240 V	Ph/Ph 380-415 V
DB124079 eps N L1	DB123991 eps 2P	See table Ue: 220-240 V	(1) See table Ue: 220-240 V	See table Ue: 220-240 V	(1) See table Ue: 220-240 V		
	DB124191 eps 1P DB123992 eps 1P + N	See table Ue: 220-240 V	(2) See table Ue: 380-415 V	See table Ue: 220-240 V	(2) See table Ue: 380-415 V		
DB124192 eps L1 L2	DB123991 eps 2P			See table Ue: 220-240 V	See table Ue: 380-415 V	See table Ue: 220-240 V	See table Ue: 380-415 V
DB124080 eps L1 L2 L3	DB123993 eps 3P			See table Ue: 220-240 V	See table Ue: 380-415 V	See table Ue: 220-240 V	See table Ue: 380-415 V
DB124081 eps NL1 L2 L3	DB123994 eps 4P			See table Ue: 220-240 V	See table Ue: 380-415 V		
	DB123993 eps 3P DB123995 eps 3P + N			See table Ue: 220-240 V	See table Ue: 380-415 V		

(1) For fault phase-earth please consult the table Ue: 380-415 V.

(2) For iC60 1P+N circuit breaker connected between phase and neutral under 220-240 V, consult the table Ue: 220-240 V (only for faults between phase and neutral).

Coordination

Upstream: iDPN, iC60

Downstream: switch-disconnectors,
residual current circuit breakers

Ue: 380-415 V and Ue: 220-240 V

Protection by circuit breaker

Downstream				Ue: 380-415 V			Ue: 220-240 V		
Product		Ratings (A)		Upstream Circuit breaker		Ratings (A)			
iID NG125NA iSW-NA INS	All	iDPN	iDPN						
		iC60	iC60a	iC60N	iC60H	iC60L			
iSW	20 to 32	iDPN	iDPN						
		iC60	iC60a/N/H/L						
	40 to 125	iDPN	iDPN						
		iC60	iC60a	iC60N	iC60H	iC60L			
RCCB-ID type B	All	iDPN	iDPN						
		iC60	iC60a	iC60N	iC60H	iC60L			

10	Total coordination up to the MCB breaking capacity: Value of Short circuit withstand of the circuit breaker - Switch-disconnector or residual current circuit breaker combination (kA rms)
4.5	Coordination limit: Value of Short circuit withstand of the circuit breaker - Switch-disconnector or residual current circuit breaker combination (kA rms)
	No coordination

Ue: 380-415 V and Ue: 220-240 V

Protection by circuit breaker				Ue: 380-415 V								Ue: 220-240 V							
Downstream		Upstream Circuit breaker																	
Product	Ratings (A)	Product	Ratings (A)	0.5 to 25	32-40	50-63	80	100	125	160	0.5 to 25	32-40	50-63	80	100	125	160		
iID iSW-NA	≤ 63	C120	C120N	10	10	10	6	6	6		20	20	20	12	12	12			
			C120H	15	15	15	6	6	6		30	30	30	12	12	12			
		NG125	NG125a				4	4	4					8	8	8			
			NG125N	16	16	16	6	6	6		30	30	30	12	12	12			
			NG125H	20	16	16	6				40	30	30	12					
			NG125L	25	20	16	6				50	36	30	12					
		NG160	NG160	7	7	7	4	4	4	4	8	8	8	5	5	5	5		
		NSX	NSX100/160	5	5	5	4	4	4	4	6	6	6	5	5	5	5		
iID iSW-NA	80 to 100	C120	C120N	10	10	10	10	10	10		20	20	20	20	20	20			
			C120H	15	15	15	10	10	10		30	30	30	20	20	20			
		NG125	NG125a				6	6	6					12	12	12			
			NG125N	16	16	16	10	10	10		30	30	30	20	20	20			
			NG125H	20	16	16	10				36	30	30	20					
			NG125L	25	20	16	10				50	36	30	20					
		NG160	NG160	7	7	7	7	7	7	7	8	8	8	8	8	8	8		
		NSX	NSX100/160	5	5	5	5	5	5	5	6	6	6	6	6	6	6		
iSW	20 to 32	C120	C120N/H	3	3						4.5	4.5							
		NG125	NG125N/H/L	3	3						4.5	4.5							
NG125NA INS	All	C120	C120N	10	10	10	10	10	10		20	20	20	20	20	20			
			C120H	15	15	15	15	15	15		30	30	30	30	30	30			
		NG125	NG125a				16	16	16					16	16	16			
			NG125N	25	25	25	25	25	25		50	50	50	50	50	50			
			NG125H	36	36	36	36				70	70	70	70					
			NG125L	50	50	50	50				100	100	100	100					
NG125NA	All	NG160	NG160E	16	16	16	16	16	16	16	25	25	25	25	25	25	25		
			NG160N	25	25	25	25	25	25	25	40	40	40	40	40	40	40		
			NG160H	36	36	36	36	36	36	36	50	50	50	50	50	50	50		
		NSX	NSX100B/160B	25	25	25	25	25	25	25	40	40	40	40	40	40	40		
			NSX100F/160F	36	36	36	36	36	36	36	50	50	50	50	50	50	50		
			NSX100N/H/S/L NSX160N/H/S/L	36	36	36	36	36	36	36	50	50	50	50	50	50	50		
RCCB-ID type B	All	C120	C120N/H	7	7	7	7	5	5										
		NG125	NG125a				8	8	8										
			NG125N	15	15	15	15	10	10										
			NG125H/L	15	15	15	15												
		NG160	NG160	7	7	7	5	5	5	4									
		NSX	NSX100/160	4	4	4	4	4	4	4									

10 Total coordination up to the MCB breaking capacity: Value of Short circuit withstand of the circuit breaker - Switch-disconnector or residual current circuit breaker combination (kA rms)

4.5 Coordination limit: Value of Short circuit withstand of the circuit breaker - Switch-disconnector or residual current circuit breaker combination (kA rms)

No coordination

Coordination

Upstream: fuses gG

Downstream: switch-disconnectors,
residual current circuit breakers

Ue: 380-415 V and Ue: 220-240 V

Protection by fuse

Ue: 380-415 V

Ue: 220-240 V

Downstream		Upstream Fuse										
Product	Ratings (A)	Product	Ratings (A)	16	20	25	32	40	63	80	100	125
iID	16 to 40	Fuse gG		100	100	100	80	80	30	15	10	
	63 to 100			100	100	100	80	80	30	15	10	5
iSW	20 to 32			60	40	25	15	8				
	40 to 63			60	40	25	20	10	10			
	100 to 125			60	40	25	20	10	10	10	10	10
iSW-NA	40			100	100	100	80	80	30	15		
	63 to 100			100	100	100	80	80	30	15	10	5
NG125NA	125			100	100	100	80	80	50	50	50	50
RCCB-ID type B	25			100	100	100	80					
	40 à 80			100	100	100	100	80	30	20		
	100 à 125			100	100	100	100	80	30	20	10	10

100 Total coordination up to the fuse breaking capacity: Value of Short circuit withstand of the fuse - Switch-disconnector or residual current circuit breaker combination (kA rms)

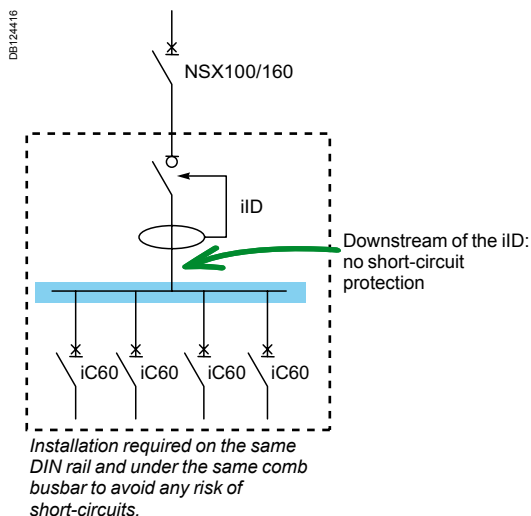
30 Coordination limit: Value of Short circuit withstand of the fuse - Switch-disconnector or residual current circuit breaker combination (kA rms)

No coordination

Coordination

Upstream: NSX100/160

Downstream: modular residual current circuit breakers and modular circuit breakers



2P residual current circuit breakers installed between a NSX100/160 and a circuit breaker (220 V to 240 V single-phase circuit)

Protection by circuit breaker

Upstream	Residual current circuit breakers 2P ratings (A)		
	25	40	63
Downstream Circuit breakers			
iDPN	6	6	-
iDPN N	7.5	7.5	-
iC60N	20	20	20
iC60H	30	30	30
iC60L	50	36	30

Short-circuit current withstand of the circuit breakers-residual current circuit breakers
combination (kA r.m.s.)

4P residual current circuit breakers installed between a NSX100/160 and a circuit breaker (380 V to 415 V three-phase circuit)

Protection by circuit breaker

Upstream	Residual current circuit breakers 4P ratings (A)		
	25	40	63
Downstream Circuit breakers			
iDPN	2	2	-
iDPN N	3	3	-
iC60N	10	10	10
iC60H	15	15	15
iC60L	20	20	15

Short-circuit current withstand of the circuit breakers-residual current circuit breakers
combination (kA r.m.s.)



4.1	25/11/2013	Add RCCB-ID type B	
4.0	19/11/2013	New coordination tables	Sedoc
3.0	13/03/2013	New coordination tables	Sedoc
2.5	12/03/2012	Add table 1P, 1P+N page 3-Changed tables pages 5-6	Sedoc
2.4	04/10/2011	"A si" change in "SI"	Sedoc
2.3	28/07/2011	Change table page 3 and 4	Sedoc
2.2	07/06/2011	Change text, table page 2, 3, 5, 6, 7 and add NS100/160 page 4	Sedoc
2.1	20/06/2011	Change iSW-NA values in table page 5	Sedoc
2.0	19/05/2011	InDesign CS5-Change iSW-NA values in table page 5	Sedoc
1.2	10/05/2011	Add iSW, iSW-NA products	Sedoc
1.0	21/03/2011	Creation	Ameg
Indice	Date	Modification	Name