Control Panel Technical Guide

How to find the right circuit breaker and transfer switch for a genset

schneider-electric.com

Life Is On Schneider Electric

Standby power supply by generator set

Everything has been planned so that this will not happen…

If it is not controlled, the disappearance of the 'mains' power supply of a facility is an event with potentially serious consequences, endangering the occupants, disrupting critical activities and causing economic loss.
A standby generator set is the commonly adopted solution to temporarily supply power when the main source fails. An immediate and reliable service is expected, whatever happens to the electrical installation.

In this guide, important IEC design options that cannot be ignored

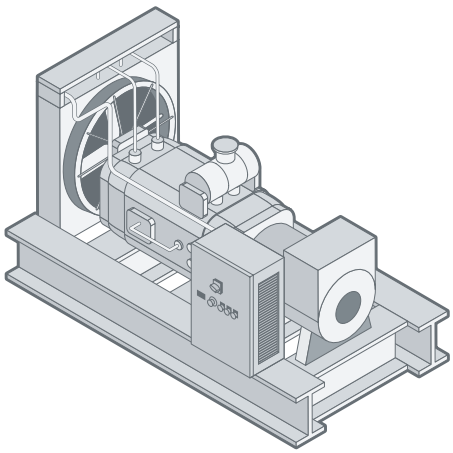
Apart from sizing the set's power, certain **technological options** are important with regard to reliability of service.

They concern, in particular:

> **Protecting of the set from electrical faults**

> **Mains/Generator switchover.**

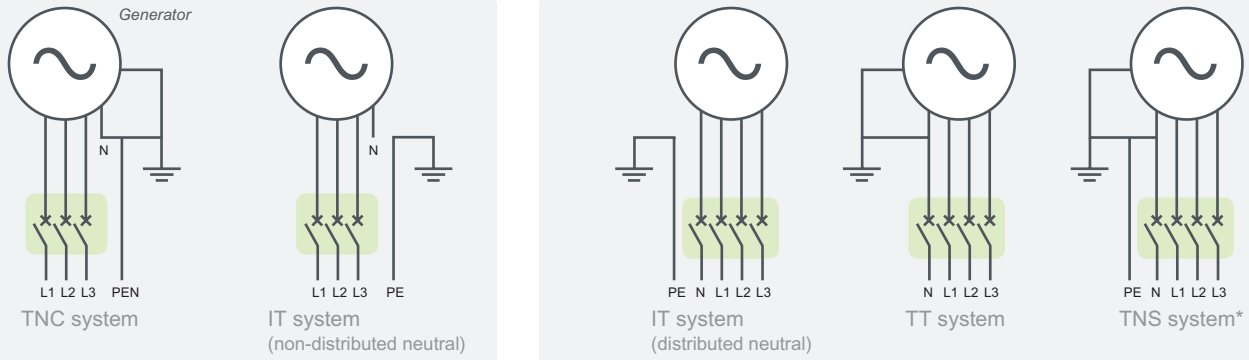
Summary



Generator set protection by circuit breaker

What you should know

Number of circuit breaker poles: 4-pole device recommended



** Neutral cutoff: preserves the operation of earth leakage protection devices*

Three-pole circuit breaker

Four-pole circuit breaker

When the earthing system is not known, the choice of a **four-pole circuit breaker** allows ex-post adaptation to all constraints (even if it means using it as a three-pole device in the case of a non-distributed neutral). The same reasoning will apply in choosing the transfer switching equipment.

Overload protection: choice of circuit breaker rating

Adjustable tripping threshold

The IEC 60364 installation rules require overload protection for cable between generator and installation.
However, the protection system is often determined according to the generator characteristics, when its resistance to overload is lower than that of the cable. Consequently, prefer a circuit breaker whose tripping threshold "Ir" is adjustable, to optimize protection.

ESP, PRP, LTP, COP rating categories

ISO-8528-1:2005 defines four generator set basic rating categories:

> Emergency Standby Power (ESP),
> Prime Power (PRP),
> Limited-Time Running Prime (LTP),
> Continuous Power (COP).

For each category, the generator set rating is determined by maximum allowable power output in relation to running time and load profile.

Allowance for max. power: PRP or LTP

The set's PRP (Prime Running Power) is the power available for a variable load, during an unlimited period. A 10% overload is permissible.

or

The set's LTP (Limited Time Running Power) is the power that it can supply for at most 500 hours per year at a constant load. No overload is permissible.

Rating (Ir)*: that corresponding to the current (In) for selected power or that immediately higher

**Ir for 40°C ambient temperature. 50°C: Ir + 5%; 60°C: Ir + 10%*

Example:

PRP = 70 kVA / 400 V ⟶ In: 100 A - possible overload 110 A
LTP = 77 kVA / 400 V ⟶ In: 110 A - overload prohibited

Schneider Electric circuit breaker Ir = 100 A:
- Non-tripping current limit 1.05 x Ir: 105 A
- Tripping < 2h 1.3 x Ir: 130 A

Protection: must be adapted to the generator operating characteristics

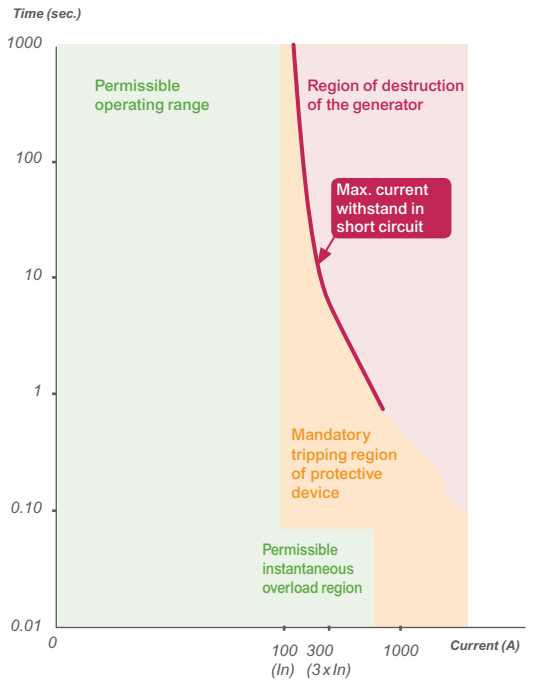
The characteristics define 3 types of situations depending on the current delivered by the generator:

> Normal situation: the max. current can be maintained for a long time

> Risk: the current may reach or exceed its overload value; the circuit breaker must open

> Destruction: the short-circuit current is destructive when it occurs for more than a few seconds.

The circuit breaker must be able to prevent damage to the generator by tripping on a low short-circuit current.



Example of chart of short-circuit resistance time – Generator with In = 100 A

Circuit breaker: with thermomagnetic or electronic tripping device?

Its tripping curve must be located in the mandatory tripping region.

Thermomagnetic tripping device

A circuit breaker with a low magnetic threshold (tripping at 3 x In) will protect better than a circuit breaker with a standard magnetic threshold (tripping between 5 and 10 x In).

Electronic tripping device

The electronic tripping device allows precision adjustment of its tripping curve according to the desired profile.

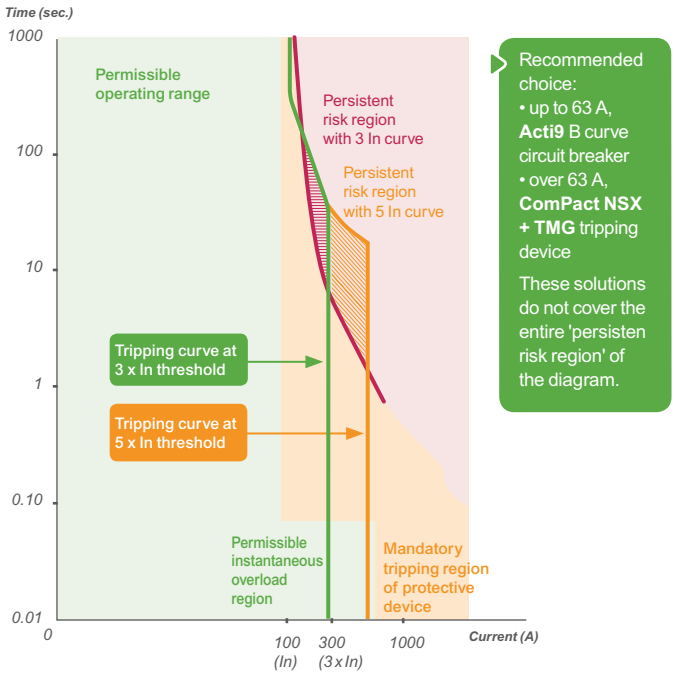


Illustration of persistent risk: with circuit breaker at 3 x In threshold, with 5 x In circuit breaker

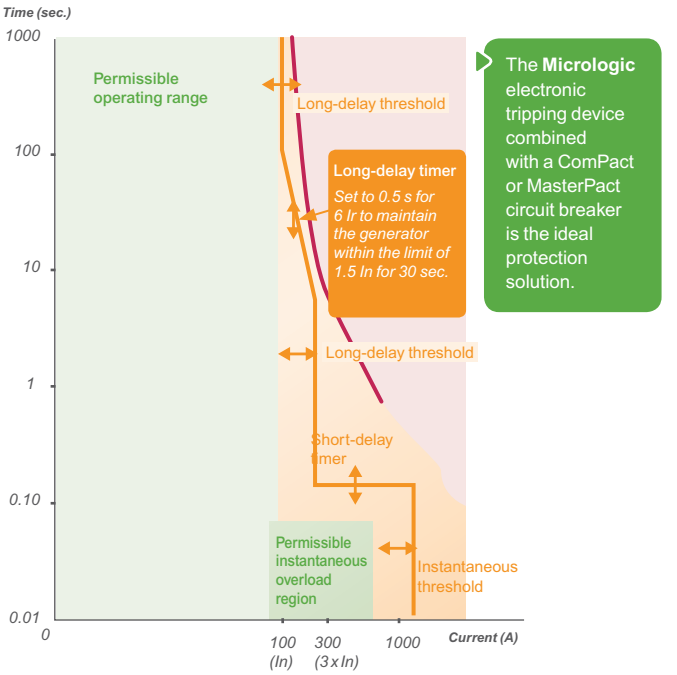


Illustration of the adjustable tripping curve: no risk region persists

Insulation fault protection system

What you should know

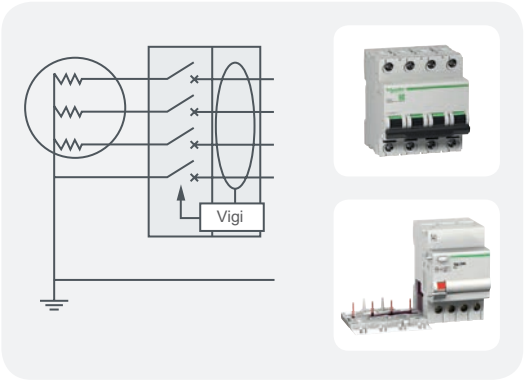
Protection by a Residual Current Device (RCD)

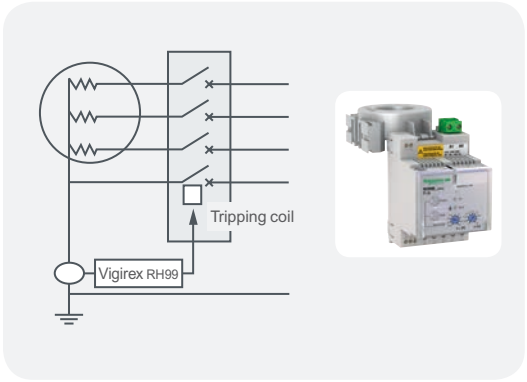
This is mandatory:
> in a TN system when the main circuit breaker does not trip fast enough in the event of a phase-to-earth fault (in particular with C curves or TM-D tripping devices: see previous chapter)
> in a TT system
> on mobile units

When the generator set is provided with power sockets, they must be protected by RCDs of 30 mA sensitivity.

Principle of RCDs

RCDs monitor any earth current leak. They are activated upon a fault exceeding a current threshold after a time lag. The threshold and the time lag can be adjustable.





'Vigi module' type RCD:

To be associated electrically and mechanically with a circuit breaker.

⊕ **Advantage:** no auxiliary power supply.

⊖ **Disadvantages:** size, less installation flexibility, commercial reference depending on the rating of the main circuit breaker.

'Residual current relay' type RCD:

This RCD, independent of the circuit breaker, measures the earth fault current by means of a current transformer placed on the neutral earthing of the generator. Its 'fault' output contact controls the tripping coil (MX or MN) of the main circuit breaker.

⊕ **Advantage:** one product reference and one size irrespective of the set's power.

⊖ **Disadvantages:** requires a tripping coil in the main circuit breaker and an auxiliary power supply.

RCDs are by definition very sensitive. Due to their position at the incoming end of the installation in the generator set, it is recommended to choose selective versions, of the 'S' type, with an adjustable time lag (when there is no information concerning the downstream installation).

Combination of RCD + circuit breaker

Installation rules such as IEC 60364 require checking the conformity of the time for automatic disconnection of the power supply in the event of a phase-to-earth fault.

In practice, setting the 'magnetic' threshold of a TMG tripping device to 3 x In or choosing a B-curve circuit breaker combined with an RCD offers satisfactory protection of the electrical installation.

The choice of a TMD tripping device or a C-curve circuit breaker combined with a RCD would, in the event of a short circuit, dramatically reduce the generator protection due to a longer response time even if it still contributes to human life protection.

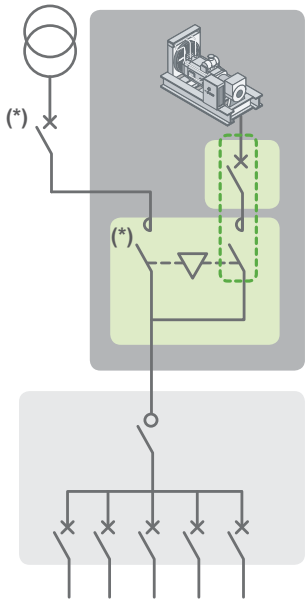
Transfer switching equipment

What you should know

Transfer switching equipt. classes as per IEC 60947-6-1	CB	PC	CC
Technology	Circuit breakers	Switches	Contactors
Short-circuit withstand	☑	⊟	☒
Breaking capacity in the event of a short circuit	Yes Without risk of contact welding	No Without risk of contact welding	No Risk of contact welding
Necessary coordination	-	With the circuit breaker upstream	
Selection criteria	Icu = ultimate breaking capacity Must be greater than the prospective short-circuit current of the installation	Iq = conditional short-circuit current of the combination circuit breaker + switch or contactor. Must be greater than the prospective short-circuit current of the installation	

Transfer switching equipment

Recommended solution up to 410 kVA



(*) Coordination of contactor (transfer-switch) and main source (Utility) protection device must be validated by electrical installation designer.

Contactors with electrical and mechanical interlocking

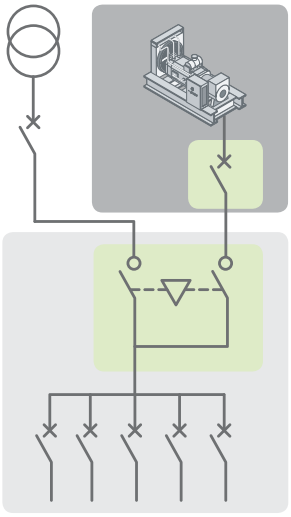
This CC class solution is economical.
The installation's safety is ensured by choosing a coordinated contactor + circuit breaker combination, but with no guarantee of absence of contact welding.

Selection of contactors according to the coordination table
The table on pages 12 and 13 shows coordinated contactor + circuit breaker combinations according to type 1, in accordance with the IEC 60947-4-1 standard, up to the breaking capacity of the upstream circuit breaker.

Type 1 coordination specifies that the effect of the short circuit on all coordinated products is safe for the operators.

Repair or replacement is needed to resume operation.

Recommended solution above 410 kVA



Circuit breaker + switch with electrical and mechanical interlocking integrated into the main LV switchboard

Since the transformer is generally near the main LV switchboard, this solution is optimized, and ensures good reliability:

> A single circuit breaker performs the functions of switchboard incoming end protection and 'Mains' source switching

> One switch is sufficient to ensure switching to the generator set

> The circuit breaker and switch have been designed to interface directly with an interlocking mechanism.

Savings can be achieved by using different ratings for Mains and Generator, when the generator set is sized for partial backup of the electrical installation.

Feasible combinations: Mains circuit breaker + Generator circuit breaker or switch

	Generator				
Mains	NSX100 NSX160 NSX250	NSX400 NSX630	NS630b NS1600	MTZ1	MTZ2 MTZ3
NSX100/160/250	✓				
NSX400 - 630	✓	✓			
NS630b… NS1600			✓		
MTZ1				✓	
MTZ2, MTZ3				✓	✓

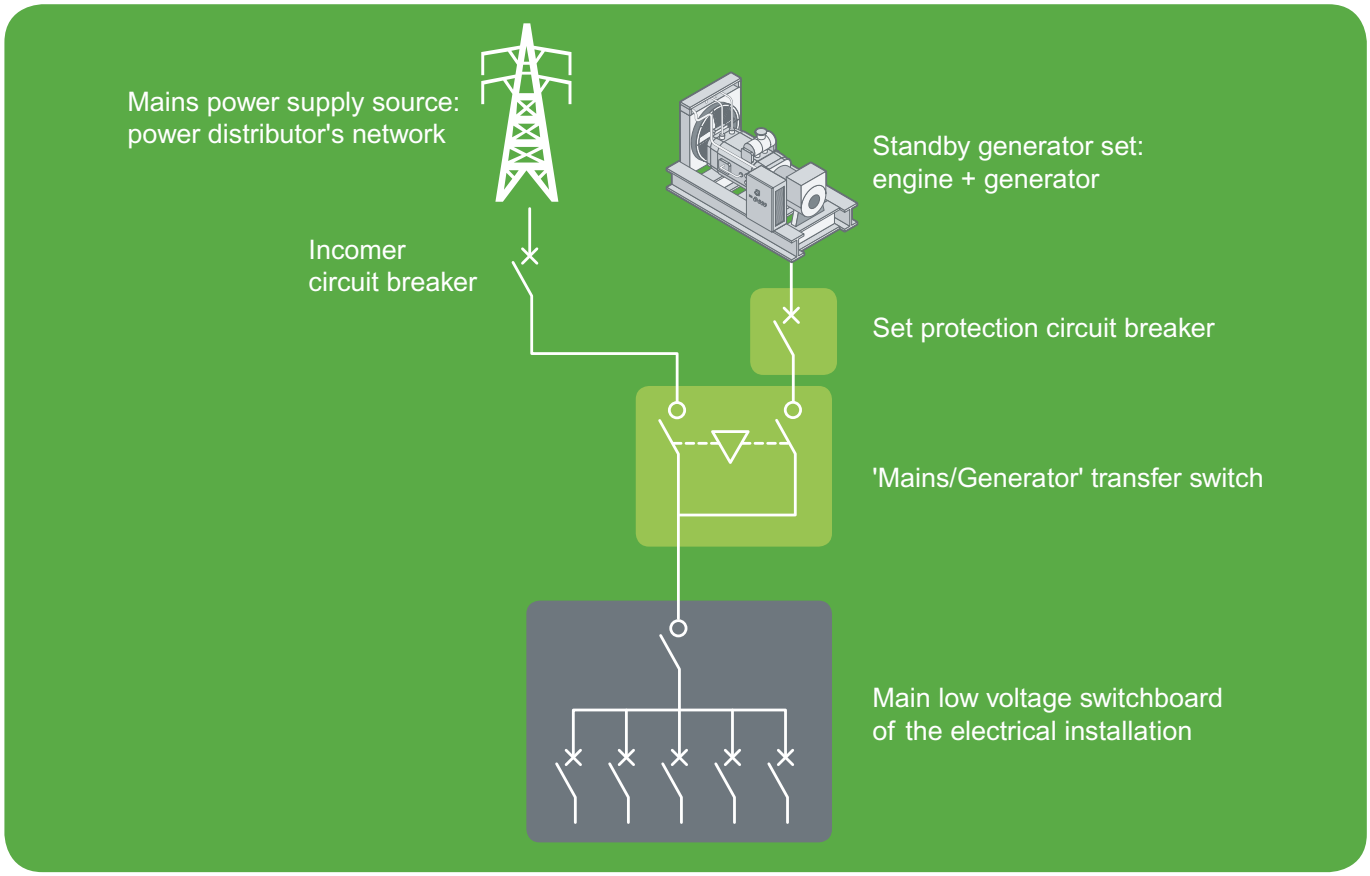
These combinations allow the use of an interlocking mechanism, irrespective of the size or rating of the devices.

Standby power supply for standard installations

Backup power supply is appreciated in case of power outage from the main supply (e.g. the Utility).

In this case, the generator supplies a selection of essential equipment.

Standby power supply for standard applications



What is expected

Typical concern for normal service application:

> Loads supply for a limited period of time

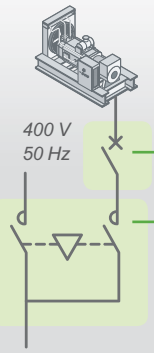
> Technically/economically optimized solution.

The Genset is used as a backup source in case of power outage (usually the Grid).

A transfer switch is needed (open transition).

Quick component selection table

Standby
Standard



> Generator sets up to 45 kVA

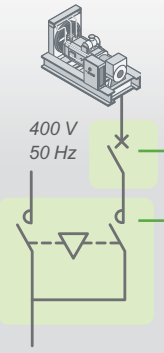
Generator			Circuit breaker (1)			Transfer switching equipment (2)
Power		**Current**	**Curve**	**Rating**	**Type**	**CC class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)		(A)		Reference (3)
10	11	**15**	B	16	Mutli9 C60N 16A – B (M9F10416) + Vigi or RH	EasyPact TVS - **LC1E09**
15	16.5	**22**	B	25	Mutli9 C60N 25A – B (M9F10425) + Vigi or RH	EasyPact TVS - **LC1E09**
20	22	**29**	B	32	Mutli9 C60N 32A – B (M9F10432) + Vigi or RH	EasyPact TVS - **LC1E18**
25	27.5	**37**	B	40	Mutli9 C60N 40A – B (M9F10440) + Vigi or RH	EasyPact TVS - **LC1E25**
27	30	**39**	B	40	Mutli9 C60N 40A – B (M9F10440) + Vigi or RH	EasyPact TVS - **LC1E25**
32	35.2	**47**	B	50	Mutli9 C60N 50A – B (M9F10450) + Vigi or RH	EasyPact TVS - **LC1E32**
35	38.5	**51**	B	50	Mutli9 C60N 50A – B (M9F10450) + Vigi or RH	EasyPact TVS - **LC1E38**
40	45	**58**	B	63	Mutli9 C60N 63A – B (M9F10463) + Vigi or RH	EasyPact TVS - **LC1E40**

*(1) Circuit breakers in accordance with the IEC 60947-2 standard – **for a 40°C environment (for 60°C, derate by 10%)***
Vigi = Residual Current Device; RH = Residual Current protection relay
(2) Transfer switching equipment in accordance with the IEC 60947-6-1 standard - Two devices of this type are needed, with mechanical and electrical interlocking
(3) Each reference must be completed by a coil voltage code > see details on page 15

⚠ *CC type transfer switching equipt: selectivity not guaranteed for tripping of a downstream CB; contactor welding possible upon short circuit.*

Standby
Standard

> Generator sets up to 450 kVA



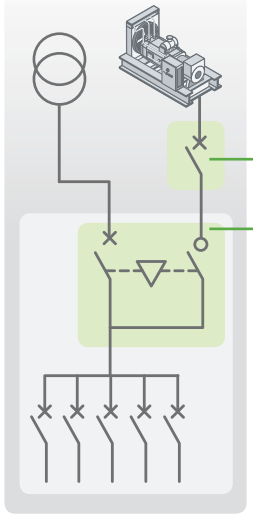
Generator			Circuit breaker (1)			Transfer switching equipment (2)
Puissance		**Current**	**Curve**	**Rating**	**Type**	**CC class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)		(A)	Reference	Reference (3)
45	50	**65**	TM-G	80	EasyPact CVS100B + TM-G 80 4P: **LV510748**	EasyPact TVS - **LC1E65••**
50	55	**73**	TM-G	80	EasyPact CVS100B + TM-G 80 4P: **LV510748**	EasyPact TVS - **LC1E65••**
60	66	**87**	TM-G	100	EasyPact CVS100B + TM-G 100 4P: **LV510749**	EasyPact TVS - **LC1E80••**
70	77	**101**	TM-G	100	EasyPact CVS100B + TM-G 100 4P: **LV510749**	EasyPact TVS - **LC1E80••**
80	90	**116**	TM-G	160	EasyPact CVS160B + TM-G 160 4P: **LV516743**	EasyPact TVS - **LC1E95••**
90	100	**130**	TM-G	160	EasyPact CVS160B + TM-G 160 4P: **LV516743**	EasyPact TVS - **LC1E120••** (4)
105	116	**152**	TM-G	160	EasyPact CVS160B + TM-G 160 4P: **LV516743**	EasyPact TVS - **LC1E120••** (4)
125	138	**181**	TM-G	200	EasyPact CVS250B + TM-G 200 4P: **LV525742**	EasyPact TVS - **LC1E160••** (4)
135	150	**195**	TM-G	200	EasyPact CVS250B + TM-G 200 4P: **LV525742**	EasyPact TVS - **LC1E160••** (4)
150	165	**217**	TM-G	250	EasyPact CVS250B + TM-G 250 4P: **LV525743**	EasyPact TVS - **LC1E200••** (4)
165	175	**239**	TM-G	250	EasyPact CVS250B + TM-G 250 4P: **LV525743**	EasyPact TVS - **LC1E200••** (4)
180	203	**260**	Adj.	400	EasyPact CVS400F + ETS 2.3 400A 4P: **LV540506**	EasyPact TVS - **LC1E300••** (4)
200	223	**289**	Adj.	400	EasyPact CVS400F + ETS 2.3 400A 4P: **LV540506**	EasyPact TVS - **LC1E300••** (4)
250	275	**361**	Adj.	400	EasyPact CVS400F + ETS 2.3 400A 4P: **LV540506**	EasyPact TVS - **LC1E400••** (4)
280	300	**405**	Adj.	400	EasyPact CVS400F + ETS 2.3 400A 4P: **LV540506**	EasyPact TVS - **LC1E400••** (4)
315	341	**455**	Adj.	630	EasyPact CVS630F + ETS 2.3 630A 4P: **LV563506**	EasyPact TVS - **LC1E400••** (4)
365	420	**527**	Adj.	630	EasyPact CVS630F + ETS 2.3 630A 4P: **LV563506**	EasyPact TVS - **LC1E500••** (4)
410	450	**592**	Adj.	630	EasyPact CVS630F + ETS 2.3 630A 4P: **LV563506**	EasyPact TVS - **LC1E500••** (4)

*(1) Circuit breakers in accordance with the IEC 60947-2 standard – **for a 40°C environment (for 60°C, derate by 10%)***
The addition of a residual current protection relay to the circuit breaker is recommended:
> Integrated RCD: MH vigi module for Easypact CVS 100 and CVS 160 (LV429211), MH Vigi module for CVS 250 (LV431536) and MB vigi module for CVS 400 and CVS 630 (LV432456)
> Separate RCD: Vigirex RH21.
(2) Transfer switching equipment in accordance with the IEC 60947-6-1 standard - Two devices of this type are needed, with mechanical and electrical interlocking
(3) Each reference must be completed by a coil voltage code > see details on page 15
(4) LC1E120 ... LC1E500 contactor references are only available in 3 poles configuration. For a 4-poles configuration, choose from the TeSys F product range

⚠ *CC type transfer switching equipt: selectivity not guaranteed for tripping of a downstream CB; contactor welding possible upon short circuit.*

Quick component selection table

Standby
Standard



> Generator sets over 450 kVA

ComPact NS EasyPact MVS

Generator			Circuit breaker (1)			Transfer switching equipment (2)
Power		**Current**	**Curve**	**Rating**	**Type**	**CB class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)		(A)		
455	500	**657**	Adj.	800	ComPact NS800N + Micrologic 5.0: **33337**	**CB class transfer switching equipment recommended in main LV switchboard**
500	570	**722**	Adj.	800	ComPact NS800N + Micrologic 5.0: **33337**	
550	600	**794**	Adj.	800	ComPact NS800N + Micrologic 5.0: **33337**	
600	660	**866**	Adj.	1000	ComPact NS1000N + Micrologic 5.0: **33347**	
660	725	**953**	Adj.	1000	ComPact NS1000N + Micrologic 5.0: **33347**	
725	800	**1047**	Adj.	1250	ComPact NS1250N + Micrologic 5.0: **33357**	
800	880	**1155**	Adj.	1250	ComPact NS1250N + Micrologic 5.0: **33357**	
880	960	**1271**	Adj.	1600	ComPact NS1600N + Micrologic 5.0: **33367**	
910	1000	**1314**	Adj.	1600	ComPact NS1600N + Micrologic 5.0: **33367**	
1000	1100	**1444**	Adj.	1600	ComPact NS1600N + Micrologic 5.0: **33367**	
1250	1375	**1805**	Adj.	2000	EasyPact MVS 20 H - ET5S + RH	
1350	1485	**1949**	Adj.	2000	EasyPact MVS 20 H - ET5S + RH	
1500	1650	**2166**	Adj.	2500	EasyPact MVS 25 H - ET5S + RH	

(1) Circuit breakers in accordance with the IEC 60947-2 standard
(2) Transfer switching equipment in accordance with the IEC 60947-6-1 standard - Two devices of this type are needed, with mechanical and electrical interlocking

The addition of a residual current protection relay to the circuit breaker is recommended:
> Vigirex RH21.

Coding of Easypact TVS (LC1E••) contactor references

LC1E ●●● ●●● ● ●

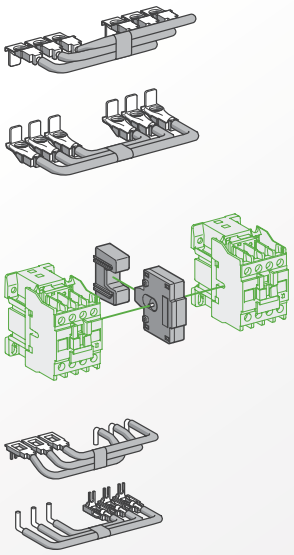
Frequency	Code
50 Hz	5
60 Hz	6
50/60 Hz	7

Coil voltage	Code
24 V	B
48 V	E
110 V	F
220 V	M
240 V	U
380 V	Q
415 V	N
440 V	R

Rated operation current (AC3)	Auxiliary contact configuration	Code
EasyPact TVS 3-pole		
06… 38	1NO (or 1 NC)	01 (or 10)
40… 160	1NO +1 NC	none
200… 630	no auxiliary contact	none
Rated operation current (AC3)	**Main contact**	**Code**
EasyPact TVS 4-pole		
06… 95	4NO	004
06… 95	2NO + 2NC	008

Rated operation current (AC3)	Code
EasyPact TVS 3-pole	
06… 630	06… 630
EasyPact TVS 4-pole	
06… 95	06… 95

Type	Designation
Contactor	EasyPact TVS



Accessories for interlocked contactor assembly

Contactors with screw clamp terminals

Using 2 identical contactors	Set of power connections Reference	Mechanical interlock Reference
Mechanical interlock		
LC1E06...E12	**LAEP1**	**LAEM1**
LC1E18/E25	**LAEP12**	**LAEM1**
LC1E32/E38	**LAEP2**	**LAEM1**
LC1E40...E65	**LAEP3**	**LAEM1**
LC1E80/E95	**LAEP4**	**LAEM4**
LC1E120/E160	– (DIY) (1)	**LAEM5**
LC1E200/E250	– (DIY) (1)	**LAEM6**
LC1E300	– (DIY) (1)	**LAEM7**
LC1E400	– (DIY) (1)	**LAEM7**
LC1E500	– (DIY) (1)	**LAEM7**
LC1E630	– (DIY) (1)	**LAEM8**

(1) DIY: Do It Yourself.

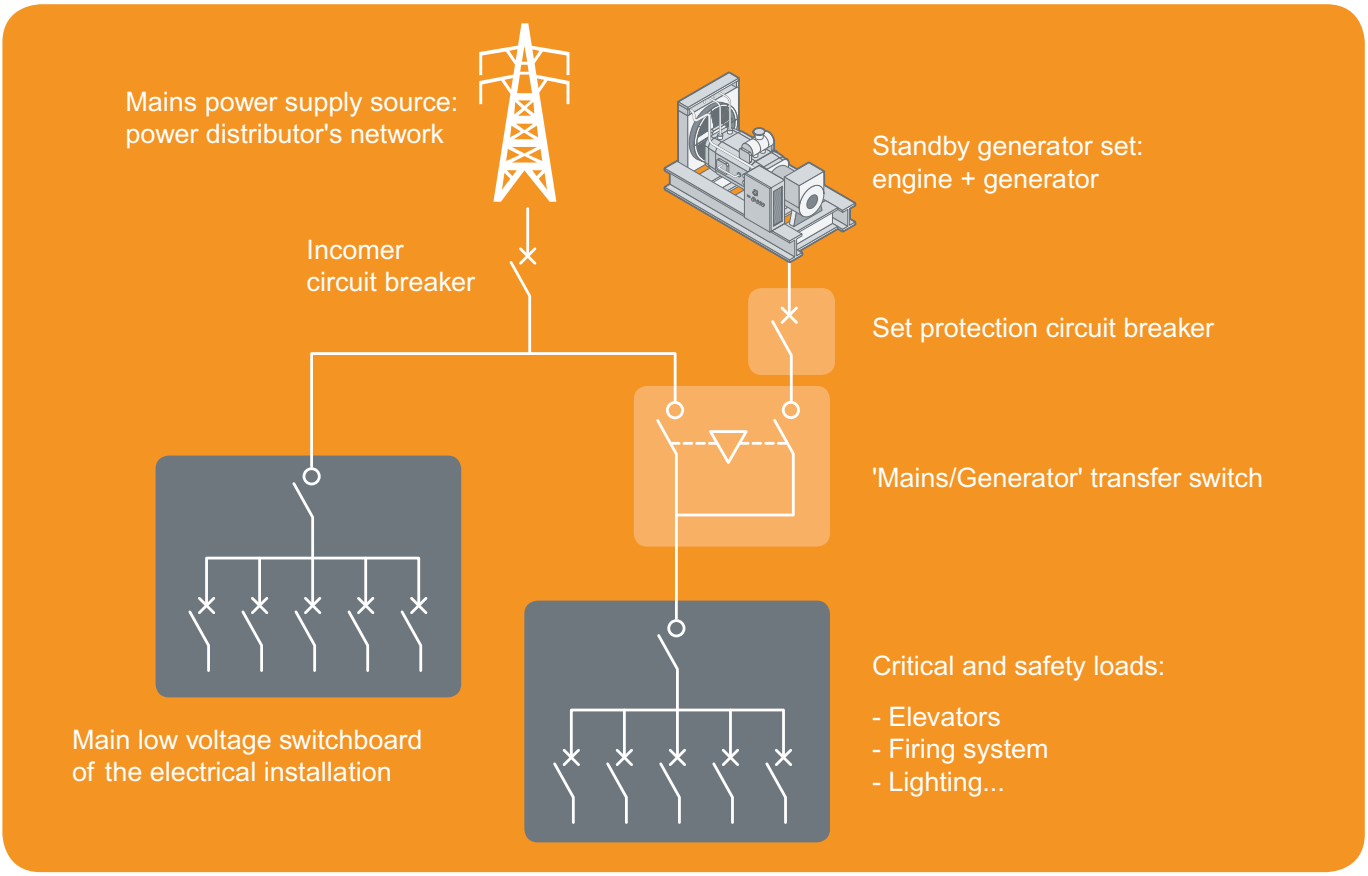
Standby power supply for safety installations

Permanence of the power supply can be important to maintain the safety of building users in the event of a mains failure.

In that case the generator source powers the lighting of areas used for evacuation, smoke extractors, elevators reserved for emergency responders, etc.

Additional requirements apply to generator sets in this case (appended: IEC 60364-5-56)

Standby power supply for safety applications



What is expected

The Genset shall provide power supply to the critical equipments and life safety systems in case of power outage (safety lighting, smoke extractors, elevators...).

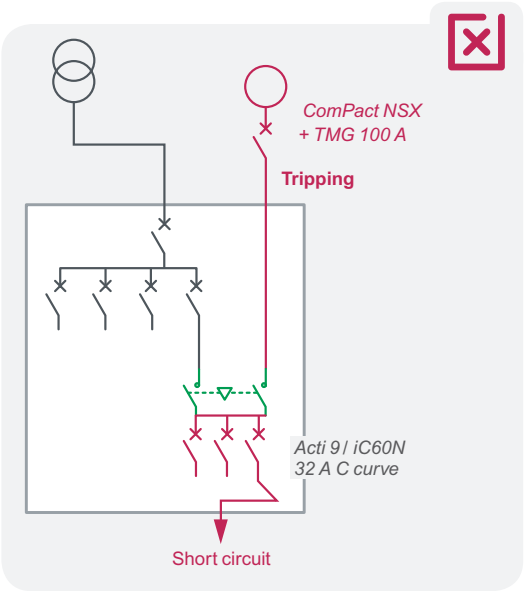
Typical concerns for safety services application:

> Local regulation requirements
> Selective electrical protection
> High reliability and periodic tests requested
> Need for a transfer switch (open transition)

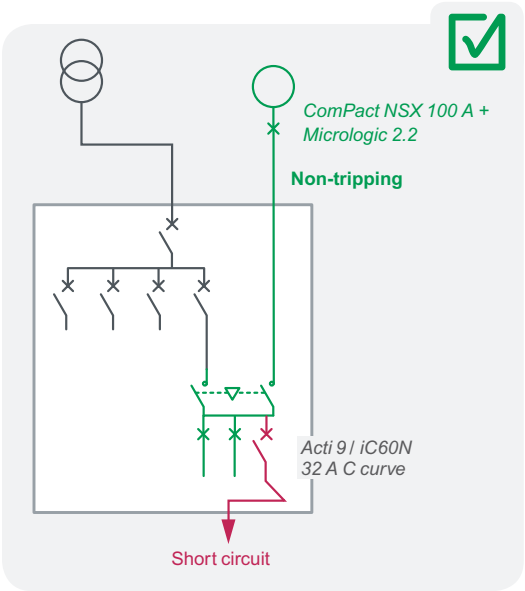
Standby power supply for safety installations

> Selectivity requirement: only the circuit breaker closest to the electrical fault should trip

Transfer switching equipment's impact on selectivity



The ComPact NSX circuit breaker with TMG 100 A thermomagnetic tripping device does not allow selectivity with the Acti9 iC60N C-curve circuit breaker.



The ComPact NSX circuit breaker with Micrologic 2.2 electronic tripping device allows selectivity with the Acti9 iC60N C-curve circuit breaker

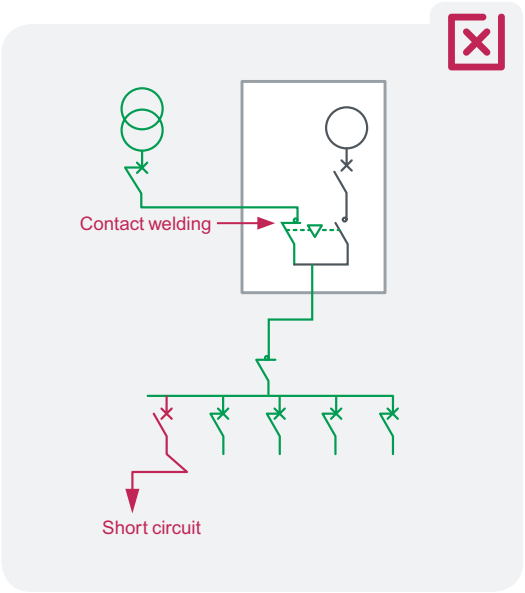
Selectivity is also required:

> between the circuit breakers and the Mains power circuit breaker;

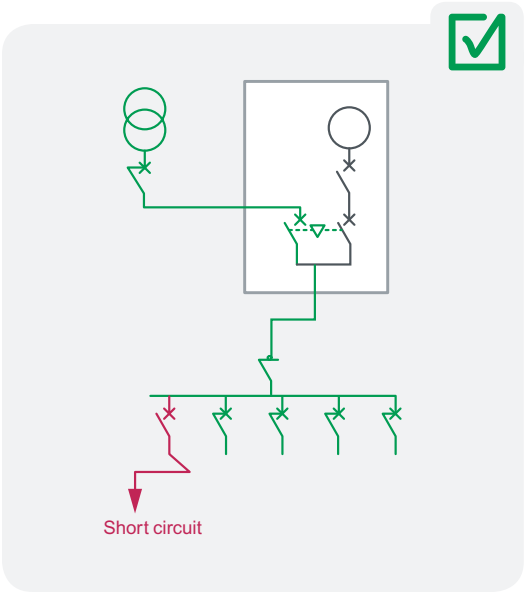
> between RCDs.

Safety requirement: the transfer switching equipment must withstand short-circuit currents without any damage

Transfer switching equipment's impact on safety



Transfer switching equipment with contactors:
A short circuit in the installation is likely to cause welding of the Mains contactor contacts.
Switchover to the generator set will becomes impossible.



Transfer switching equipment with circuit breakers (= class CB) or switches (= class PC)

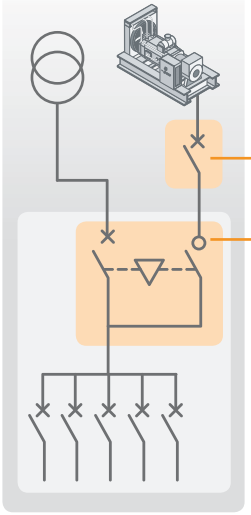
Safe switchover to the generator set, without risk of contact welding.

The coordination study of the various protection and switching devices must be performed for the complete installation in accordance with the IEC 60364-5-56 standard.

Integration of the transfer switching equipment in the main LV switchboard facilitates consistent electrical studies.

Standby power supply for safety installations

Standby
Safety



> Generator sets up to 410 kVA

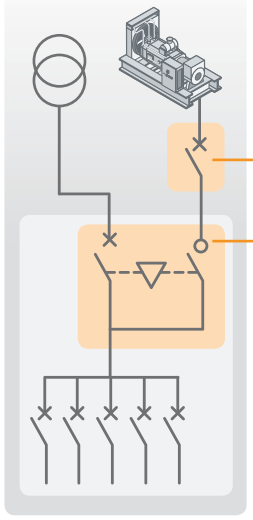
Integration of the transfer switching equipment in the Main Low Voltage Switchboard is the preferred solution.

Generator			Circuit breaker (1)		Transfer switching equipment (2)
Power		**Current**	**Rating**	**Type**	**CB class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)	(A)		
45	50	**65**	80	ComPact NSX 100B + Micrologic 2.2: **LV429785**	
50	55	**73**	80	ComPact NSX 100B + Micrologic 2.2: **LV429785**	
60	66	**87**	100	ComPact NSX 100B + Micrologic 2.2: **LV429785**	
70	77	**101**	100	ComPact NSX 100B + Micrologic 2.2: **LV429785**	
80	90	**116**	125	ComPact NSX 160B + Micrologic 2.2: **LV430750**	
90	100	**130**	160	ComPact NSX 160B + Micrologic 2.2: **LV430750**	
105	116	**152**	160	ComPact NSX 160B + Micrologic 2.2: **LV430750**	
125	138	**181**	200	ComPact NSX 250B + Micrologic 2.2: **LV431150**	
135	150	**195**	200	ComPact NSX 250B + Micrologic 2.2: **LV431150**	**CB class transfer switching equipment recommended in main LV switchboard**
150	165	**217**	250	ComPact NSX 250B + Micrologic 2.2: **LV431150**	
165	175	**239**	250	ComPact NSX 250B + Micrologic 2.2: **LV431150**	
180	203	**260**	400	ComPact NSX 400F + Micrologic 2.3 400 A: **LV432677**	
200	223	**289**	400	ComPact NSX 400F + Micrologic 2.3 400 A: **LV432677**	
250	275	**361**	400	ComPact NSX 400F + Micrologic 2.3 400 A: **LV432677**	
280	300	**405**	400	ComPact NSX 400F + Micrologic 2.3 400 A: **LV432677**	
315	341	**455**	630	ComPact NSX 630F + Micrologic 2.3 630 A: **LV432877**	
365	420	**527**	630	ComPact NSX 630F + Micrologic 2.3 630 A: **LV432877**	
410	450	**592**	630	ComPact NSX 630F + Micrologic 2.3 630 A: **LV432877**	

(1) Circuit breakers in accordance with the IEC 60947-2 standard – the addition of a residual current protection relay is recommended
(2) Transfer switching equipment in accordance with the IEC 60947-6-1 standard - Two devices of this type are needed, with mechanical and electrical interlocking

RCD: if used it should be chosen to ensure selectivity:
> Integrated RCD: ComPact NSX with embedded earth leakage protection (Micrologic 4 or Micrologic 7E including metering)
> Separate RCD: Vigirex RH99.

Standby
Safety



> Generator sets over 450 kVA

Generator			Circuit breaker (1)			Transfer switching equipment (2)
Power		**Current**	**Curve**	**Rating**	**Type**	**CB class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)	(A)	(A)		
455	500	**657**	Adj.	800	ComPact NS800N + Micrologic 5.0: **33337**	**CB class transfer switching equipment recommended in main LV switchboard**
500	570	**722**	Adj.	800	ComPact NS800N + Micrologic 5.0: **33337**	
550	600	**794**	Adj.	800	ComPact NS800N + Micrologic 5.0: **33337**	
600	660	**866**	Adj.	1000	ComPact NS1000N + Micrologic 5.0: **33347**	
660	725	**953**	Adj.	1000	ComPact NS1000N + Micrologic 5.0: **33347**	
725	800	**1047**	Adj.	1250	ComPact NS1250N + Micrologic 5.0: **33357**	
800	880	**1155**	Adj.	1250	ComPact NS1250N + Micrologic 5.0: **33357**	
880	960	**1271**	Adj.	1600	ComPact NS1600N + Micrologic 5.0: **33367**	
910	1000	**1314**	Adj.	1600	ComPact NS1600N + Micrologic 5.0: **33367**	
1000	1100	**1444**	Adj.	1600	ComPact NS1600N + Micrologic 5.0: **33367**	
1250	1375	**1805**	Adj.	2000	MasterPact MTZ2 20 H1 - Micro 5.0X	
1350	1485	**1949**	Adj.	2000	MasterPact MTZ2 20 H1 - Micro 5.0X	
1500	1650	**2166**	Adj.	2500	MasterPact MTZ2 25 H1 - Micro 5.0X	

(1) Circuit breakers in accordance with the IEC 60947-2 standard – the addition of a residual current protection relay is recommended
(2) Transfer switching equipment in accordance with the IEC 60947-6-1 standard - Two devices of this type are needed, with mechanical and electrical interlocking

RCD: if used it should be chosen to ensure selectivity:
> Integrated RCD: Micrologic 7.0
> Separate RCD: Vigirex RH99.

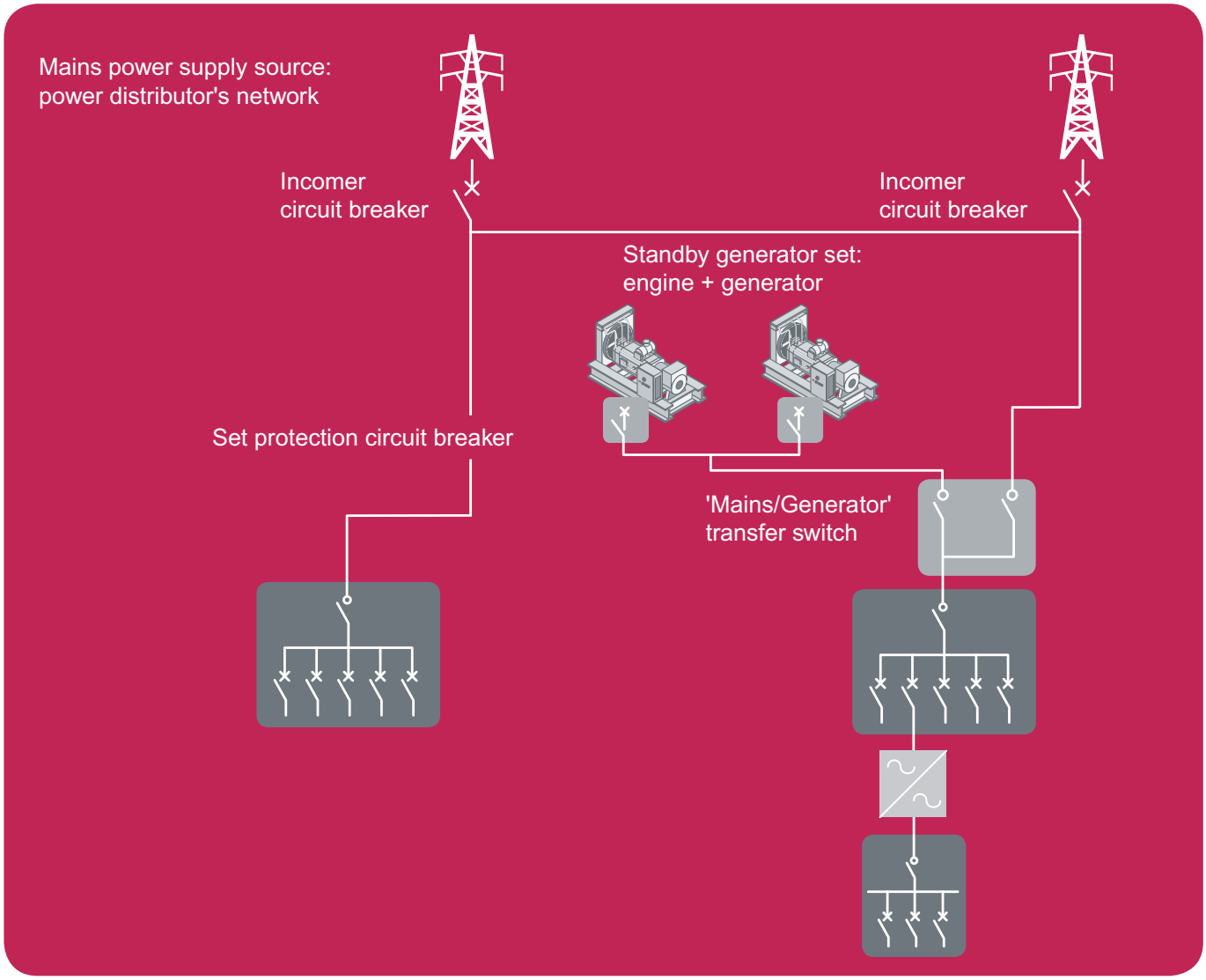
Standby power supply for mission critical installations

A reliable power supply is critical to ensure uninterrupted surgical operations, breathing assistance systems, premature infant care, etc.

Power failure to certain industrial processes has serious consequences.

Like those of safety installations (reliability, selectivity), the characteristics of these installations are also enhanced: redundant standby sources, test modes, parallel connection of sources, etc.

Standby power supply for mission critical installations



What is expected

The Genset shall provide power supply to the critical loads and life safety systems in case of power outage from the main supply (Grid).

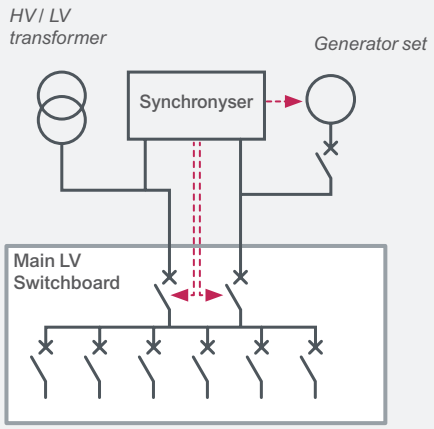
Typical concerns for critical mission application:

> Regulatory requirements related to building activity (e.g. hospital)
> Selective electrical protection
> Continuity of service
> High reliability and periodic tests requested
> Architectures allowing operating redundancy
> Need for a transfer switch (could be open, close or soft transition).

The design of the backup power supply through generator sets is generally managed by the design engineering company in charge of the design for the project.

Indeed each project is different and has its own specificities according to final application (hospital, data center…) and geographical locations, generator sets can be redundant, operates in parallel with the Grid, be centralized in medium voltage… so no selection table is given in this section as all case studies are different.

Source changeover without outage



Specific constraints for choosing the generator circuit breaker and transfer switching equipment:

> They must resist the maximum short-circuit current from main source or generator

> They allow total selectivity

> The transfer switching equipment does not prevent simultaneous closing of the two electrical paths (main/backup).

There are solutions that can limit the impact of cutoffs during switching:

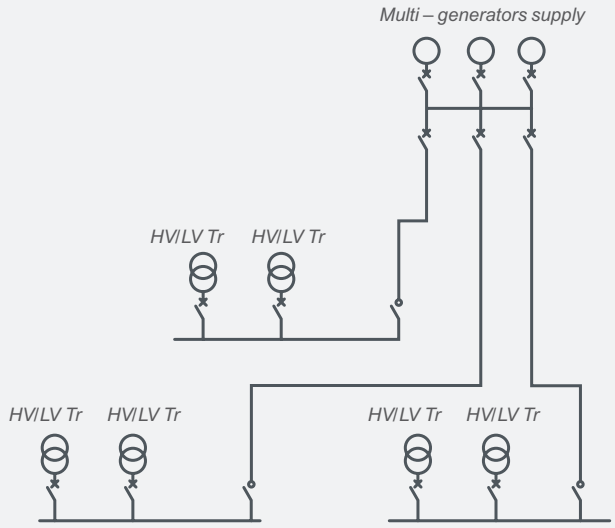
> during scheduled cutoffs of the Mains source

> during generator set tests

> upon return to the Mains source

One of the solutions is coupling of the generator set for a period of time in parallel with the main source (Grid).

High power or very high availability



Source changeover types:

> Open transition: transition where the changeover from one source to the other is done sequentially without overlap. Interlocks are implemented between the 2 sources.

> Close transition: transition where the changeover from one source to the other is done with short overlap (< 100-300 ms) meaning both sources operating in parallel during a short period of time.

> Soft transition: transition where the changeover from one source to the other is done with longer overlap (few seconds to 1 min) meaning both sources operating in parallel to enable Genset load ramp up or down.

Parallel coupling of generator sets is used to increase the standby power or to get redundancy in case of unavailability of a generator (maintenance, malfunction, etc.).

Note: *specific constraints for choosing generator circuit breakers:*

> They must resist the sum total of short-circuit currents of the generator sets + possibly the main source (if main and backup sources are used in parallel)

> They do not prevent parallel operation of the generator sets (no interlocking)

> They allow total selectivity with the downstream protective devices

Recommended products for generator set applications

Circuit breakers, for protection of generators and cables

Multi9 iC60

ComPact NSX

ComPact NS

EasyPact CVS

EasyPact MVS

MasterPact MTZ

Residual current devices, for protection of human life

Multi9 Vigi C60

ComPact NSX ELCB

Vigirex

Transfer switching equipment

EasyPact TVS

CB type: ComPact NSX

Recommended products for generator set applications

Buttons, indicators, emergency stop switch

Harmony range

Scan or click on QR code to discover the catalog

Measuring equipment

PowerLogic Voltmeters and ammeters

PowerLogic multi-function metering

PowerTag sensors for Acti9 circuit breakers

Scan or click on QR code to discover the PowerLogic catalog

Auxiliary circuit monitoring and motor control

Zelio control relays

TeSys motor control and protection components

Scan or click on QR code to discover TeSys catalog

Scan or click on QR code to discover Zelio catalog

Enclosures and thermal management

Spacial

ClimaSys

Scan or click on QR code to discover the Universal Enclosures catalog

Industrial power sockets

Pratika

Scan or click on QR code to discover the Pratika industrial plugs and sockets catalog

MV transformers, switchgears

Trihal

Minera

Premset

SM6

Life Is On | Schneider Electric

Schneider Electric Industries SAS

35, rue Joseph Monier
CS 30323
92506 Rueil Malmaison Cedex (France)

RCS Nanterre 954 503 439
Capital social 896 313 776 €
www.schneider-electric.com

07-2019
CPTG012_EN

This document has been printed on recycled paper.