Control Panel Technical Guide

How to choose the circuit breaker and transfer switch for a generator set

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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.

Standby Power Supply by Generator Set

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

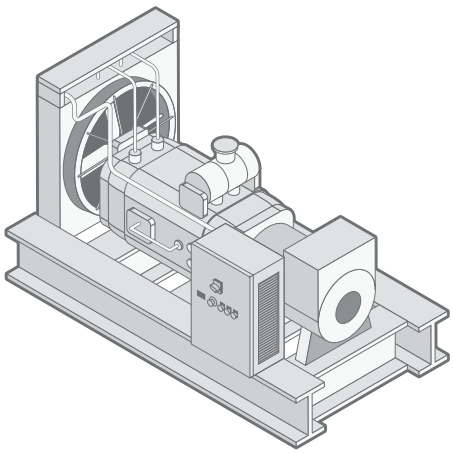
Apart from sizing the set's power, certain **technological options** are important with regard to reliability of service.

They concern, in particular:

> Protecting of the set from electrical faults

> Mains/Generator switchover.

Summary



Design

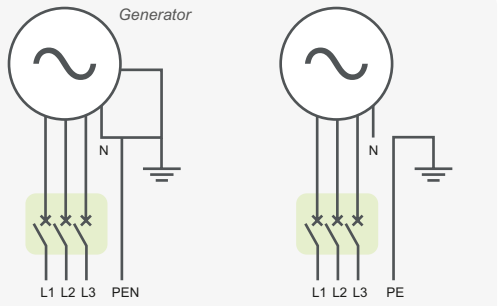
Typical Applications

Recommendations

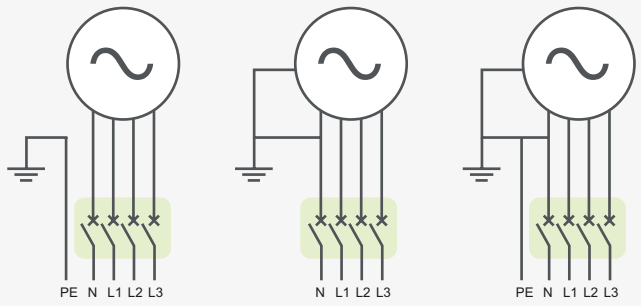
Generator Set Protection by Circuit Breaker

What You Should Know

Number of Circuit Breaker Poles: 4-Pole Device Recommended



Three-pole circuit breaker



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

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

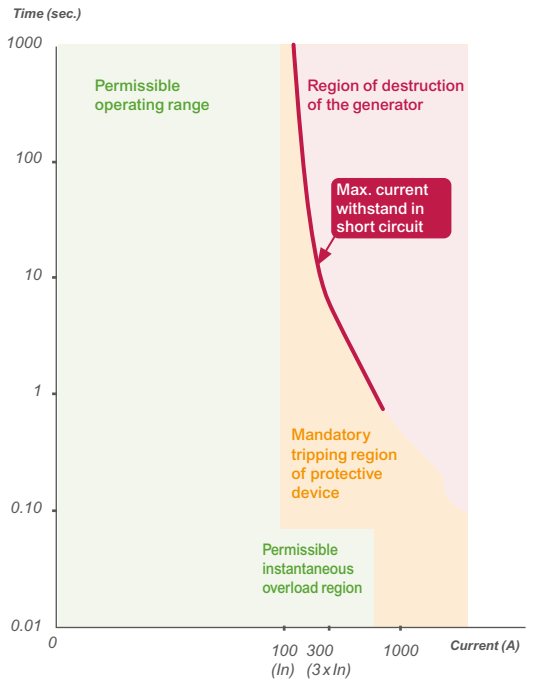
The characteristics define 3 types of situations depending on the current delivered by the generator:

> 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.

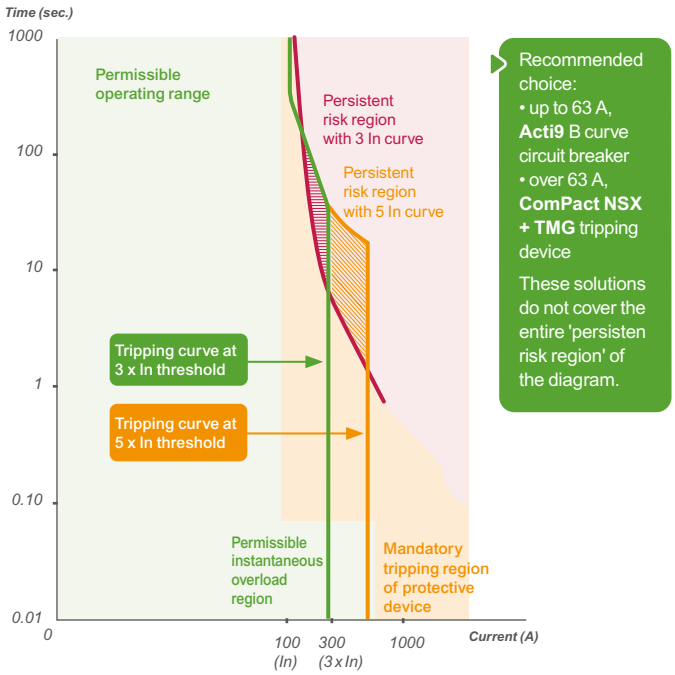


Illustration of persistent risk: with circuit breaker at 3 x In threshold, with 5 x In circuit breaker

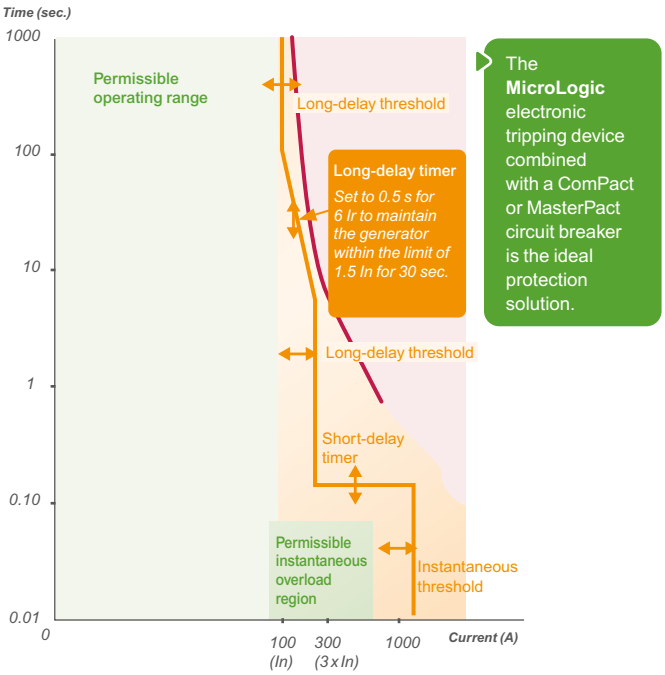


Illustration of the adjustable tripping curve: no risk region persists

Insulation Fault Protection System

What You Should Know

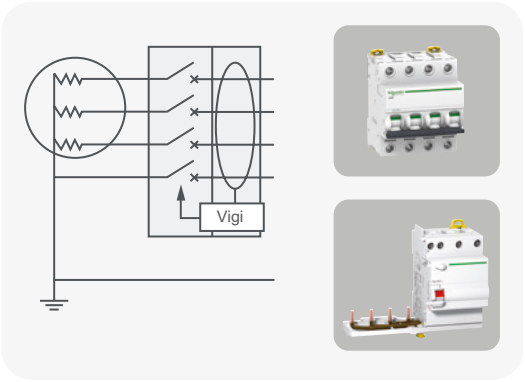
Protection by a Residual Current Device (RCD)

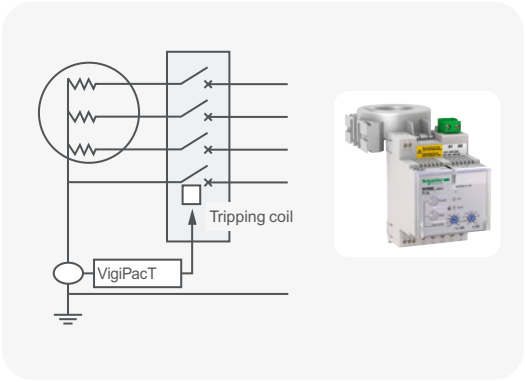
This is mandatory:
> in a TN system when the main circuit breaker does not trip fast enough in the event of a phase-to-earth fault (in particular with C curves or TM-D tripping devices: see previous chapter)
> in a TT system
> on mobile units

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.

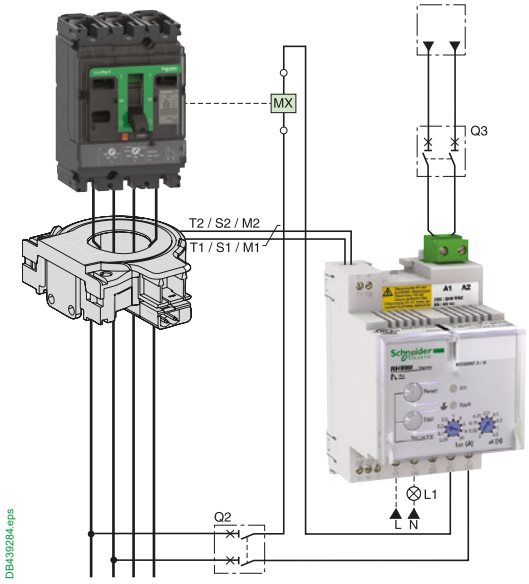
We offer a complete and consistent range of RCDs

> Either integrated in the electronic MicroLogic trip unit

ComPacT NSXm MicroLogic Vigi 4.1

ComPacT NSX and MicroLogic 4 and 7

> Or able to be installed externally with any kind of thermomagnetic trip unit. RCD acting on opening coils in this case to operate the circuit breaker.



ComPacT NSX with VigiPacT external relay and toroid

ComPacT NSX and VigiPacT add-on

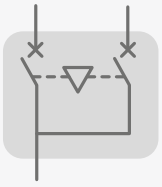
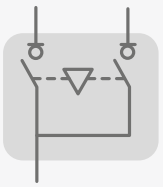
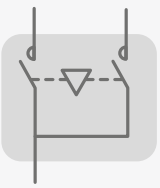
Transfer Switching Equipment

What You Should Know

Remote-operated source-changeover system

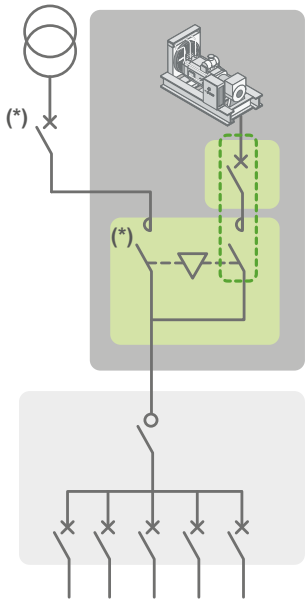
TransfertPacT automatic

Changeover contactor assembly with TeSys Giga

Transfer switching equipment classes as per IEC 60947-6-1	CB	PC	CC
Technology	Circuit Breakers 	Switches 	Contactors 
	☑	☑	☑
Short circuit protection	**Embedded**	**By SCPD** Ensured by coordination with upstream Short- Circuit Protective Device (SCPD)	**By SCPD** Ensured by coordination with upstream Short-Circuit Protective Device (SCPD). Risk of contact welding in type 2 coordination
Coordination table	Refer to complementary technical guide (LVPED318033EN)		
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. Iq must be equal or greater than the prospective short-circuit current of the installation	

Transfer Switching Equipment

Recommended Solution up to 450 kVA



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

Automatic Transfer Switch (PC Class)

Or Contactors with electrical and mechanical interlocking (CC class)

Two main solutions are recommended for installations up to 450kVA.
In both cases, a suitable coordination must be chosen to ensure short-circuit protection of the transfer switching device, see the tables provided in the following pages. For more information, see also the Complementary Technical Guide LVPED318033EN. Complete information available within complementary technical guide.

o The PC class solution is available with TransferPacT automatic and active automatic offers. Up to 630A.

o The CC class solution is economical, ensured by contactors. Two types of coordination are available, based on IEC 60947-4-1 standard
> Type 1: under short-circuit conditions, the contactor or starter shall cause no danger to persons or installation and may not be suitable for further service without repair and replacement of parts
> Type 2: under short-circuit conditions, the contactor shall cause no danger to persons or installation and shall be suitable for further use. The risk of contact welding is recognized. Measures to be taken as regards the maintenance of the equipment are available from Schneider-Electric services. This type 2 coordination brings better service continuity.

TA16DALI6047PE-ISO.png

TransfertPacT active automatic

LC2DT40M7_Image.png

Changeover contactor assembly with TeSys Deca

Giga_4P_std_interlock_changover.png

Changeover contactor assembly with TeSys Giga

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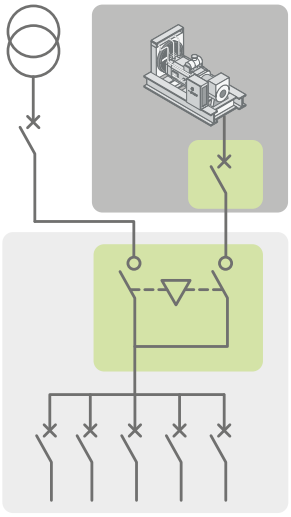
TransfertPacT TA25D

PB123977.png

TransfertPacT TA63D

Recommended Solution above 450 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 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.

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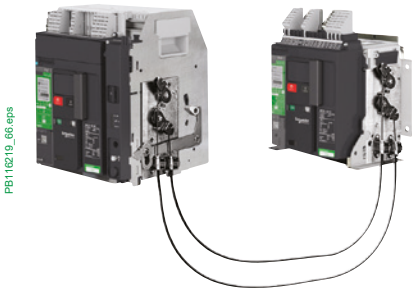
Remote operated source-changeover system



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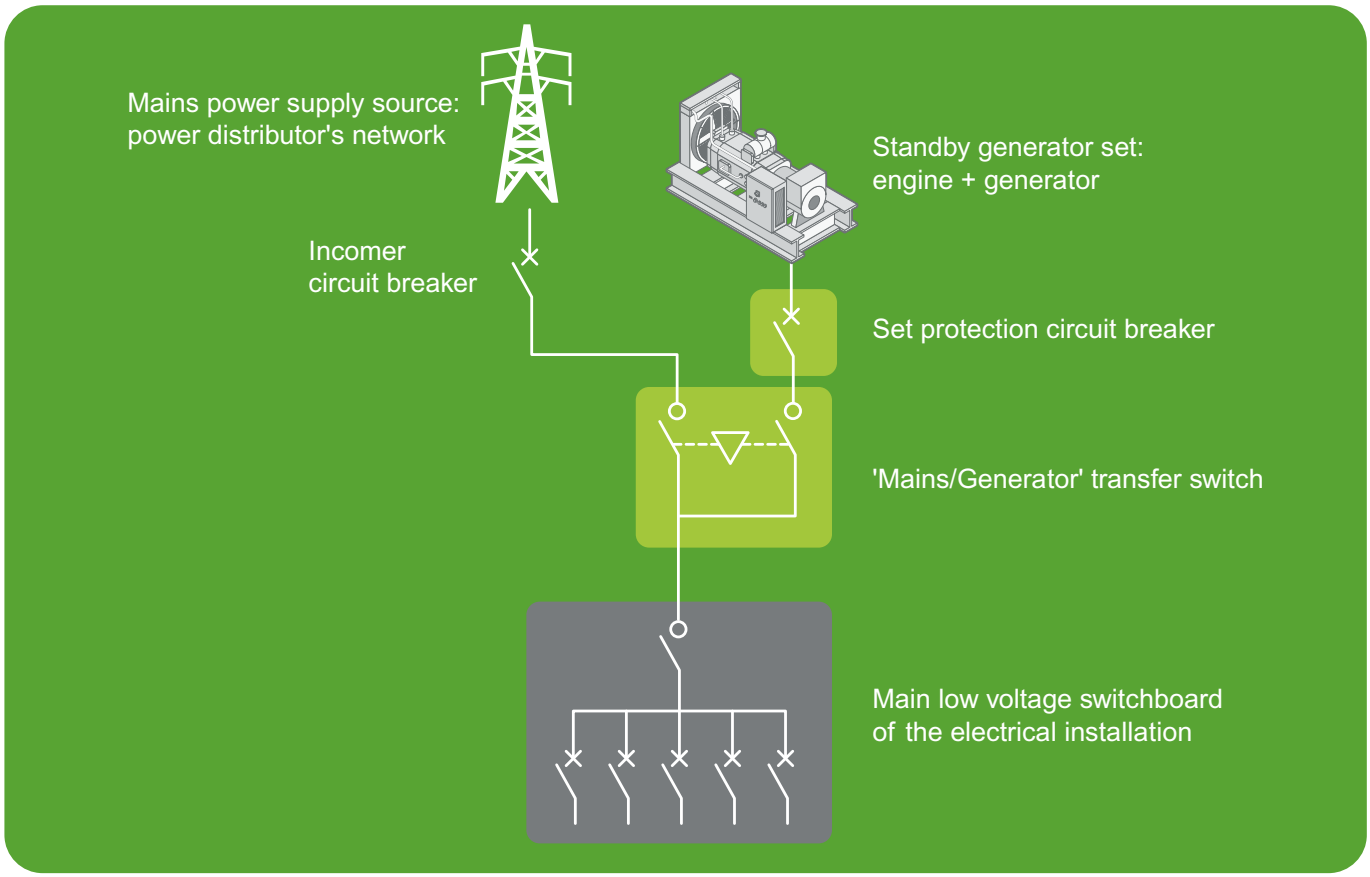
DB403810.eps

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.

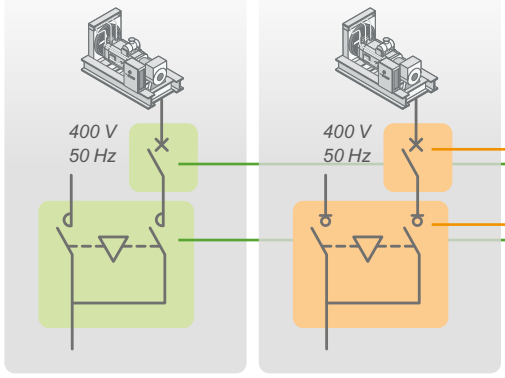
The Genset is used as a backup source in case of power outage (usually the Grid).

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**	**PC class**	**CC class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)		(A)		Reference (3)	Reference (2) (3)
10	11	**15**	B	B	iC60N 16 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT20••**
15	16.5	**22**	B	B	iC60N 20 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT20••**
20	22	**29**	B	B	iC60N 32 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT32••**
25	27.5	**37**	B	B	iC60N 40 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT40••**
27	30	**39**	B	B	iC60N 40 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT40••**
32	35.2	**47**	B	B	iC60N 50 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT60A••**
35	38.5	**51**	B	B	iC60N 50 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT60A••**
40	45	**58**	B	B	iC60N 60 A – B + Vigi or RH	TA10D••••••	TeSys **LC1DT60A••**

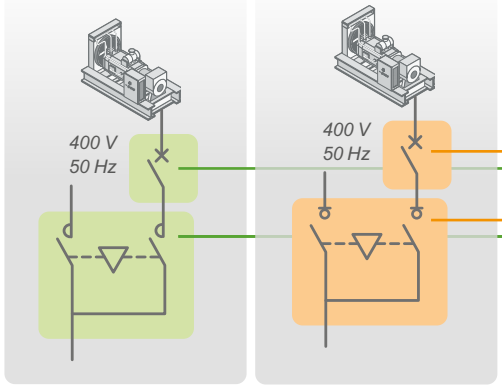
Interlocking Devices for Transfer Switching Assemblies

Interlocking kits for	Mechanical + electrical with set of connections	Mechanical with set of connections	Mechanical
LC1DT20 to DT40	LADT9R1V	LADT9R1	LAD9V2
LC1DT60A	-	-	LAD4CM

(1) Circuit breakers in accordance with the IEC 60947-2 standard– see related catalogs for additional information.
> Integrated RCD option: vigi – residual current device
> Separate RCD option: RH – residual current protection relay.
(2) Two devices of this type are needed, with mechanical and electrical interlocking.
(3) See complete reference to be ordered detailed on page 18.

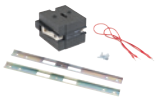
Standby
Standard

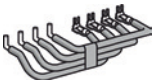
> Generator sets up to 450 kVA



Generator			Circuit Breaker (1)			Transfer Switching Equipment (2)	
Puissance		**Current**	**Curve**	**Rating**	**Type**	**PC class**	**CC class**
PRP (40°C) (kVA)	LTP (27°C) (kVA)	@ 400 V / 50 Hz (A)		(A)	Reference	Reference (3)	Reference (2) (3)
45	50	**65**	TM-G	63	ComPacT NSX100B + TM-G 80	**TA10D••••••• / TA16D•••••••** NSX80A rating not coordinated need to go to 100A rating	TeSys **LC1DT80A••**(3)
50	55	**73**	TM-G	80	ComPacT NSX100B + TM-G 80	**TA10D••••••• / TA16D•••••••** NSX80A rating not coordinated need to go to 100A rating	TeSys **LC1DT80A••**(3)
60	66	**87**	TM-G	100	ComPacT NSX100B + TM-G 100	**TA10D••••••• / TA16D•••••••**	TeSys **LC1D80004••**(3)
70	77	**101**	TM-G	100	ComPacT NSX100B + TM-G 100	**TA10D••••••• / TA16D•••••••**	TeSys **LC1D80004••**(3)
80	90	**116**	TM-G	125	ComPacT NSX160B + TM-G 125	**TA16D••••••• / TA25D•••••••**	TeSys **LC1D80004••**(3)
90	100	**130**	TM-G	160	ComPacT NSX160B + TM-G 160	**TA16D••••••• / TA25D•••••••**	TeSys **LC1D115004••**(3)
105	116	**152**	TM-G	160	ComPacT NSX160B + TM-G 160	**TA16D••••••• / TA25D•••••••**	TeSys **LC1D115004••**(3)
125	138	**181**	TM-G	200	ComPacT NSX250B + TM-G 200	**TA25D••••••• / TA63D•••••••**	TeSys **LC1D115004••**(3)
135	150	**195**	TM-G	200	ComPacT NSX250B + TM-G 200	**TA25D••••••• / TA63D•••••••**	TeSys **LC1D115004••**(3)
150	165	**217**	TM-G	250	ComPacT NSX250B + TM-G 250	**TA25D••••••• / TA63D•••••••**	TeSys **LC1G1154•••**(3)
165	175	**239**	TM-G	250	ComPacT NSX250B + TM-G 250	**TA25D••••••• / TA63D•••••••**	TeSys **LC1G1154•••**(3)
180	203	**260**	Adj.	400	ComPacT NSX400F + MicroLogic 2.3 400 A	**TA63D•••••••**	TeSys **LC1G1504•••**(3)
200	223	**289**	Adj.	400	ComPacT NSX400F + MicroLogic 2.3 400 A	**TA63D•••••••**	TeSys **LC1G1854•••**(3)
250	275	**361**	Adj.	400	ComPacT NSX400F + MicroLogic 2.3 400 A	**TA63D•••••••**	TeSys **LC1G2654•••**(3)
280	300	**405**	Adj.	400	ComPacT NSX400F + MicroLogic 2.3 400 A	**TA63D•••••••**	TeSys **LC1G3304•••**(3)
315	341	**455**	Adj.	630	ComPacT NSX630F + MicroLogic 2.3 630 A	**TA63D•••••••**	TeSys **LC1G4004•••**(3)
365	420	**527**	Adj.	630	ComPacT NSX630F + MicroLogic 2.3 630 A	**TA63D•••••••**	TeSys **LC1G4004•••**(3)
410	450	**592**	Adj.	630	ComPacT NSX630F + MicroLogic 2.3 630 A	**TA63D•••••••**	TeSys **LC1G5004•••**(3)

Interlocking Devices for Transfer Switching Assemblies



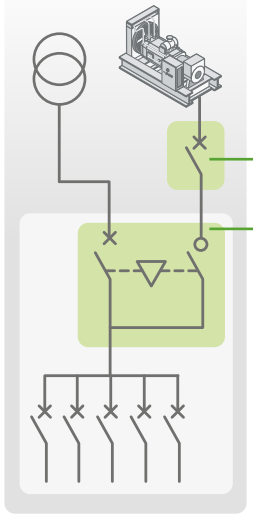


For pair of contactors	Mechanical interlocks with electrical interlocking	Mechanical interlocks without elec. interlocking	Set of connections	Power connection	Mechanical interlock
LC1D80004	LA9D4002	LA9D50978	LA9D8070	-	-
LC1D115004	LA9D11502	-	LA9D11570	-	-
LC1G1504	-	-	-	LA9G4750	LA9G970
LC1G1854	-	-	-	LA9G4750	LA9G970
LC1G2254	-	-	-	LA9G4750	LA9G970
LC1G2654	-	-	-	LA9G4751	LA9G970
LC1G3304	-	-	-	LA9G4751	LA9G970
LC1G4004	-	-	-	LA9G4751	LA9G970
LC1G5004	-	-	-	LA9G4751	LA9G970

(1) Circuit breakers in accordance with the IEC 60947-2 standard – see related catalogs for additional information
> Integrated RCD option: ComPacT NSXm / NSX with embedded earth leakage protection (MicroLogic 4.1 / 4 or MicroLogic 7E including metering)
*> Separate RCD option: Vigi**PacT** RH99 or Vigi**PacT** add-on.*
(2) Two devices of this type are needed, with mechanical and electrical interlocking
(3) See complete reference to be ordered detailed on page 18

Quick Component Selection Table

Standby
Standard



> Generator sets over 450 kVA

ComPact NS

MasterPact MTZ

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 2.0 + RH	**CB class transfer switching equipment recommended in main LV switchboard**
500	570	**722**	Adj.	800	ComPact NS800N - MicroLogic 2.0 + RH	
550	600	**794**	Adj.	800	ComPact NS800N - MicroLogic 2.0 + RH	
600	660	**866**	Adj.	1000	ComPact NS1000N - MicroLogic 2.0 + RH	
660	725	**953**	Adj.	1000	ComPact NS1000N - MicroLogic 2.0 + RH	
725	800	**1047**	Adj.	1250	ComPact NS1250N - MicroLogic 2.0 + RH	
800	880	**1155**	Adj.	1250	ComPact NS1250N - MicroLogic 2.0 + RH	
880	960	**1271**	Adj.	1600	ComPact NS1600N - MicroLogic 2.0 + RH	
910	1000	**1314**	Adj.	1600	ComPact NS1600N - MicroLogic 2.0 + RH	
1000	1100	**1444**	Adj.	1600	ComPact NS1600N - MicroLogic 2.0 + RH	
1250	1375	**1805**	Adj.	2000	MasterPact MTZ2 20 H1 - MicroLogic 5.0X + RH	
1350	1485	**1949**	Adj.	2000	MasterPact MTZ2 20 H1 - MicroLogic 5.0X + RH	
1500	1650	**2166**	Adj.	2500	MasterPact MTZ2 25 H1 - MicroLogic 5.0X + RH	

(1) Circuit breakers in accordance with the IEC 60947-2 standard
> Integrated RCD option: MicroLogic 7.0 (NS) or 7.0X (MTZ)
*> Separate RCD option: Vigi**PacT** RH21.*

TeSys Deca, TeSys Giga Contactor Reference Coding

> TeSys Deca Contactors

LC1

Contactor

D

TeSys Deca series 4 poles

T40

Contactor rating AC1
T20: 20 A (Screw connection*)
T25: 25 A (Screw connection*)
T32: 32 A (Screw connection*)
T40: 40 A (Screw connection*)
T60A: 60 A (Everlink connection*)
T80A: 80 A (Everlink connection*)
80004: 125 A (Screw connection*)
115004: 200 A (Screw connection*)

(*) For more connection types, please consult the catalog.

EHE

Control voltage
Standard coils(*)
B7: 24 Vac
F7: 110 Vac
P7: 230 Vac
BD: 24 Vdc
FD: 110 Vdc
MD: 220 Vdc
Wide band coils(*)
available only for LC1DT60A and LC1DT80A
BNE: 24-60 Vac/Vdc
EHE: 48-130 Vac/Vdc
KUE: 100-250 Vac/Vdc
BBE: 24 Vdc only

(*) For more coil control voltages, please consult the catalog.

Example:
LC1DT25P7 - TeSys Deca Contator, 25 A, 4-Pole, 230 Vac 50/60 Hz Coil
LC1DT80AKUE - TeSys Deca Contactor, 80 A, 4-Pole, 100...250 Vac/Vdc Coil

> TeSys Giga Contactors

LC1

Contactor

G

TeSys Giga series

185

Contactor rating
115: 115 A
150: 150 A
185: 185 A
225: 225 A
265: 265 A
330: 330 A
400: 400 A
500: 500 A
630: 630 A
800: 800 A

4

Poles
4: 4-pole

EHE

Control voltage (AC/DC)
Advanced version (A)
BEE: 24…48 V (1)
EHE : 48...130 V
LSE: 200…500 V
Standard version (N)
EHE: 48…130 V
KUE: 100…250 V

N

Offer type
A: Advanced version
N: Standard version

Example:
LC1G4004LSEA - TeSys Giga Contactor Advanced version 400 A, 4-pole, 200...500 Vac/Vdc coil, with PLC control.
LC1G1854EHEN - TeSys Giga Contactor Standard version 185 A, 4-pole, 48...130 Vac/Vdc coil, without PLC control.
(1) 24...48 V AC/DC control voltage option is available for LC1G115...LC1G500 ratings.

Transfert**PacT** and Com**PacT** Reference Coding

The commercial reference of Transfer**PacT** Automatic Transfer Switching equipment is coded with significant features to explain the type of frame rating, transition, controller type, rated voltage, rated current and number of poles.

> Transfert**PacT**


TA16D4L1604TPE-ISO.png


PB123976.png


PB123977.png

TA	16	D	4	L	160	4	T	P	E

TA: Transfert**PacT** Auto
TR: Transfert**PacT** Remote

Frame rating
10: 100 A (32-100 A)
16: 160 A (80-160 A)
25: 250 A (100-250 A)
63: 630 A (320-630 A)

Off Delay

Number of poles
2: 2 poles
3: 3 poles
4: 4 poles

Controller
L: Active automatic HMI
S: Automatic HMI
R: Remote

Rated current (A)
032: 32 A
040: 40 A
050: 50 A
063: 63 A
080: 80 A
100: 100 A
125: 125 A
160: 160 A
200: 200 A
250: 250 A
320: 320 A
400: 400 A
500: 500 A
630: 630 A

Rated voltage (V)
2: 230 V(*)
3: 230 V(*)
4: 400 V(*)

factory default value
(*) L to L
(**) L to N

IEC
PC type
Top entry

The commercial reference of Com**PacT** equipment is coded to explain the type of frame rating, breaking capacity, number of poles, trip unit and trip unit ratings.

> Com**PacT**


C16F3TM080C-ISO.png

C	10	F	3	TM	100	L

ComPacT type
NSX = C
NSXm = C

Frame rating
NSX = C
100m = 11
NSXm = C
160m = 12
100m = 10
160m = 16
250m = 25
400m = 40
630m = 63

Breaking capacity
NSX = C
16kA = E
NSXm = C
25kA = B
36kA = F
50kA = N
70kA = H
100kA = S
105kA = L

Number of poles
NSX = C
1P = 1
NSXm = C
2P = 2
3P3D = 3
4P4D = 4
3P2D = 5
4P3D = 6

Trip unit
NSX = C
TMD = TM
NSXm= C
MA = MA
TMG = MG
1.3 = 1M
2.2 = 2D
2.3 = 3D
4.1 = 4V
4.2 = 4V

Suffix
NSX = C
EverLink = L
NSXm = C
Busbar = B
Fixed = F
DC = D
Switch = S
DC PV = DP

Acc with ID change =T

Trip unit rating
NSX = C
16 = 016
NSXm = C
20 = 020
25 = 025
30 = 030
40 = 040
50 = 050
63 = 063
80 = 080
100 = 100

Example:

C10F3TM100 Com**PacT** Breaker NSX100F 36kA AC 3P3D 100A TMD
For Com**Pact** NS and Master**PacT** MTZ devices, please refer to their respective product selector.

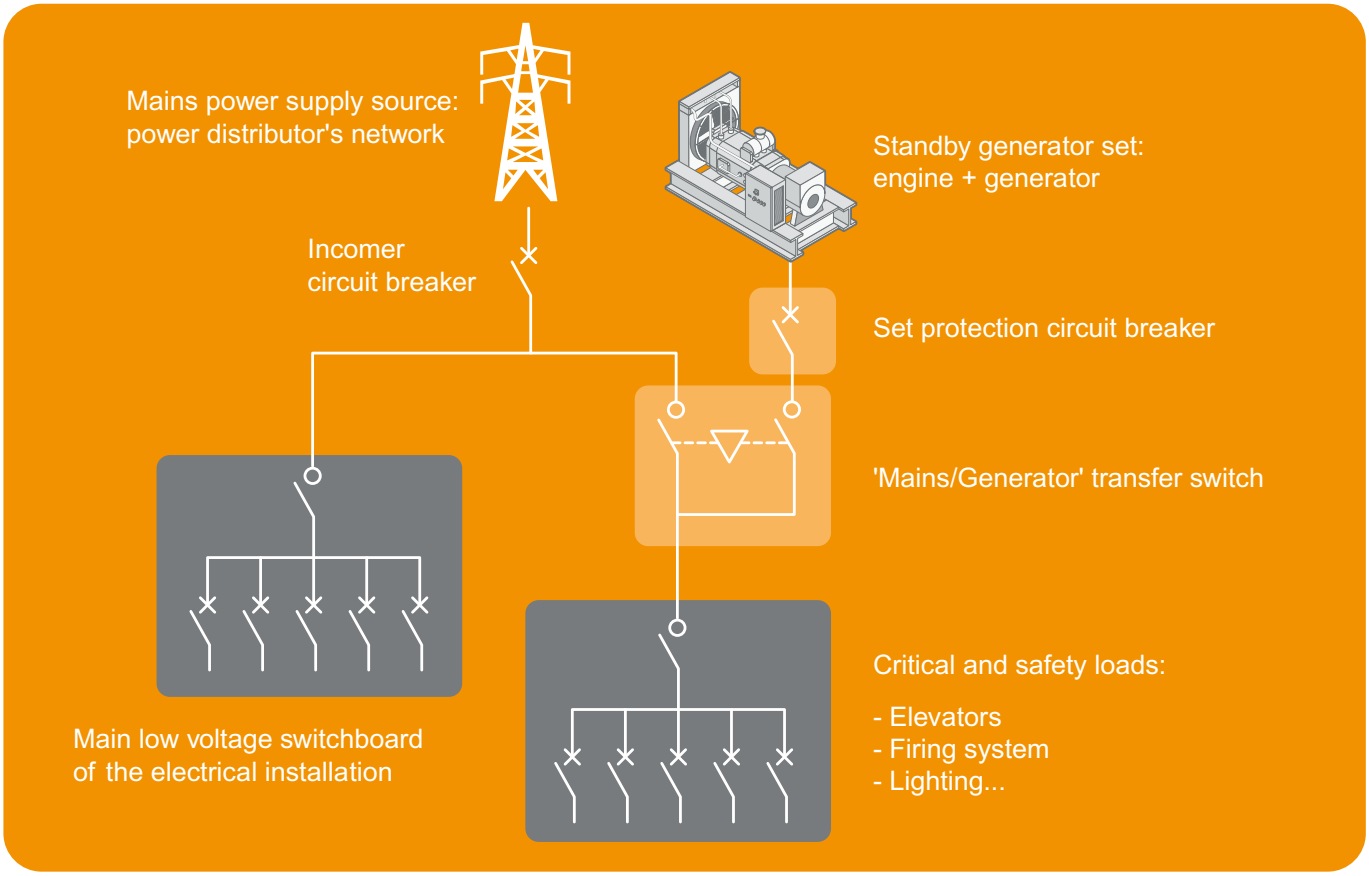
Standby Power Supply for Safety Installations

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 equipment and life safety systems in case of power outage (safety lighting, smoke extractors, elevators...).

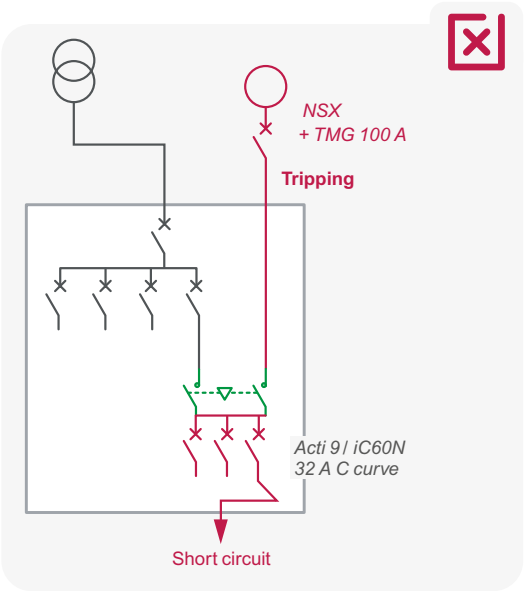
Typical concerns for safety services application:

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

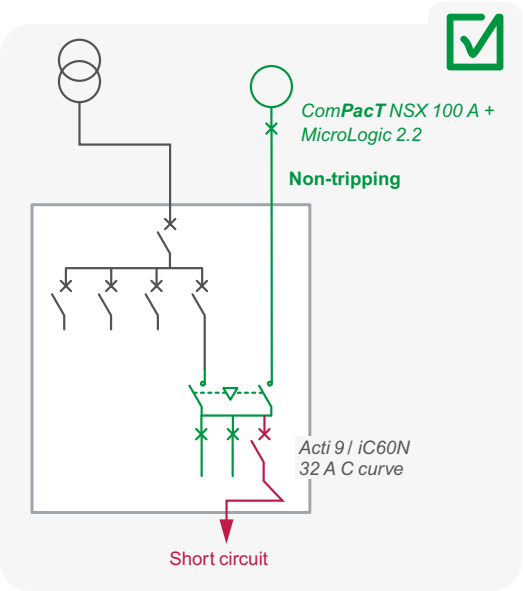
Standby Power Supply for Safety Installations

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

Transfer Switching Equipment Impact on Selectivity



The Com**PacT** 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

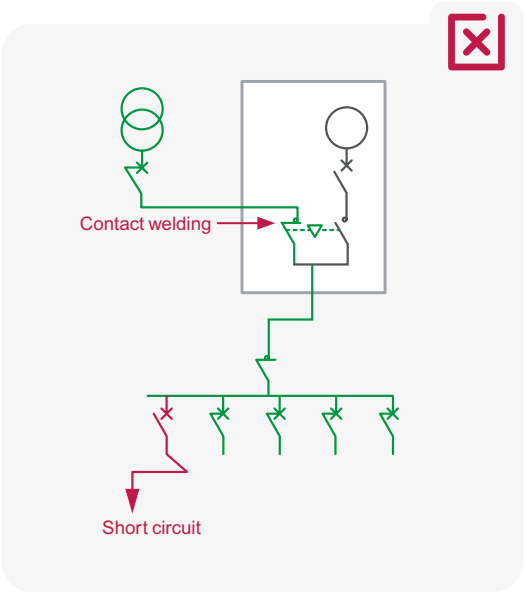
Selectivity is also required:

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

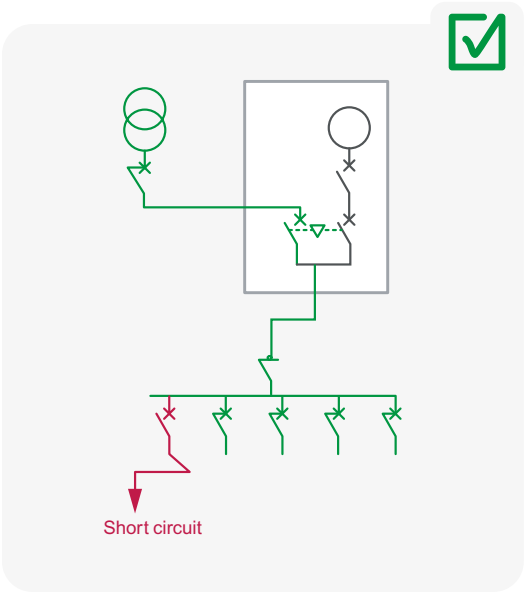
> between RCDs.

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

Transfer Switching Equipment 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)

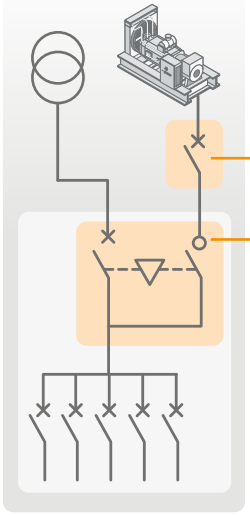
Safe switchover to the generator set, without risk of contact welding.

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



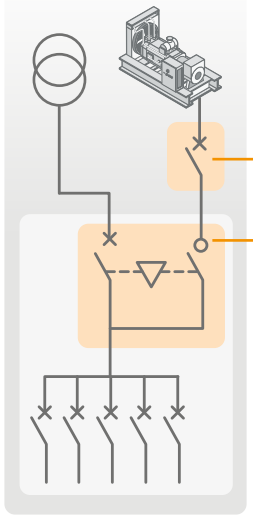
> Generator sets up to 410 kVA

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**	**PC class**	**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**	**TA10D••••••• / TA16D•••••••** NSX80A rating not coordinated need to go to 100A rating	**CB class transfer switching equipment recommended in main LV switchboard**
50	55	**73**	80	ComPacT NSX 100B + MicroLogic 2.2: **LV429785**	**TA10D••••••• / TA16D•••••••** NSX80A rating not coordinated need to go to 100A rating	
60	66	**87**	100	ComPacT NSX 100B + MicroLogic 2.2: **LV429785**	**TA10D••••••• / TA16D•••••••**	
70	77	**101**	100	ComPacT NSX 100B + MicroLogic 2.2: **LV429785**	**TA10D••••••• / TA16D•••••••**	
80	90	**116**	125	ComPacT NSX 160B + MicroLogic 2.2: **LV430750**	**TA16D••••••• / TA25D•••••••**	
90	100	**130**	160	ComPacT NSX 160B + MicroLogic 2.2: **LV430750**	**TA16D••••••• / TA25D•••••••**	
105	116	**152**	160	ComPacT NSX 160B + MicroLogic 2.2: **LV430750**	**TA16D••••••• / TA25D•••••••**	
125	138	**181**	200	ComPacT NSX 250B + MicroLogic 2.2: **LV431150**	**TA25D••••••• / TA63D•••••••**	
135	150	**195**	200	ComPacT NSX 250B + MicroLogic 2.2: **LV431150**	**TA25D••••••• / TA63D•••••••**	
150	165	**217**	250	ComPacT NSX 250B + MicroLogic 2.2: **LV431150**	**TA25D••••••• / TA63D•••••••**	
165	175	**239**	250	ComPacT NSX 250B + MicroLogic 2.2: **LV431150**	**TA25D••••••• / TA63D•••••••**	
180	203	**260**	400	ComPacT NSX 400F + MicroLogic 2.3 400 A: **LV432677**	**TA63D•••••••**	
200	223	**289**	400	ComPacT NSX 400F + MicroLogic 2.3 400 A: **LV432677**	**TA63D•••••••**	
250	275	**361**	400	ComPacT NSX 400F + MicroLogic 2.3 400 A: **LV432677**	**TA63D•••••••**	
280	300	**405**	400	ComPacT NSX 400F + MicroLogic 2.3 400 A: **LV432677**	**TA63D•••••••**	
315	341	**455**	630	ComPacT NSX 630F + MicroLogic 2.3 630 A: **LV432877**	**TA63D•••••••**	
365	420	**527**	630	ComPacT NSX 630F + MicroLogic 2.3 630 A: **LV432877**	**TA63D•••••••**	
410	450	**592**	630	ComPacT NSX 630F + MicroLogic 2.3 630 A: **LV432877**	**TA63D•••••••**	

(1) Circuit breakers in accordance with the IEC 60947-2 standard – see related catalogs for additional information. RCD feature highly recommended for safety installations
> Integrated RCD: MicroLogic 4.1 / 4 or MicroLogic 7E including metering with embedded earth leakage protection. Basic MicroLogic without RCD still available
*> Separate RCD: Vigi**PacT** RH99 or Vigi**PacT** add-on.*
(2) MicroLogic 4 up to 570A rating only. Alternative is to go for MicroLogic 2.3 630A + external RCD relay.
(3) See complete reference to be ordered detailed on page 19

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
> Integrated RCD: MicroLogic 7.0 (NS) or 7.0X (MTZ) with embedded earth leakage protection. Basic MicroLogic without RCD still available.
*> Separate RCD: Vigi**PacT** RH99.*

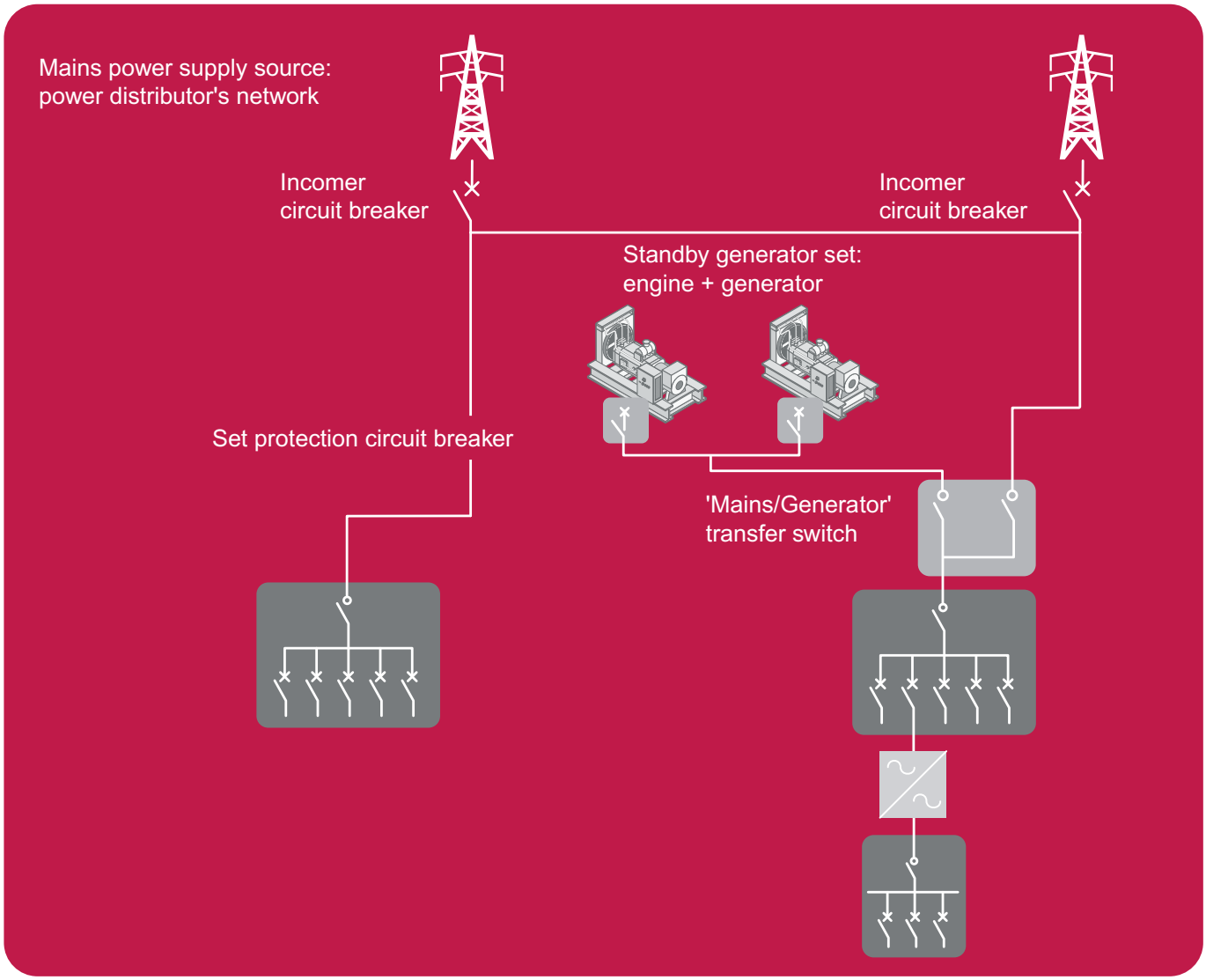
Standby Power Supply for Mission Critical Installations

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).

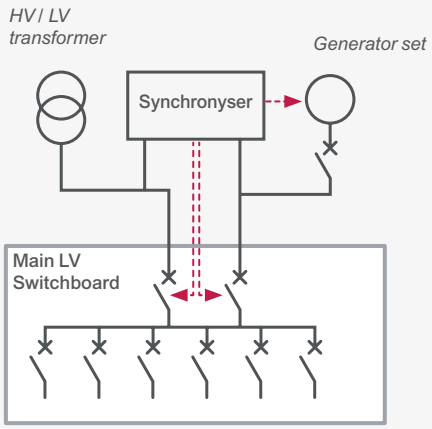
Typical concerns for critical mission application:

> 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



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).

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).

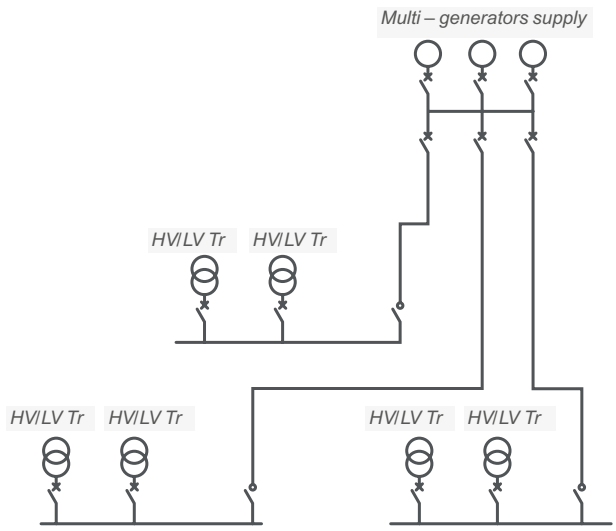
Source changeover types:

> 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.

> High Power or Very High Availability



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

Acti 9 iC60

ComPacT NSX

ComPacT NS

MasterPacT MTZ

Residual Current Devices, for Protection of Human Life

Acti 9 DPN Vigi

Vigi iC60 modules

ComPacT integrated Vigi

VigiPacT

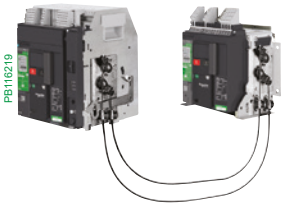
Transfer Switching Equipment

Changeover contactor assembly with TeSys Deca

Changeover contactor assembly with TeSys Giga

TransfertPacT Active Automatic

CB class: ComPact



MasterPacT MTZ1

ASCO 7000

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 multi-function metering

PowerTag sensors for Acti9 circuit breakers

PowerLogic HeatTag

TH110

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

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