APPLICATION NOTE

Continuous Power in F&B

Selectivity in low voltage power distribution systems

Reliability and continuous operation are fundamental requirements in the Food & Beverage industry. Choosing the right protection devices to limit the impact of a failure, guarantee safety and avoid extra cost are basic needs.

The importance of selectivity for continuous power availability

Selectivity solutions enable protection devices to be coordinated so as to isolate a faulty part of the installation, thus preventing other equipment from being affected by the failure or stressed beyond limits and allowing it to continue to operate. Selectivity is rather like plant insurance. If faults occur, remuneration is paid out as a reduction in the extent of the power outage and the time it lasts.

Why you need selectivity to ensure continuous power

The need for higher production rates in Food & Beverage plants has created demands for enhanced reliability in power systems. Unexpected failures can still occur despite all the precautions taken, while the cost of consequent production downtime can vary from $100K to $1M per hour. Selectivity limits power outage to the sole faulty part of the installation, preserving the greater part of the production lines and therefore reducing failure costs.

Main benefits

24/7

Continuous Operation
- Less risk of downtime.
- Adjusts the protection of multiple energy sources: grid, renewables, cogeneration…
- Strengthens your energy strategy by ensuring energy flow to critical loads.

Cost
- Reduces the financial impact on material replacement & equipment destruction by containing the fault in small part of the installation

Safety
- Increases people safety: isolates the risk and reduces the consequences involving personnel.
- Minimizes the risk of power outage in your processes, thereby reducing the risk of food recall.

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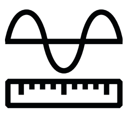
Application overview

The primary function of protection devices in electrical distribution systems is to protect equipment and people if faults such as overload, short circuit, overvoltage and other electrical failures occur. Over the last decades, the need for increased production output, especially in Food & Beverage plants, has stepped up the demand for reliable power able to prevent lengthy hold-ups in production caused by failures and their consequences (time for replacing or repairing equipment).
This is why good selectivity design is recommended, if not actually mandatory. Protection devices must be carefully selected. Not only must their single functions be considered, but also the interactions among them, so that if a failure occurs in a sub-distribution circuit, the circuit breaker in the circuit trips, while the protection devices at main distribution board level continue to feed the other circuits in the installation.

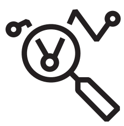
Nowadays different techniques can be used to design selectivity in a power distribution plant. The customer can choose a traditional system, such as time-current selectivity and energy selectivity, or rely on the latest generation of electronic relays, which enable digital selectivity techniques, such as directional protection. Modern electronic relays with directional selectivity not only measure the intensity of fault current but also its direction and this function enables selectivity to be designed even in distribution systems fed by multiple power sources, such as cogeneration in dairy enterprises for the production of both steam and electricity.
It is sometimes difficult to choose the right selectivity strategy, but whichever strategy is adopted, careful design and protection device selection must be performed from the early stage of the project. ABB bundles are designed to help engineers choose optimum solutions for the type of installation in question, as shown below.

Overview of Continuous Power – Selectivity Applications



Essential

- Time-current selectivity
- Energy selectivity



Enhanced

- Directional selectivity

The **“Essential”** package is recommended for radial distribution systems without paralleling of power sources.

On the other hand, the **“Enhanced”** package is recommended for LV distribution systems with paralleling of multiple power sources.

Small Food & Beverage factories are characterized by limited daily production, enough to provide the local community. Power distribution is generally a traditional radial system connected to the utility.

There could be a lack of supply generators in.large Food & Beverage factories featuring 24/7 intensive production cycles. In this case, several substations feed all the production departments together with generators and more often even co-generation systems, as in the diagram below.

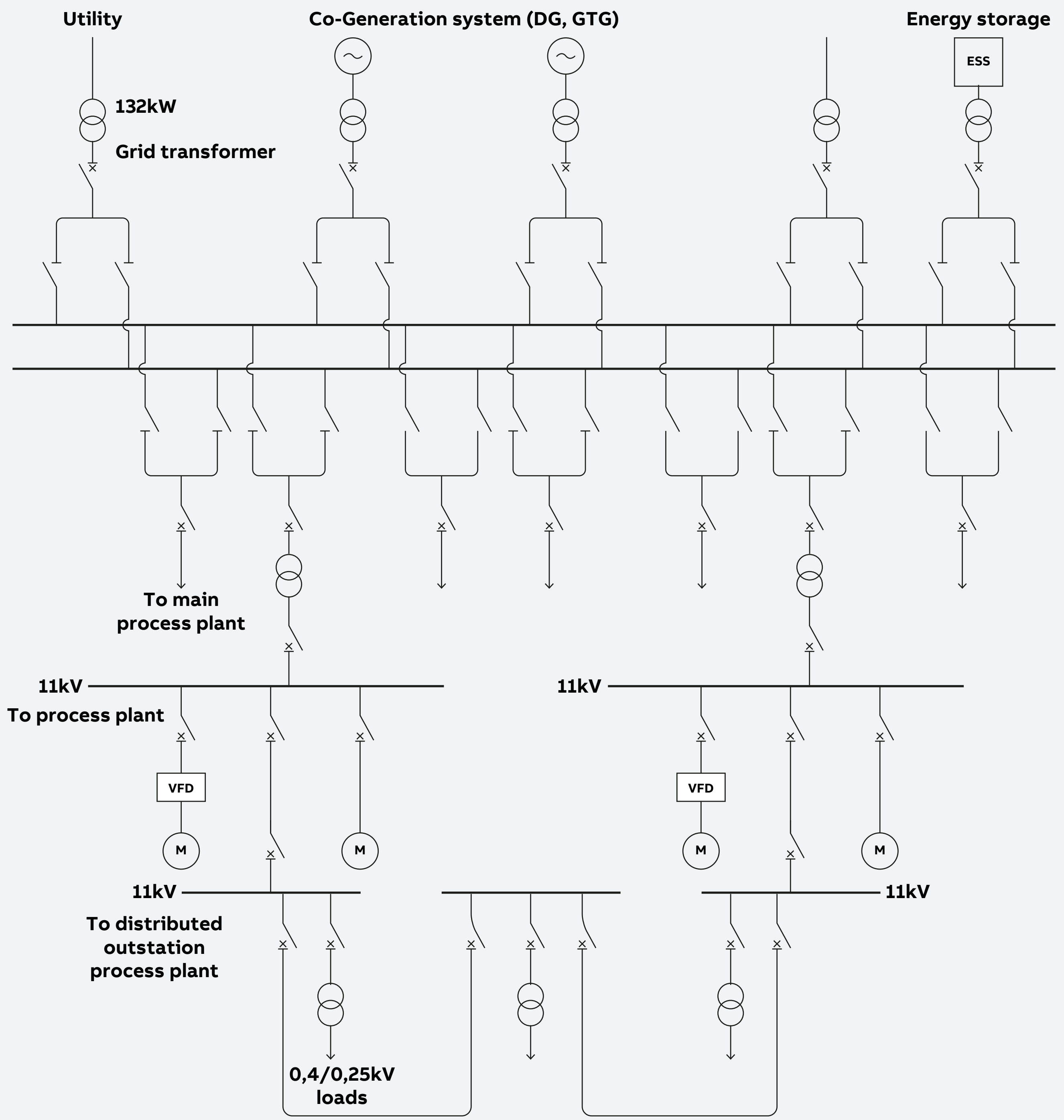


Fig. 1

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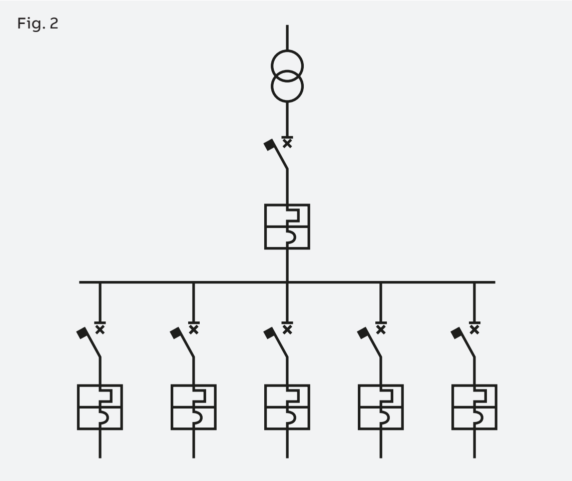
Figure 1. Example of a large Food & Beverage factory

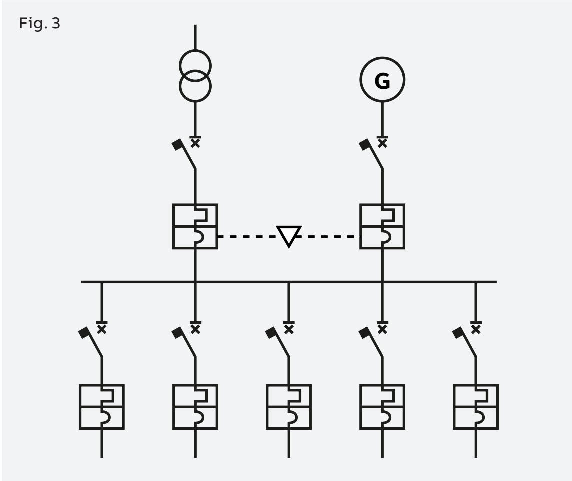
“Essential” Selectivity Bundles

“Essential” bundles are specifically designed for Food & Beverage industries with radial power distribution systems, such as the one in figures 2 and 3.

Figure 2.
Radial distribution fed by transformer

Figure 3.
Radial distribution fed by transformer or generator

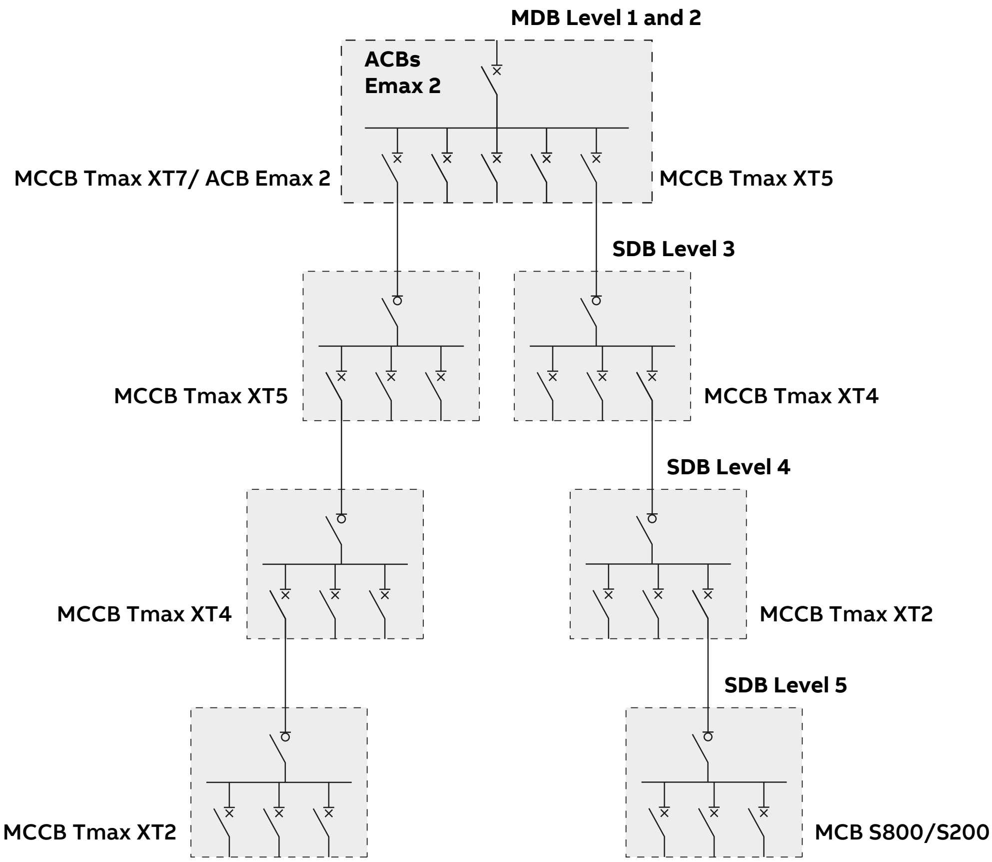




A limited investment is required for these bundles. Traditional time-current and energy selectivity techniques are sufficient to create a reliable system.

This methodology enables up to about 5 selectivity levels to be obtained, from the main distribution system to the terminal boards, as shown in figure 4.

Figure 4.
Possible selectivity levels using ABB protection devices



ACB: Air Circuit Breaker
MCCB: Moulded Case Circuit Breaker
MCB: Miniature Circuit Breaker
MDB: Main distribution Board
SDB: Sub-Distribution Board

Fig. 4

Emax 2 series non-limiting circuit breakers (type B) are recommended as incoming breakers. These protection devices are designed to withstand fault currents so that downstream devices, closer to the origin of the fault, can trip.
Time-current selectivity can be designed among non-limiting breakers and when there are upstream non-limiting breakers and downstream limiting breakers. Use of limiting breakers such as (type A) Tmax XT moulded case circuit breakers and S800 or S200 miniature circuit breakers, is recommended in sub-distribution boards. Limiting breakers are designed to trip within the shortest possible time in the case of short circuit currents, even before the fault current reaches its peak.

This behavior limits fault propagation to other parts of the installation and considerably reduces the mechanical and dynamic stress caused by the fault.
ABB provides selectivity tables based on laboratory tests to guarantee selectivity among limiting circuit breakers.
The bundles are designed to facilitate the choice of components in power distribution systems. They can also help consultants to obtain a fast budgetary quotation for electrical installations. The proposed coordinated solutions are in line with the selectivity table available in SOC tool.

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SOC tool

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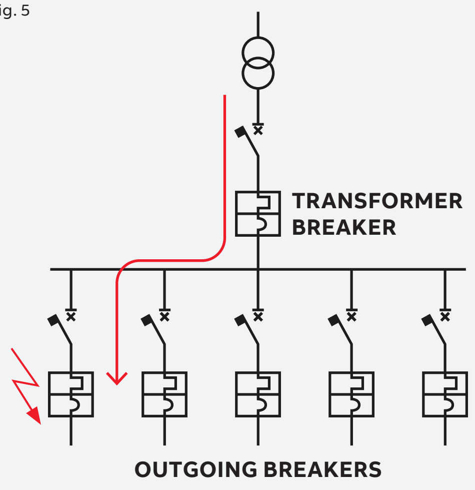
Figure 5.
MDB supplied via utility
– selectivity path

“Essential” bundle for Main Distribution Boards
The first bundle considered is for a pure radial distribution supplied by the utility. There is no emergency generator in this configuration. Critical loads are fed by a UPS system in all emergency conditions. The bundle proposed in Table 2 enables the protection device to be selected for the incoming line according to the main transformer parameters. Follow the table in the horizontal direction to find the largest size of breaker that can be used for outgoing circuits to guarantee selectivity.

Fig. 5



The second bundle considers radial distribution fed by the utility and emergency generator, which feed loads in an outage so that the two sources never operate in parallel.
If the generator is dimensioned to supply the complete installation, the protection devices can be selected as shown in Table 3.

Fig. 6

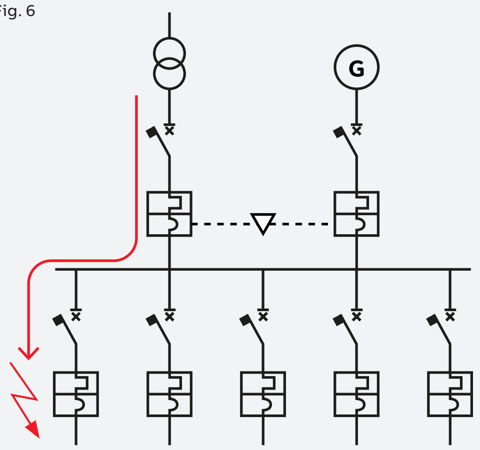
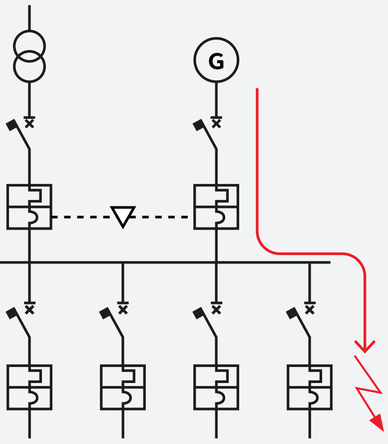


Fig. 7



If the generator is dimensioned to supply critical loads only, there are 2 tables for selecting protection devices: Table 2 for sheddable loads fed only by the transformer and Table 4 for critical loads which can be fed by both the utility and generator.

Fig. 8

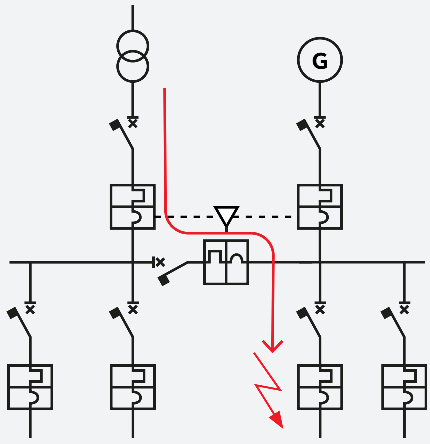
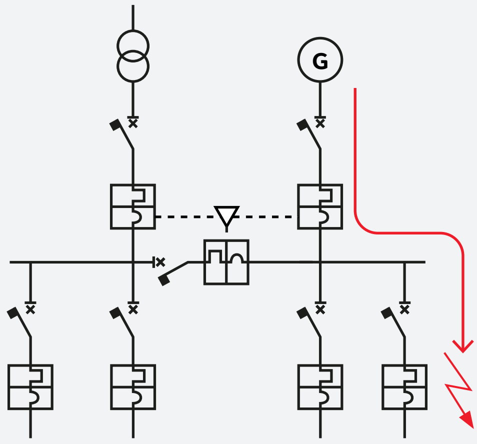


Fig. 9



We suggest using an adjustable relay in the main distribution board so as to also enable time-current selectivity with sub-distribution boards.
Adjustment of protection device relays must comply with the following rules:

- Overload protection L must be adjusted as per time-current selectivity, without overlapping between the upstream and downstream breaker tripping curves.
- Protection against time-delayed short-circuit current S must be adjusted according to the same indications as time-current selectivity: no overlapping the downstream breaker curve. Tripping time t2 must be set as follows:
  $t_{2upstream} \leq t_{2downstream}$ + 150ms, for curve i^2t=const
  $t_{2upstream} = t_{2downstream}$ + 100ms, for t=const
- The instantaneous overcurrent protection function I of the supply-side circuit-breakers must be off, i.e., I3=OFF

In addition to the ABB rules for selectivity, the designer must always comply with IEC 60364 and IEC 60947-2 specifications when selecting protection devices and for protection relay adjustment.

Table 2. MDB Bundle fed by transformer @400 – 415V (see figure 5)

Transformer			Busbar	Transformer Circuit Breaker				Largest outgoing Circuit Breaker				Selectivity
Power [kVA]	In [A]	SCC [kA]	Total SCC (1) [kA]	Frame	In [A]	Icu [kA]	Trip Unit	Frame	In [A]	Icu [kA]	Trip Unit	
250	361	9	10	XT5N 630	400	36	Ekip Dip LSI	XT4N 250 (2)	250	36	Ekip Dip LSI	Total
315	455	11	13	XT5N 630	630	36	Ekip Dip LSI	XT4N 250 (2)	250	36	Ekip Dip LSI	Total
400	577	14	16	XT5N 630	630	36	Ekip Dip LSI	XT4N 250 (2)	250	36	Ekip Dip LSI	Total
630	909	23	25	XT7S 1000	1000	50	Ekip Dip LSI	XT5N 400 (3)	400	36	Ekip Dip LSI	Total
800	1155	23	26	XT7S 1250	1250	50	Ekip Dip LSI	XT5N 630 (3)	630	36	Ekip Dip LSI	Total
1000	1443	29	32	XT7S 1600	1600	50	Ekip Dip LSI	XT5N 630 (3)	630	36	Ekip Dip LSI	Total
1250	1804	36	40	E2.2B 2000	2000	42	Ekip Dip LSI	XT7S 1600 (4)	1600	50	Ekip Dip LSI	Total
1600	2309	38	43	E2.2N 2500	2500	66	Ekip Dip LSI	XT7S 1600 (4)	1600	50	Ekip Dip LSI	Total
2000	2887	48	54	E4.2N 3200	3200	66	Ekip Dip LSI	XT7H 1600 (4)	1600	70	Ekip Dip LSI	Total
2500	3608	60	67	E4.2S 4000	4000	85	Ekip Dip LSI	XT7H 1600 (4)	1600	70	Ekip Dip LSI	Total

1) Motor contribution (12%) to short circuit has been considered.
2) Selectivity can also be achieved with breaker frames XT1 and XT2 belonging to the same series.
3) Selectivity can also be achieved with breaker frames XT1, XT2, XT3 and XT4 belonging to the same series.
4) Time-current selectivity between Emax 2 breakers can be obtained as an alternative.
5) Use of the Ekip electronic trip unit with time delayed protection against short circuit S is recommended.
6) Ekip Touch and Hi-Touch can be used instead of Ekip DIP.

Table 3. MDB Bundle fed by utility and generator @ 400 – 415V (see figures 6 and 7)

Transformer				Transformer Circuit Breaker				Generator		
Power [kVA]	In [A]	SCC [kA]	SCC Total(1) [kA]	Frame	In [A]	Icu [kA]	Trip Unit	Power [kVA]	In [A]	SCC [kA]
250	361	9	10	XT5N 630	400	36	Ekip Dip LSI	250	361	2
315	455	11	13	XT5N 630	630	36	Ekip Dip LSI	315	455	2
400	577	14	16	XT5N 630	630	36	Ekip Dip LSI	400	577	3
630	909	23	25	XT7S 1000	1000	50	Ekip Dip LSI	630	909	5
800	1155	23	26	XT7S 1250	1250	50	Ekip Dip LSI	800	1155	6
1000	1443	29	32	XT7S 1600	1600	50	Ekip Dip LSI	1000	1443	7
1250	1804	36	40	E2.2B 2000	2000	42	Ekip Dip LSI	1250	1804	9
1600	2309	38	43	E2.2N 2500	2500	66	Ekip Dip LSI	1600	2309	12
2000	2887	48	54	E4.2N 3200	3200	66	Ekip Dip LSI	2000	2887	14
2500	3608	60	67	E4.2S 4000	4000	85	Ekip Dip LSI	2500	3608	18

1) Motor contribution (12%) to short circuit has been considered.
2) Selectivity is also achievable with breakers frames XT1 and XT2 belonging to same series.
3) Selectivity can also be achieved with breaker frames XT1, XT2, XT3 and XT4 belonging to the same series.
4) Time-current selectivity between Emax 2 breakers can be obtained as an alternative.
5) Use of the Ekip electronic trip unit with time delayed protection against short circuit S is recommended.
6) Ekip Touch and Hi-Touch can be used instead of Ekip DIP.

Table 4. MDB Bundle with sheddable loads fed by utility and generator @400- 415V (see figures 8 and 9)

Transformer			Transformer Circuit Breaker					Generator		
Power [kVA]	In [A]	SCC [kA]	SCC Total(1) [kA]	Frame	In [A]	Icu [kA]	Trip Unit	Power [kVA]	In [A]	SCC [kA]
250	361	9	10	XT5N 630	400	36	Ekip Dip LSI	138	199	1
315	455	11	13	XT5N 630	630	36	Ekip Dip LSI	159	229	1
400	577	14	16	XT5N 630	630	36	Ekip Dip LSI	208	300	2
630	909	23	25	XT7S 1000	1000	50	Ekip Dip LSI	346	499	2
800	1155	23	26	XT7S 1250	1250	50	Ekip Dip LSI	415	599	3
1000	1443	29	32	E.12B 1600	1600	42	Ekip Dip LSI	554	800	4
1250	1804	36	40	E2.2B 2000	2000	42	Ekip Dip LSI	692	999	5
1600	2309	38	43	E2.2N 2500	2500	66	Ekip Dip LSI	865	1249	6
2000	2887	48	54	E4.2N 3200	3200	66	Ekip Dip LSI	1107	1598	8
2500	3608	60	67	E4.2S 4000	4000	85	Ekip Dip LSI	1730	2497	12

1) Motor contribution (12%) to short circuit has been considered.
2) Selectivity is also achievable with breakers frames XT1 and XT2 belonging to same series.
3) Selectivity can also be achieved with breaker frames XT1, XT2, XT3 and XT4 belonging to the same series.
4) Time-current selectivity between Emax 2 breakers can be obtained as an alternative.
5) Use of the Ekip electronic trip unit with time delayed protection against short circuit S is recommended.
6) Ekip Touch and Hi-Touch can be used instead of Ekip DIP.

Generator Circuit Breaker				Largest outgoing Circuit Breaker				Selectivity
Frame	In [A]	Icu [kA]	Trip Unit	Frame	In [A]	Icu [kA]	Trip Unit	
XT5N 630	400	36	Ekip G Dip LS/I	XT4N 250 (2)	250	36	Ekip Dip LSI / TM	Total
XT5N 630	630	36	Ekip G Dip LS/I	XT4N 250 (2)	250	36	Ekip Dip LSI / TM	Total
XT5N 630	630	36	Ekip G Dip LS/I	XT4N 250 (2)	250	36	Ekip Dip LSI / TM	Total
XT7S 1000	1000	50	Ekip G Dip LS/I	XT5N 400 (3)	400	36	Ekip Dip LSI	Total
XT7S 1250	1250	50	Ekip G Dip LS/I	XT5N 630 (3)	630	36	Ekip Dip LSI	Total
XT7S 1600	1600	50	Ekip G Dip LS/I	XT5N 630 (3)	630	36	Ekip Dip LSI	Total
E2.2B 2000	2000	42	Ekip G Touch LSIG	XT7S 1600 (4)	1600	50	Ekip Dip LSI	Total
E2.2N 2500	2500	66	Ekip G Touch LSIG	XT7S 1600 (4)	1600	50	Ekip Dip LSI	Total
E4.2N 3200	3200	66	Ekip G Touch LSIG	XT7H 1600 (4)	1600	70	Ekip Dip LSI	Total
E4.2N 4000	4000	66	Ekip G Touch LSIG	XT7H 1600 (4)	1600	70	Ekip Dip LSI	Total

Generator Circuit Breaker			Largest Tie Breaker					Largest outgoing Circuit Breaker				Selectivity
Frame	In [A]	Icu [kA]	Trip Unit	Frame	In [A]	Icu [kA]	Trip Unit	Frame	In [A]	Icu [kA]	Trip Unit	
XT4N 250	250	36	Ekip Dip LSI	XT4N 250	250	36	Ekip Dip LSI	XT2N 160	160	36	Ekip Dip LSI	Total
XT4N 250	250	36	Ekip Dip LSI	XT4N 250	250	36	Ekip Dip LSI	XT2N 160	160	36	Ekip Dip LSI	Total
XT5N 630	400	36	Ekip Dip LSI	XT4N 250	250	36	Ekip Dip LSI	XT4N 250 (2)	250	36	Ekip Dip LSI	Total
XT5N 630	630	36	Ekip Dip LSI	XT5N 630	630	36	Ekip Dip LSI	XT4N 250 (2)	250	36	Ekip Dip LSI	Total
XT5N 630	630	36	Ekip G Dip LS/I	XT5N 630	630	36	Ekip Dip LSI	XT4N 250 (2)	250	36	Ekip Dip LSI	Total
XT7S 800	800	50	Ekip G Dip LS/I	XT7S 800	800	50	Ekip Dip LSI	XT5N 400 (3)	400	36	Ekip Dip LSI	Total
XT7S 1000 (4)	1000	50	Ekip G Dip LS/I	XT7S 1000 (4)	1000	50	Ekip Dip LSI	XT5S 630 (3)	630	50	Ekip Dip LSI	Total
XT7S 1600 (4)	1600	50	Ekip G Dip LS/I	XT7S 1600 (4)	1600	50	Ekip Dip LSI	XT5S 630 (3)	630	50	Ekip Dip LSI	Total
XT7S 1600 (4)	1600	50	Ekip G Dip LS/I	XT7H 1600 (4)	1600	70	Ekip Dip LSI	XT5H 630 (3)	630	70	Ekip Dip LSI	Total
E4.2S 3200	3200	85	Ekip G Dip LS/I	E4.2S 3200	3200	85	Ekip Dip LSI	E2.2S 2500	2500	85	Ekip Dip LSI	Total

Selectivity: ABB Enhanced Bundles

When there are multiple sources, energy selectivity alone is not the best solution if the highest possible continuity of service is to be guaranteed. If a fault occurs in a power supply, it can generally be excluded, while the plant continues to be supplied by other sources. To do that, it is essential to be able to discriminate the fault location. ABB breakers with directional selectivity not only measure fault current, but also its direction. Depending on the direction of the fault current, different tripping times can then be set to guarantee selectivity.
Directional selectivity does not require connections between breakers; thus installation is as simple as that of traditional energy or time-current selectivity. Designers and installers need only define settings for directional protection, a reference direction for each breaker, a threshold, a tripping time delay for forward fault currents and a tripping time delay for backward fault currents.
Enhanced bundles have been designed for the most common power distribution layouts. Devices and components have been pre-defined by ABB technicians to ensure selectivity within specified terms of use.

To achieve directional time selectivity, first check the significant fault points and then, after the short-circuit currents involved have been assessed, establish which circuit-breakers will be required to trip.
We recommend the following settings and circuit-breakers:

- Choose circuit-breakers with a higher short-time withstand current value than the maximum prospective short-circuit current, Icw ≥ Ikmax
- Set the trip thresholds of directional protections D at a lower value than the minimum prospective short-circuit I7 < Ik min
- Set the trip thresholds of protections S and I at a higher level so as not to create trip overlapping with function D.
- Set the tripping time considering that there must be 100 ms delta time between breakers to ensure selectivity.

Consult the Emax 2 and Tmax XT installation manuals for further details.

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Emax 2
installation manual

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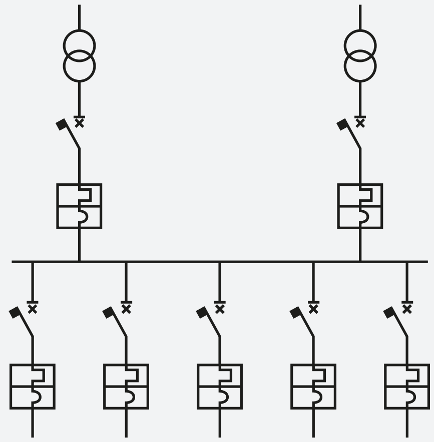
Tmax XT
installation manual

Enhanced bundle for Main Distribution Boards
The first case concerns a substation supplied by 2 sources operating in parallel, as shown in figure 10.

Fig. 10



The second case analysed concerns a substation supplied by 2 sources with cogeneration connected in parallel.

Fig. 11

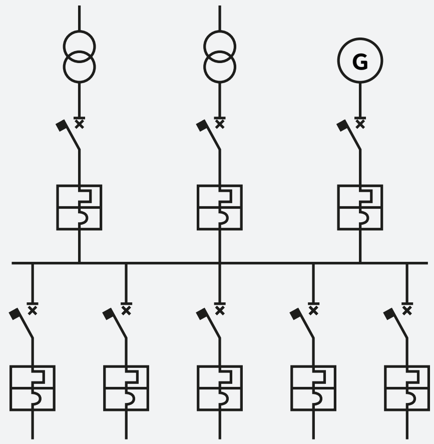


Table 5. Bundle for plant supplied by 2 transformers in parallel @400 - 415V (see figure 10)

Transformer			Busbar	Transformer Circuit Breaker					Largest outgoing Circuit Breaker				Selectivity
Power [kVA]	**In [A]**	**Total SCC [kA]**	**Max SCC [kA] (1)**	**Frame**	**In[A]**	**Icu [kA]**	**Trip Unit**	**Accessories**	**Frame**	**In [A]**	**Icu [kA]**	**Trip Unit**	
250	361	9	20	XT5N 630	400	36	Ekip Hi Touch LSI	protection D, Ekip Supply	XT4N 250 (2)	250	36	Ekip Dip LSI / TM	Total
315	455	11	25	XT5N 630	630	36	Ekip Hi Touch LSI	protection D, Ekip Supply	XT4N 250 (2)	250	36	Ekip Dip LSI / TM	Total
400	577	14	32	XT5N 630	630	36	Ekip Hi Touch LSI	protection D, Ekip Supply	XT4N 250 (2)	250	36	Ekip Dip LSI / TM	Total
630	909	23	51	XT7S 1000	1000	50	Ekip Hi Touch LSI	protection D, Ekip Supply	XT5H 400 (3)	400	70	Ekip Dip LSI	Total
800	1155	23	52	XT7S 1250	1250	50	Ekip Hi Touch LSI	protection D, Ekip Supply	XT5H 630 (3)	630	70	Ekip Dip LSI	Total
1000	1443	29	65	XT7S 1600	1600	50	Ekip Hi Touch LSI	protection D, Ekip Supply	XT5H 630 (3)	630	70	Ekip Dip LSI	Total
1250	1804	36	81	E2.2B 2000	2000	42	Ekip Hi Touch LSI	protection D, Ekip Supply	XT7L 1600 (4)	1600	120	Ekip Dip LSI	Total
1600	2309	38	86	E2.2N 2500	2500	66	Ekip Hi Touch LSI	protection D, Ekip Supply	XT7L 1600 (4)	1600	120	Ekip Dip LSI	Total
2000	2887	48	108	E4.2N 3200	3200	66	Ekip Hi Touch LSI	protection D, Ekip Supply	XT7L 1600 (4)	1600	120	Ekip Dip LSI	Total

1) Motor contribution (5%) to short circuit has been considered.
2) Selectivity is also achievable with breakers frames XT1 and XT2 belonging to same series.
3) Selectivity can also be achieved with breaker frames XT1, XT2, XT3 and XT4 belonging to the same series.
4) Time-current selectivity between Emax 2 breakers can be obtained as an alternative.
5) Use of the Ekip electronic trip unit with time delayed protection against short circuit S is recommended.
6) Ekip Touch and Hi-Touch can be used instead of Ekip DIP.

Table 6. Bundle for plant supplied by 2 transformers with cogeneration in parallel @400 - 415V (see figure 11)

Transformer 1, 2			Generator			Busbar	Transformer Circuit Breaker				
Power [kVA]	**In [A]**	**SCC Tot [kA]**	**Power [kVA]**	**In [A]**	**SCC Tot Gen [kA]**	**Max SCC [kA] (1)**	**Frame**	**In [A]**	**Icu [kA]**	**Trip Unit**	**Accessories**
250	361	11	250	361	19	21	XT5N 630	400	36	Ekip Hi Touch LSI	D protection, Ekip Supply
315	455	14	315	455	24	26	XT5N 630	630	36	Ekip Hi Touch LSI	D protection, Ekip Supply
400	577	18	400	577	30	33	XT5N 630	630	36	Ekip Hi Touch LSI	D protection, Ekip Supply
630	909	29	630	909	48	53	XT7S 1000	1000	50	Ekip Hi Touch LSI	D protection, Ekip Supply
800	1155	30	800	1155	48	55	XT7S 1250	1250	50	Ekip Hi Touch LSI	D protection, Ekip Supply
1000	1443	38	1000	1443	61	68	XT7H 1600	1600	70	Ekip Hi Touch LSI	D protection, Ekip Supply
1250	1804	47	1250	1804	76	85	E2.2N 2000	2000	66	Ekip Hi Touch LSI	D protection, Ekip Supply
1600	2309	53	1600	2309	81	93	E2.2N 2500	2500	66	Ekip Hi Touch LSI	D protection, Ekip Supply
2000	2887	66	2000	2887	101	116	E4.2S 3200	3200	85	Ekip Hi Touch LSI	D protection, Ekip Supply

1) Motor contribution (5%) to short circuit has been considered.
2) Selectivity is also achievable with breakers frames XT1 and XT2 belonging to same series.
3) Selectivity can also be achieved with breaker frames XT1, XT2, XT3 and XT4 belonging to the same series.
4) Time-current selectivity between Emax 2 breakers can be obtained as an alternative.
5) Use of the Ekip electronic trip unit with time delayed protection against short circuit S is recommended.
6) Ekip Touch and Hi-Touch can be used instead of Ekip DIP.
7) Total selectivity can be achieved with the devices and accessories suggested in the table

Cogeneration Circuit Breaker					Largest outgoing breaker			
Frame	In [A]	Icu [kA]	Trip Unit	Accessories	Frame	In [A]	Icu [kA]	Trip Unit
XT5N 630	400	36	Ekip G Touch LSI	D protection, Ekip Supply	XT4N 250 (2)	250	36	Ekip Dip LSI / TM
XT5N 630	630	36	Ekip G Touch LSI	D protection, Ekip Supply	XT4N 250 (2)	250	36	Ekip Dip LSI / TM
XT5N 630	630	36	Ekip G Touch LSI	D protection, Ekip Supply	XT4N 250 (2)	250	36	Ekip Dip LSI / TM
XT7S 1000	1000	50	Ekip G Touch LSI	D protection, Ekip Supply	XT5H 400 (3)	400	70	Ekip Dip LSI
XT7S 1250	1250	50	Ekip G Touch LSI	D protection, Ekip Supply	XT5H 630 (3)	630	70	Ekip Dip LSI
XT7H 1600	1600	70	Ekip G Touch LSI	D protection, Ekip Supply	XT5H 630 (3)	630	70	Ekip Dip LSI
E2.2S 2000	2000	85	Ekip G Touch LSIG	D protection, Ekip Supply	XT7L 1600 (4)	1600	120	Ekip Dip LSI
E2.2S 2500	2500	85	Ekip G Touch LSIG	D protection, Ekip Supply	XT7L 1600 (4)	1600	120	Ekip Dip LSI
E4.2V 3200	3200	150	Ekip G Touch LSIG	D protection, Ekip Supply	XT7L 1600 (4)	1600	120	Ekip Dip LSI

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