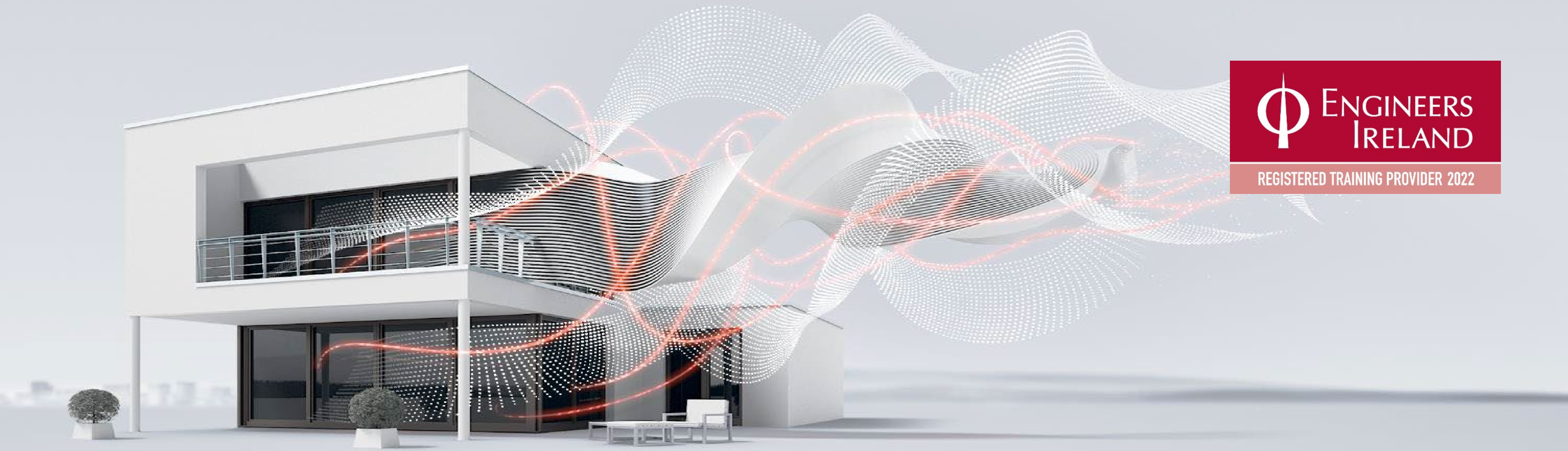
ABB



ENGINEERS IRELAND
REGISTERED TRAINING PROVIDER 2022

Low Voltage Selectivity

10th May

paul.hyland@ie.abb.com

Technical Overview CPD series:

- L.V switchgear and panel selection
- L.V selectivity and discrimination
- IEC61439 part 1 and 2 L.V switchgear & Control assemblies.

Technical support and training

Technical & Design Promotion Manager

Paul Hyland Electrical Engineer (Electrician)

29 +1 years LV switchgear and Control Assemblies

6 years ABB technical Support and product design

Degree in Electrical Service Design BEng

Honours Degree Electrical Service and Energy Management BSc

SACE Level 3 service engineer

Participating member of the ETC TC4 NSAI group for LV SWG

Member of Engineers Ireland

Participating member of the SC 121B IEC International Electrotechnical Commission, MT2 Maintenance team for the IEC 61439 part 0, part 1 and part 2. for LV switchgear

ABB provide all Technical support as one ABB team.

CPD Presentations – timetable

April/ May 2022

Monday	Tuesday	Wednesday	Thursday	Friday
	26th April Technical overview of LV Switchgear and Panel Selection. **Paul Hyland**	**27th April** Building Automation- KNX universal protocol & DALI **Pierre Badenhorst**	**28th April** The Fundamentals & Principles of Building Energy Management Systems **Seamus MacLughadha**	
	3rd May	**4th May** IIoT for Electrical installations **Paul Mimnagh**	**5th May** Building Services Integration BACnet and other options **Seamus MacLughadha**	
	10th May LV Selectivity / Discrimination **Paul Hyland**	**11th May** Introduction to MV Switchgear **David Supple**	**12th May** IE5 Synchronous Reluctance Drive and Motor Package **Tero Helpio**	
	17th May IEC61439 overview of Standard for Low Voltage Switchgear & Assemblies **Paul Hyland**	**18th May** Electric Vehicle Charging Infrastructure **James Kelly**	**19th May**	
	24th May Arc Fault Detection Devices (New MCBs & RCBOs) **Paul Hyland**	**25th May** Harmonics, VSDs and mitigation technologies **Liam Blackshaw**		

Circuit Breaker Selection

Paul Hyland

Why is breaker selection important?

How to calculate fault level?

Discrimination types?

Back up protection?

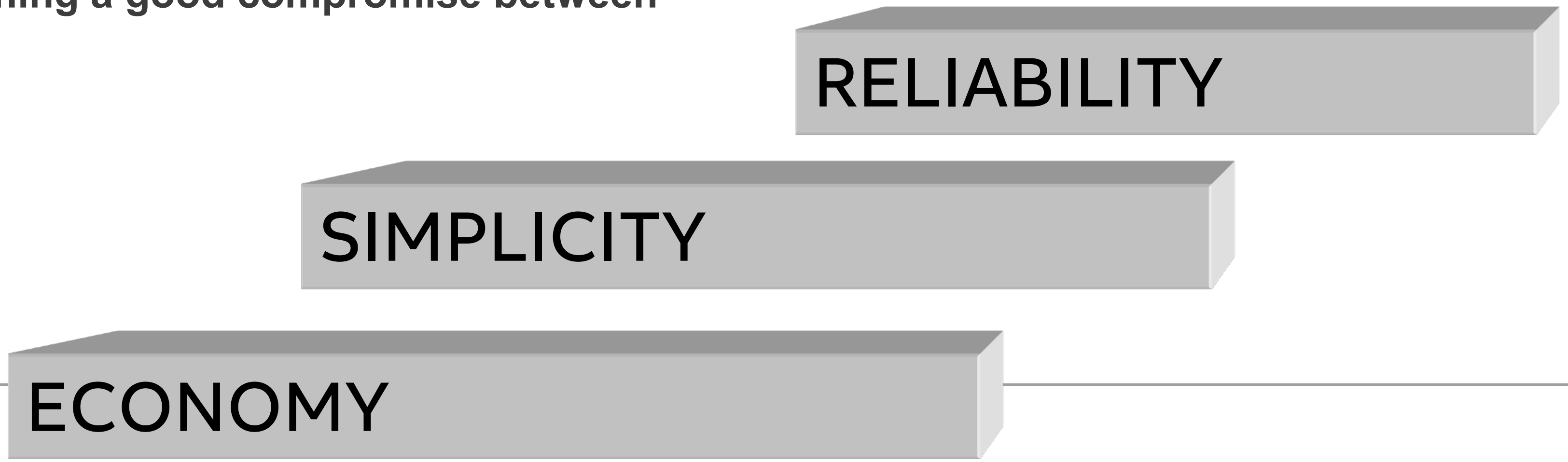
Current Limiting (breaker's)?

Definition's?

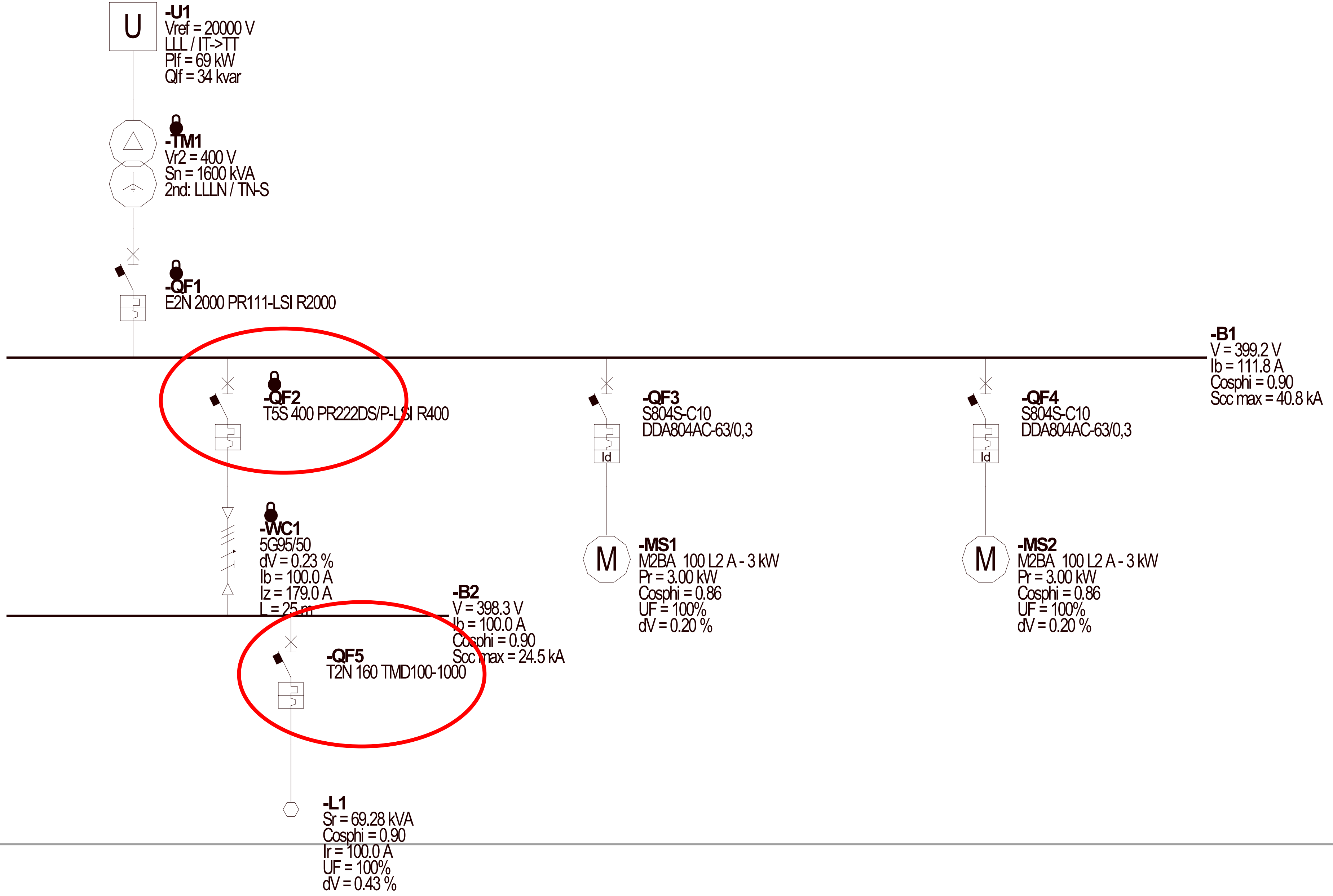
Importance of IEC61439-2 (Photos & Movies from the Lab) *CPD on the 17th of May*

Why is breaker selection/co-ordination important?

- Safety on site
- Identifying and isolating the zone where the problem is.
- Limiting the fault effects on the rest of the installation.
- Limiting stresses on components and damages to the affected zone
- Guaranteeing service continuity (to rest of plant)
- Guaranteeing restoration of power when fault is cleared
- Supplying personnel and management with a clear situation.
- **Reaching a good compromise between**



Electrical schematic



Calculation of fault level's

Mathematical way

Traffo 1600KVA (P=√3.V.I.impedance%)

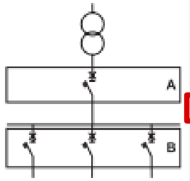
1600 ,000 / [(√3x400)x0.06]

=38kA

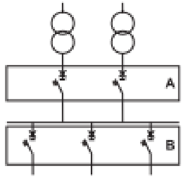
Cable Calculation's etc……….

Calculation of fault level's

Manufacturer's charts



Transformer				Circuit-breaker A (LV side)			Circuit-breaker B (Feeder circuit-breaker)								
S_r [kVA]	U_k %	Transf I_r [A]	Busbar I_b [A]	Transf Feeder I_k [kA]	Type	Trip unit size	Busbar I_k [kA]	800 A	1000 A	1250 A	1600 A	2000 A	2500 A	3200 A	4000 A
1x500	4	722	722	17.7	E1B 800	In=800	17.7	E1B08*							
1x630	4	909	909	22.3	E1B 1000	In=1000	22.3	E1B08*							
1x800	5	1155	1155	22.6	E1B 1250	In=1250	22.6	E1B08*							
1x1000	5	1443	1443	28.1	E1B 1600	In=1600	28.1	E1B08*	E1B10*	E1B12*					
1x1250	5	1804	1804	34.9	E2B 2000	In=2000	34.9	E1B08*	E1B10*	E1B12*	E1B16*				
1x1600	6.25	2309	2309	35.7	E3N 2500	In=2500	35.7	E1B08*	E1B10*	E1B12*	E1B16*	E2B20*			
1x2000	6.25	2887	2887	44.3	E3N 3200	In=3200	44.3	E1N08*	E1N10*	E1N12*	E1N16*	E2N20*	E3N25*		
1x2500	6.25	3608	3608	54.8	E4S 4000	In=4000	54.8	E2N10*	E2N10*	E2N12*	E2N16*	E2N20*	E3N25*	E3N32*	
1x3125	6.25	4510	4510	67.7	E6H 5000	In=5000	67.7	E2S08*	E2S10*	E2S12*	E2S16*	E2S20*	E3S25*	E3S32*	E4S40



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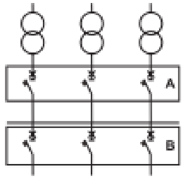
2x500	4	722	1444	17.5	E1B 800	In=800	35.9	E1B08*							
2x630	4	909	1818	21.8	E1B 1000	In=1000	43.6	E1N08*	E1N10*	E1N12*	E1N16*				
2x800	5	1155	2310	22.1	E1B 1250	In=1250	44.3	E1N08*	E1N10*	E1N12*	E1N16*	E2N20*			
2x1000	5	1443	2886	27.4	E1B 1600	In=1600	54.8	E2N10*	E2N10*	E2N12*	E2N16*	E2N20*	E3N25*		
2x1250	5	1804	3608	33.8	E2B 2000	In=2000	67.7	E2S08*	E2S10*	E2S12*	E2S16*	E2S20*	E3S25*	E3S32*	
2x1600	6.25	2309	4618	34.6	E3N 2500	In=2500	69.2	E2S08*	E2S10*	E2S12*	E2S16*	E2S20*	E3S25*	E3S32*	E4S40
2x2000	6.25	2887	5774	42.6	E3N 3200	In=3200	85.1	E3H08*	E3H10*	E3H12*	E3H16*	E3H20*	E3H25*	E3H32*	E4H40



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3x630	4	909	2727	42.8	E1N 1000	In=1000	64.2	E2N10*	E2N10*	E2N12*	E2N16*	E2N20*	E3N25*		
3x800	5	1155	3465	43.4	E1N 1250	In=1250	65	E2N10*	E2N10*	E2N12*	E2N16*	E2N20*	E3N25*		
3x1000	5	1443	4329	53.5	E2N 1600	In=1600	80.2	E2S08*	E2S10*	E2S12*	E2S16*	E2S20*	E3H25*	E3H32*	
3x1250	5	1804	5412	65.6	E2S 2000	In=2000	98.4	E3H08*	E3H10*	E3H12*	E3H16*	E3H20*	E3H25*	E3H32*	E4H40
3x 1600	6,25	2309	6927	67	E3S 2500	In=2500	100.6	E3V08*	E3V 12*	E3V12*	E3V16*	E3V20*	E3V25*	E3V32*	E4V40

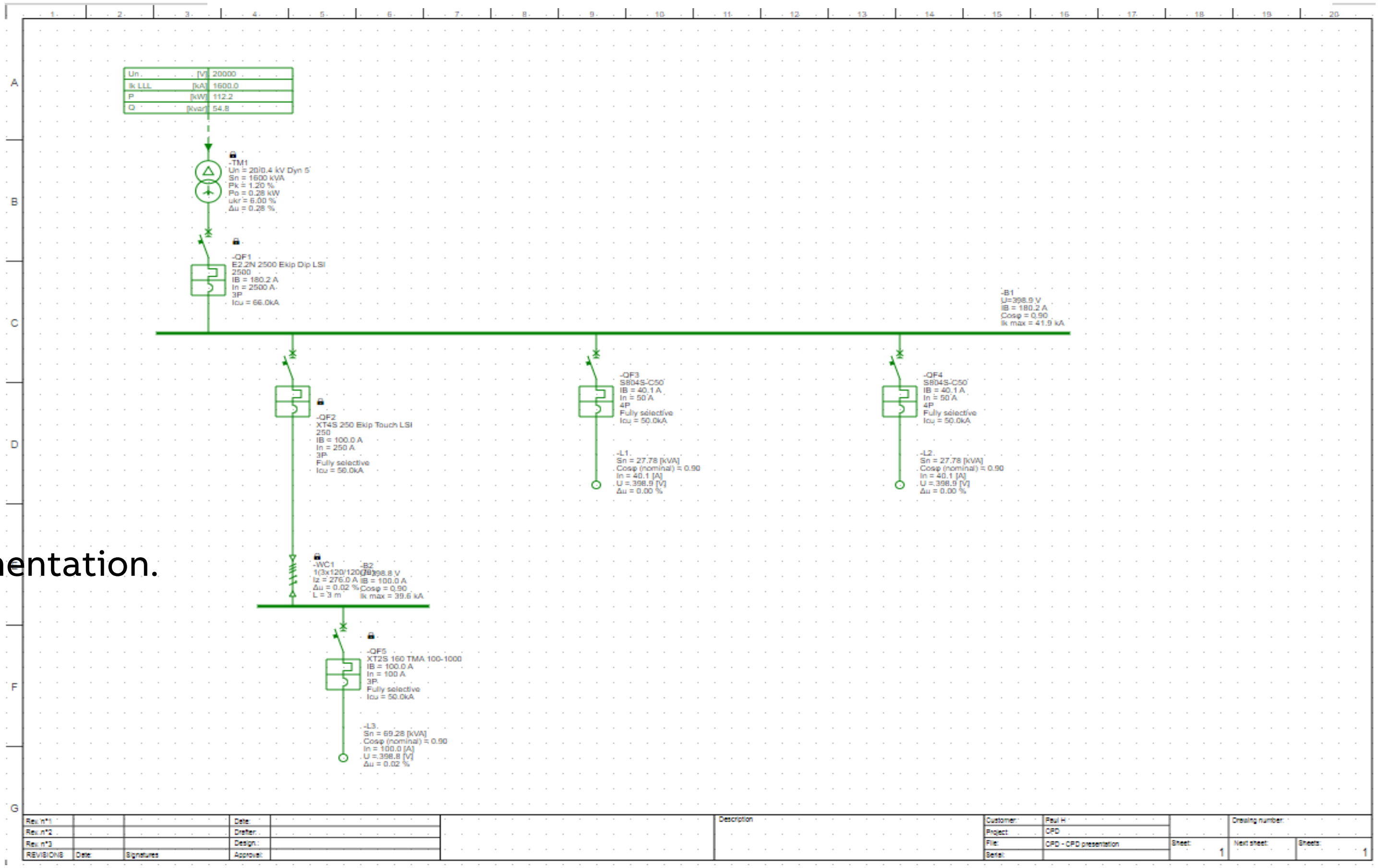
Calculation of fault level's

https://partnerhub.connect.abb.com/
https://econfigure.xe.abb.com/global/#/categories
https://www.lowvoltage-tools.abb.com/soc

Software package

The main functionalities of the program are:

- Drawing the single-line electric diagram;
- Drawing the key diagram of the auxiliary circuits;
- Calculation of line current and voltage drops;
- Calculation of short-circuit currents;
- Dimensioning low- and medium-voltage cables;
- Dimensioning switching- and protection devices;
- Switchboard configuration;
- Setting and coordination of protection devices;
- Verifying cable protection;
- Printing the single-line diagram and project documentation.



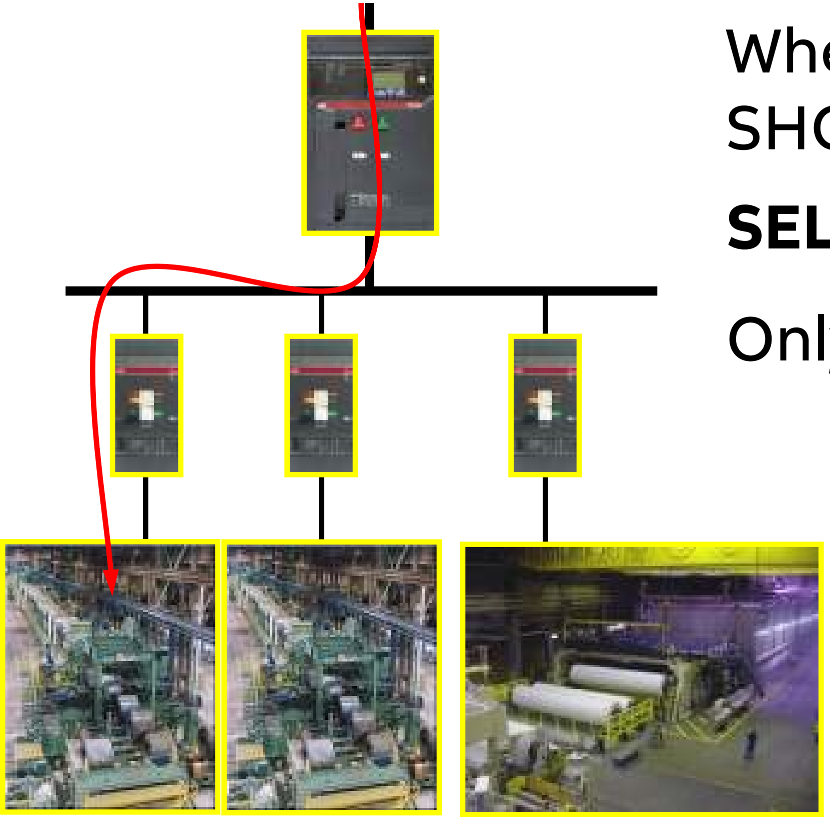
SACE Emax 2			E1.2			
Performance levels			**B**	**C**	**N**	**L**
Rated uninterrupted current Iu @ 40°C		[A]	630	630	250	630
		[A]	800	800	630	800
		[A]	1000	1000	800	1000
		[A]	1250	1250	1000	1250
		[A]	1600	1600	1250	
		[A]			1600	
		[A]				
Neutral pole current-carrying capacity for 4-pole CBs		[%Iu]	100	100	100	100
Rated ultimate short-circuit breaking capacity Icu	400-415 V	[kA]	42	50	66	150
	440 V	[kA]	42	50	66	130
	500-525 V	[kA]	42	42	50	100
	690 V	[kA]	42	42	50	60
Rated service short-circuit breaking capacity Ics		[%Icu]	100	100	100[1]	100
Rated short-time withstand current Icw	(1s)	[kA]	42	42	50	15
	(3s)	[kA]	24	24	36	-
Rated short-circuit making capacity (peak value) Icm	400-415 V	[kA]	88	105	145	330
	440 V	[kA]	88	105	145	286
	500-525 V	[kA]	88	88	105	220
	690 V	[kA]	88	88	105	132
Utilization category (according to IEC 60947-2)			B	B	B	A
Breaking	Breaking time for I<Icw		40	40	40	40
	Breaking time for I>Icw		25	25	25	10

Agenda

- Current Selectivity
- Time Selectivity
- Energy Selectivity
- Zone Selectivity
- Selectivity using Goose

Selectivity

What selectivity means :



When an OVERLOAD or a SHORT-CIRCUIT occurs.

SELECTIVITY

Only the downstream CB opens,

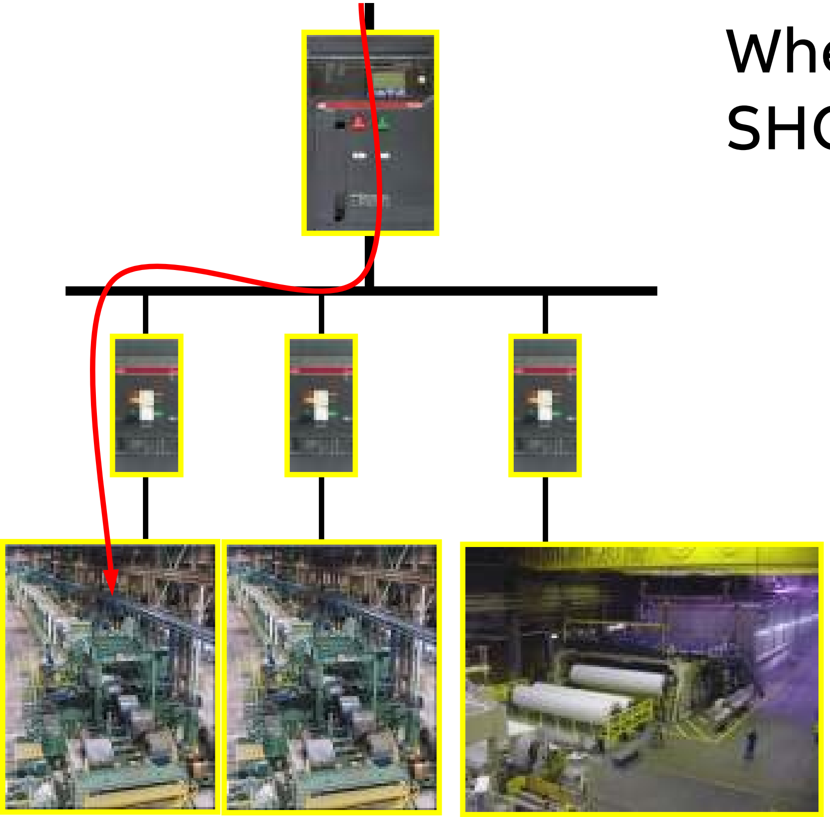
Selectivity
What Selectivity means :

When an OVERLOAD or a SHORT-CIRCUIT occur.

SELECTIVITY
Only the downstream CB opens,
the other loads can be supplied

Selectivity

What Selectivity means :



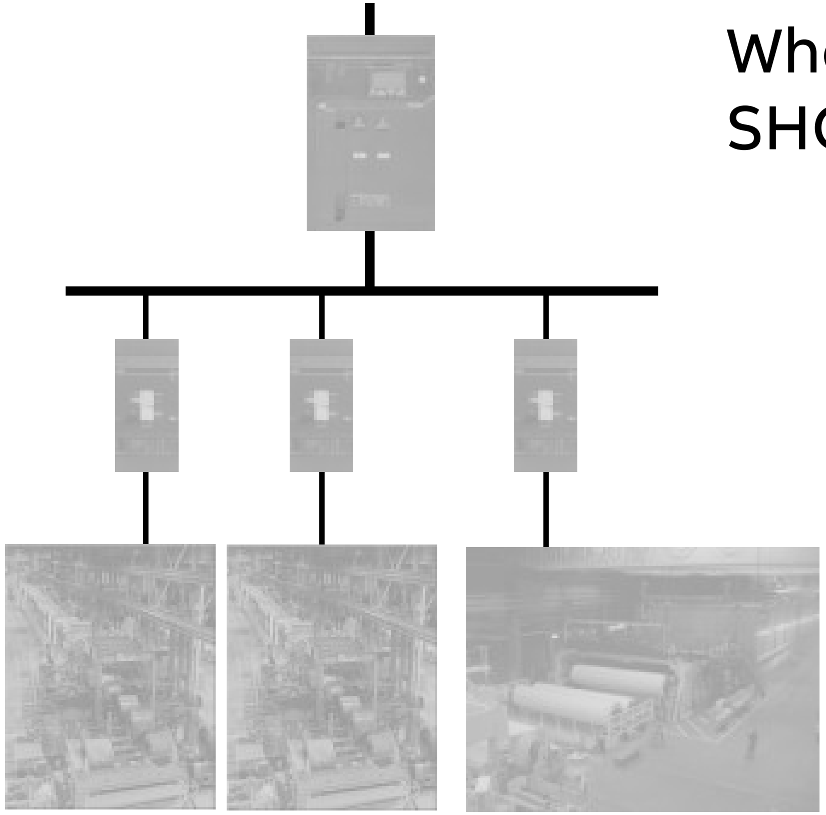
When an OVERLOAD or a SHORT-CIRCUIT occur.

NO SELECTIVITY

Also the main CB opens,

Selectivity

What Selectivity means :



When an OVERLOAD or a SHORT-CIRCUIT occur.

NO SELECTIVITY

Also the main CB opens,

ALL THE LOADS GO OUT OF SERVICE

Selectivity

Lack of coordination- The main problems

Difficult to understand what is happened and where

- Difficult to detect the zone affected by the problem
- Difficult to solve the problem

No service’s continuity

- Production stopped/ damaged
- Machines can be damaged
- It can be dangerous for people

Lack of coordination → Small problem can become BIG PROBLEM




Selectivity techniques

Traditional solutions

- Current Selectivity
- Time Selectivity
- Energy Selectivity

Advanced solutions

- Zone selectivity ZSI
- Selectivity using Goose

SOC - SELECTED OPTIMIZED COORDINATION

Power and productivity for a better world™ ABB

Motor protection | Selectivity | Back-up | Other devices protection

SOC - Selected Optimized Coordination

Motor Protection

Coordination tables for motor starting and protection.

Selectivity

Selectivity coordination tables between short circuit protection devices.

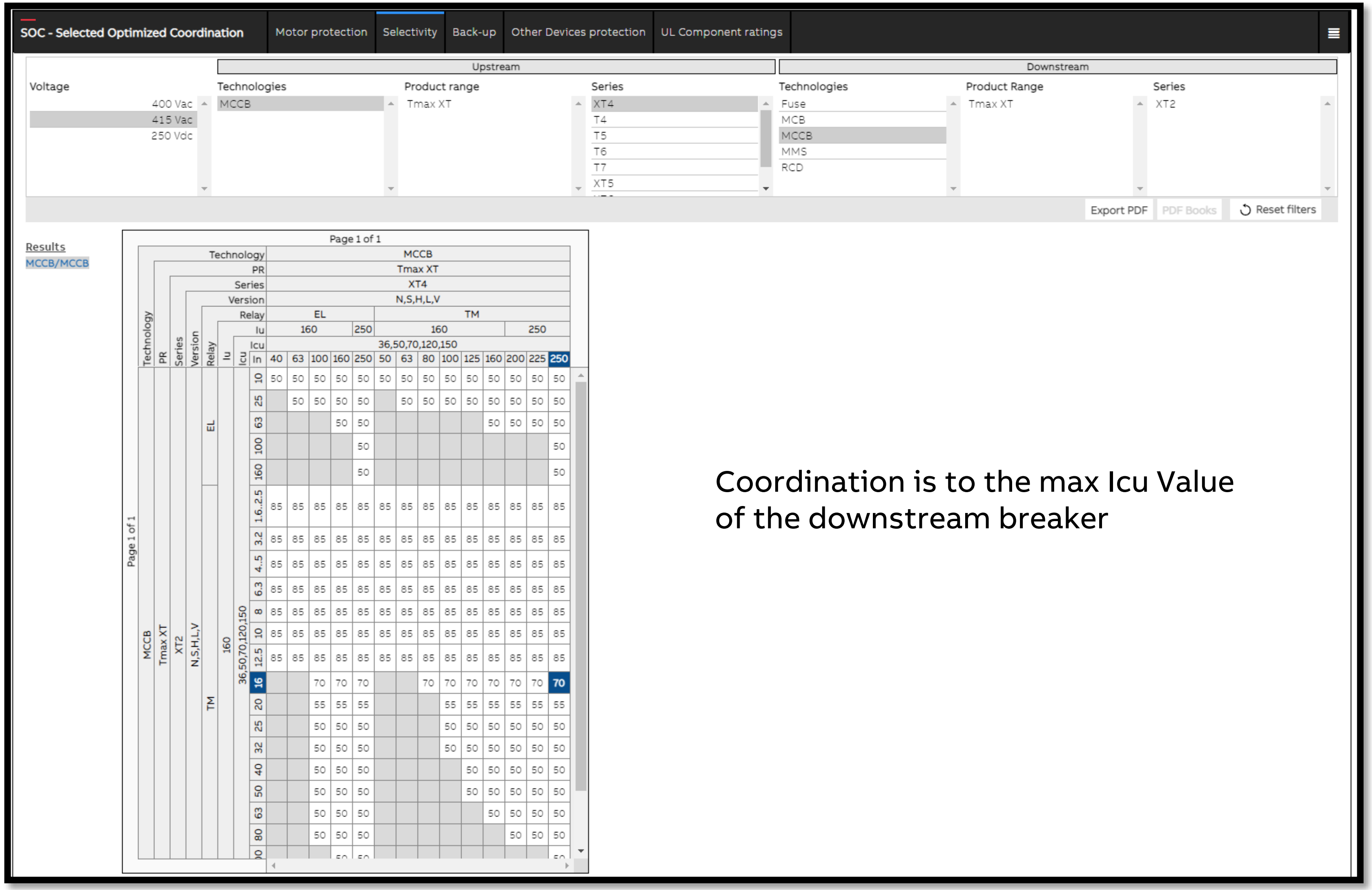
Back-Up

Back-up coordination tables between short-circuit protection devies.

Other devices protection

Coordination table for the protection of switch-disconnector and other devices by short circuit protection devices.

https://applications.it.abb.com/SOC/



Upstream: Technology MCCB; PR Tmax XT; Series XT4; Version N,S,H,L,V; Icu 36,50,70,120,150. Downstream: Technology MCCB; PR Tmax XT; Series XT2; Version N,S,H,L,V; Iu 160; Icu 36,50,70,120,150.

Relay (downstream)	In (downstream)	EL 160: 40	EL 160: 63	EL 160: 100	EL 160: 160	EL 250: 250	TM 160: 50	TM 160: 63	TM 160: 80	TM 160: 100	TM 160: 125	TM 160: 160	TM 250: 200	TM 250: 225	TM 250: 250
EL	10	50	50	50	50	50	50	50	50	50	50	50	50	50	50
EL	25		50	50	50	50		50	50	50	50	50	50	50	50
EL	63				50	50						50	50	50	50
EL	100					50									50
EL	160					50									50
TM	1.6..2.5	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	3.2	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	4..5	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	6.3	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	8	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	10	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	12.5	85	85	85	85	85	85	85	85	85	85	85	85	85	85
TM	16			70	70	70			70	70	70	70	70	70	70
TM	20			55	55	55				55	55	55	55	55	55
TM	25			50	50	50				50	50	50	50	50	50
TM	32			50	50	50				50	50	50	50	50	50
TM	40			50	50	50					50	50	50	50	50
TM	50			50	50	50					50	50	50	50	50
TM	63			50	50	50						50	50	50	50
TM	80			50	50	50							50	50	50
TM	100			[illegible]	50	50									[illegible]

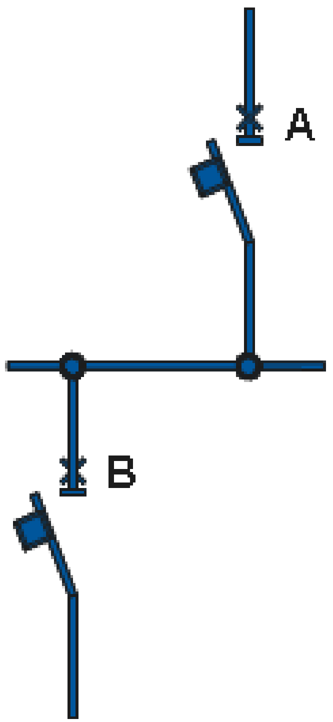
Coordination is to the max Icu Value of the downstream breaker

https://applications.it.abb.com/SOC/

Low voltage selectivity

Selectivity definitions & standards

Partial & Total selectivity



IEC 60947-2
def. 2.17.2 – 2.17.3

A and B connected in series:

partial selectivity and total selectivity.

Low voltage selectivity

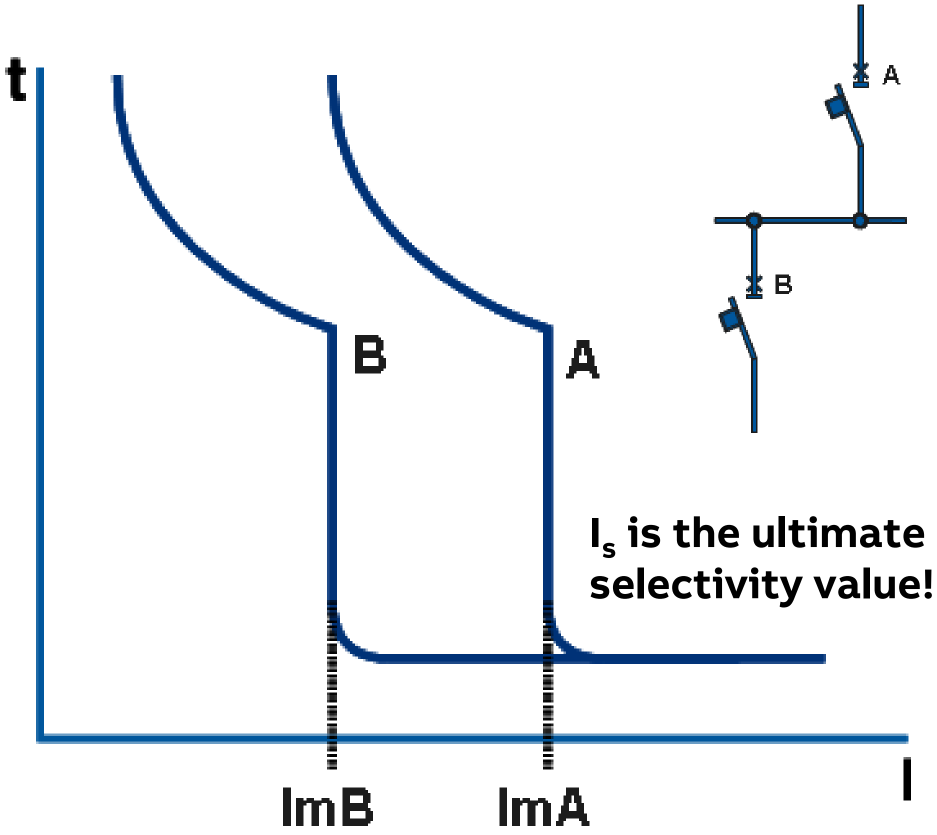
Selectivity definitions & standards

Partial selectivity

"Partial selectivity is an overcurrent selectivity where, in the presence of two protection devices against overcurrent in series, the load side protection device carries out the protection up to a given level of overcurrent, without making the other device trip."

- B opens only according to fault current lower than a certain current value;
- values equal or greater than I_s will give the trip of both A and B.

$$I_s = I_{mA}$$



I_s is the ultimate selectivity value!

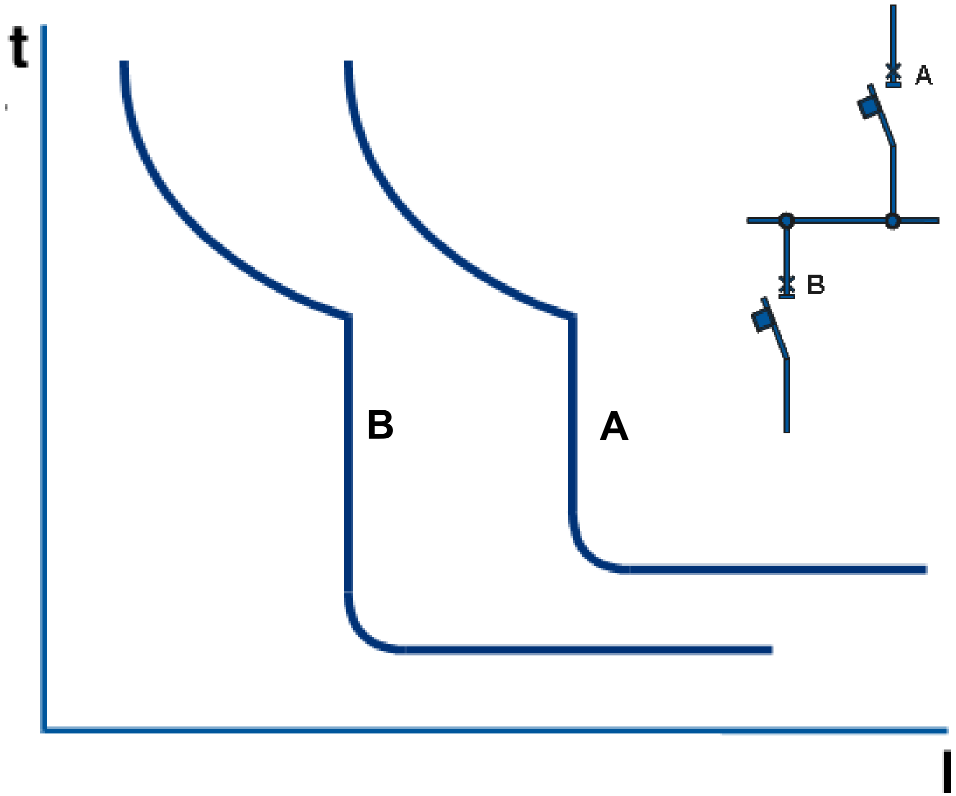
Low voltage selectivity

Selectivity definitions & standards

Total selectivity

"Total selectivity is an overcurrent selectivity where, in the presence of two protection devices against overcurrent in series, the load side protection device carries out the protection without making the other device trip."

- Only B trips for every current value lower or equal to the maximum short-circuit current..



Low voltage selectivity

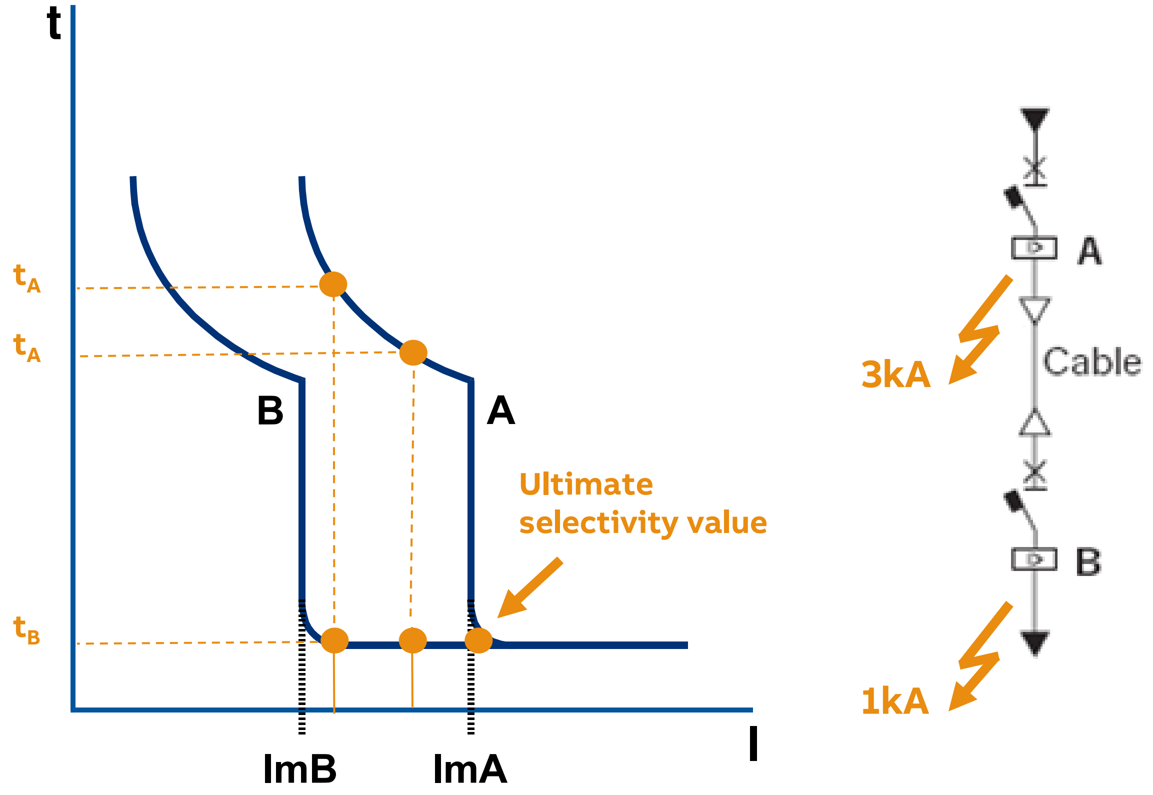
Selectivity techniques

Current selectivity

Basic concept

When the point of fault is closer to the source, the fault current will be higher.

- In order to guarantee selectivity, the protections must be set to different values of current thresholds.
- The ultimate selectivity value is equal to the instantaneous trip threshold of the upstream protection device.
- Other methods are needed to have a total selectivity



Low voltage selectivity

Selectivity techniques

Current selectivity

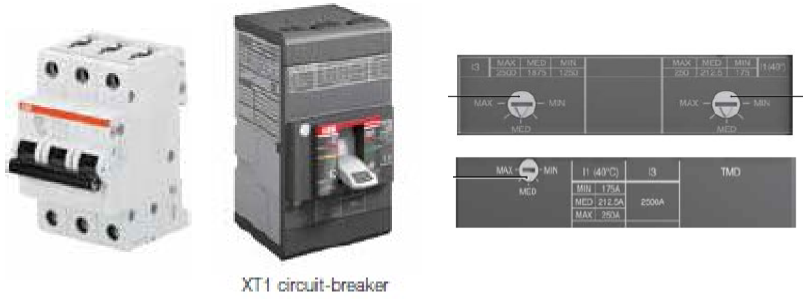
Example

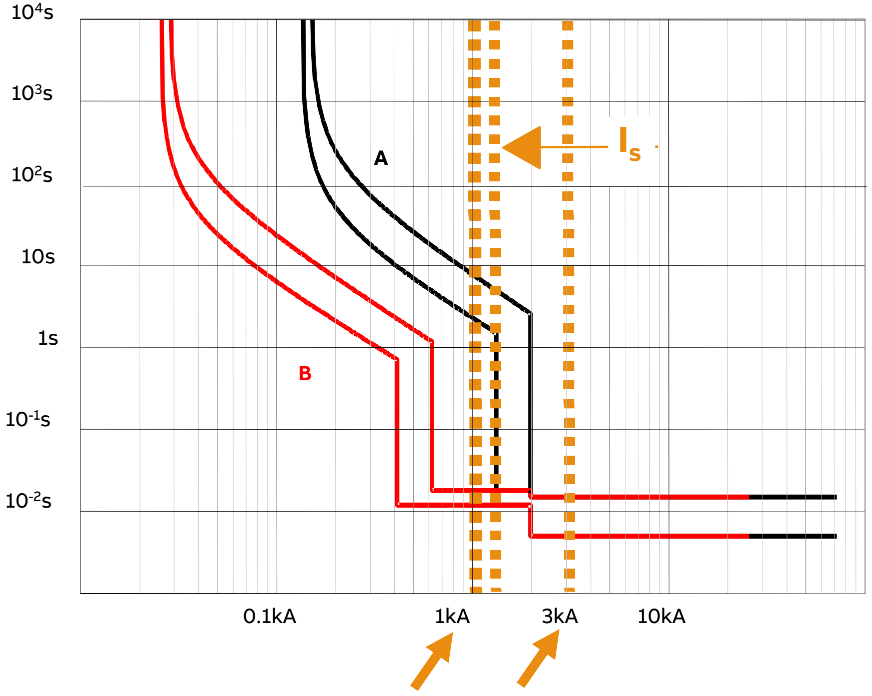
Circuit breaker A will be set to a value which does not trip for faults which occur on the load side of B. (I_{3Amin} >1kA)

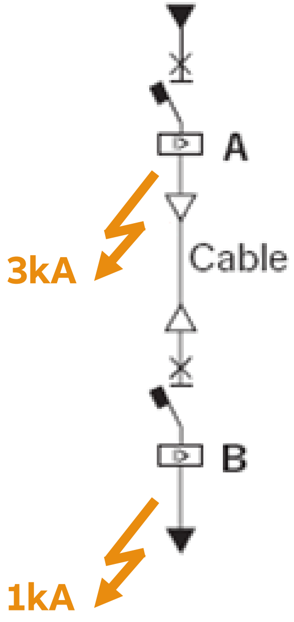
Circuit breaker B will be set to trip for faults which occur on its load side (I_{3Bmax} < 1kA)

$\mathbf{I_s = I_{3Amin}}$

Here the selectivity is a total selectivity, because it is guaranteed up to the maximum value of the short-circuit current, 1kA.







Low voltage selectivity

Selectivity techniques

Current selectivity

Pros & Cons

Pros
Easy to be realized
Economic
Instantaneous

CURRENT SELECTIVITY

Cons
Selectivity is often only partial
Current thresholds rise very quickly

Low voltage selectivity

Selectivity techniques

Time selectivity

Basic concept

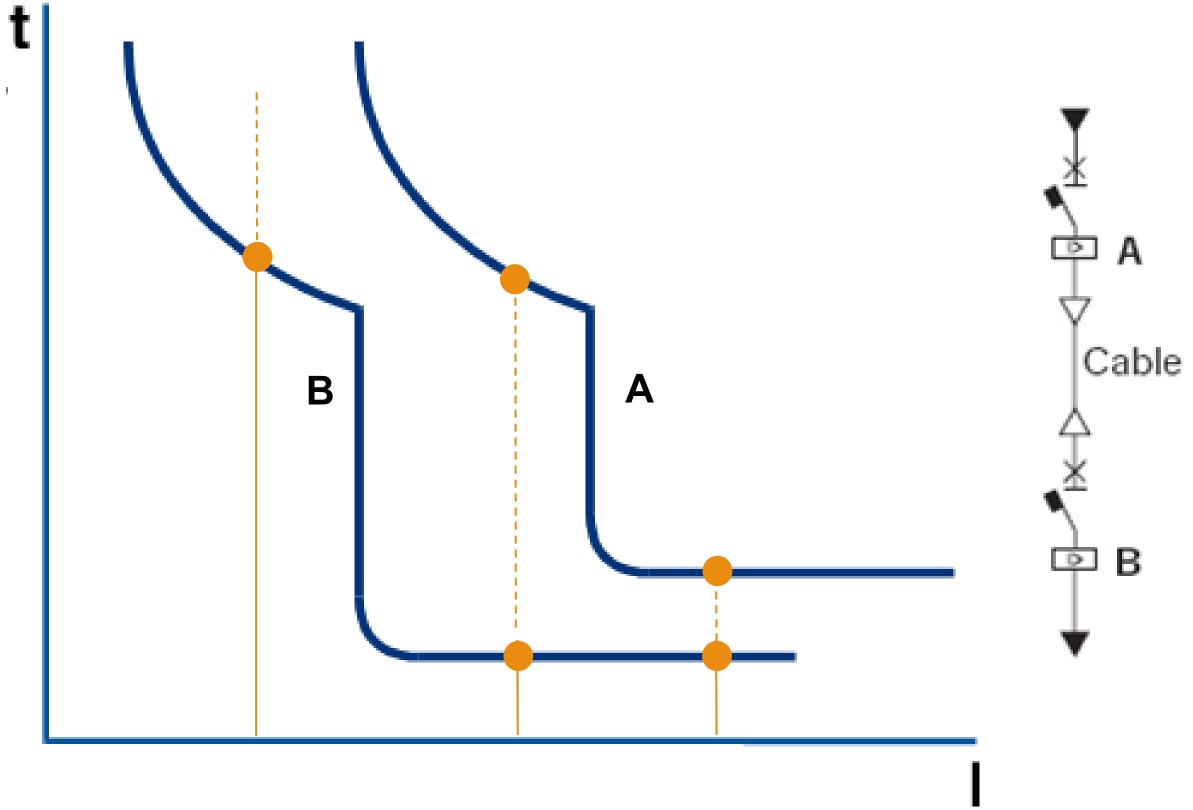
Time selectivity is based on a trip delay of the upstream circuit breaker, so to let to the downstream protection the time suitable to trip

- Setting strategy:

  Progressively increase the trip delays getting closer to the power supply source

- On the supply side:

  The S function is required



Low voltage selectivity

Selectivity techniques

Time selectivity

Example

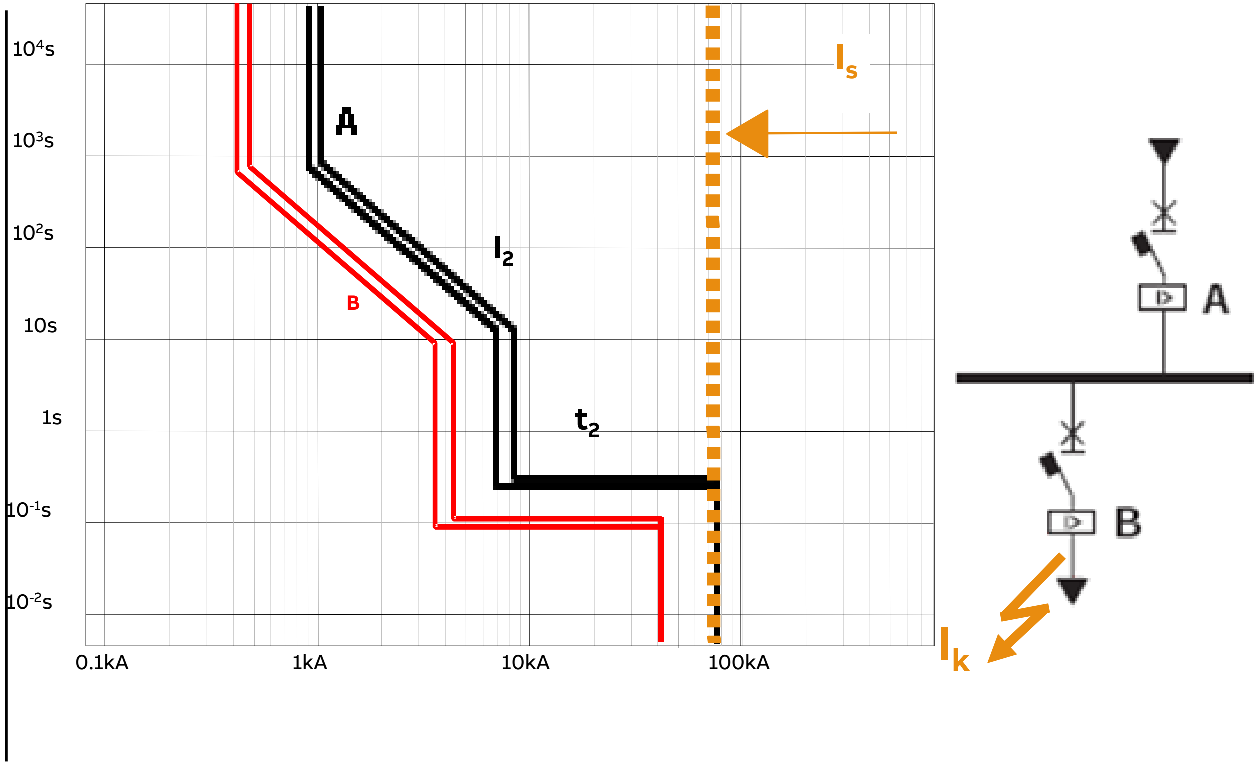
Circuit breaker A will be set with the current threshold I_2 adjusted so as not to create an overlapping trip and with a trip time t_2 adjusted so that B always clears the fault before A.

B will be set with an instantaneous trip against short-circuit.

The ultimate selectivity value is:

$I_s = I_2$ (if function S = ON/ I on Curve A=OFF)

$I_s = I_3$ (if function I = ON / Curve B)



Low voltage selectivity

Selectivity techniques

Time selectivity

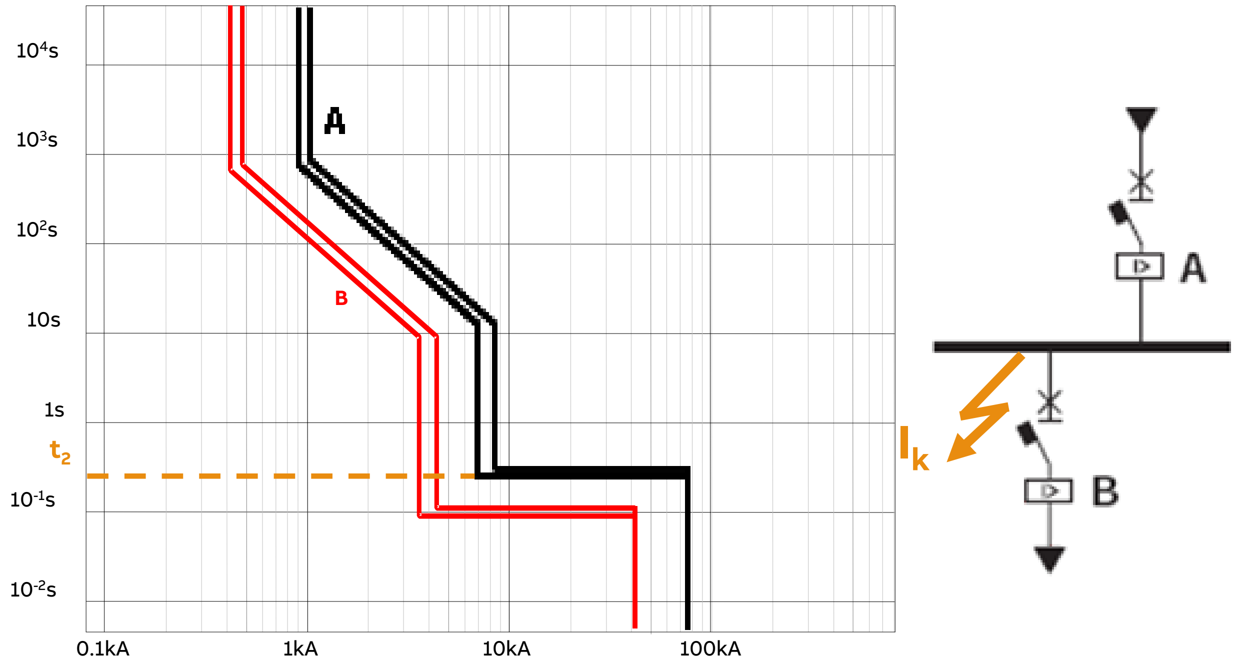
Example

There is a problem with time selectivity!

In the case of fault occurring at the busbars, circuit breaker A takes a delayed trip time t_2

The network must withstand high values of let-through energy!

If there are many hierarchical levels, the progressive delays could be significant!

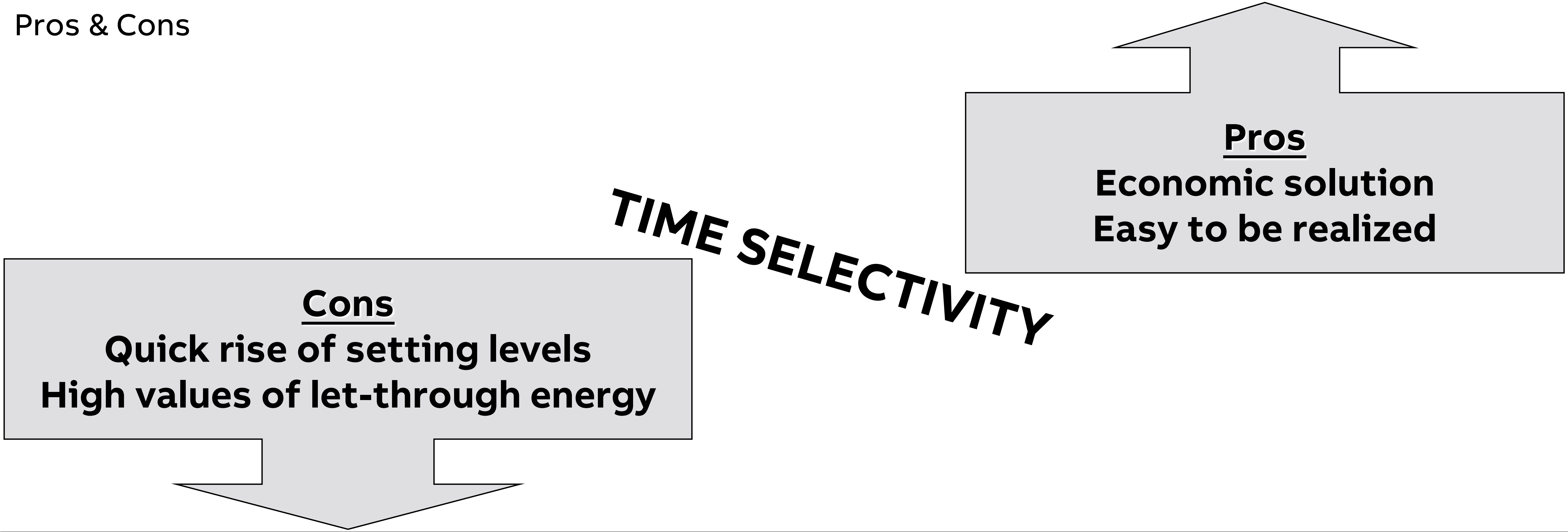


Low voltage selectivity

Selectivity techniques

Time selectivity

Pros & Cons



Low voltage selectivity

Selectivity techniques

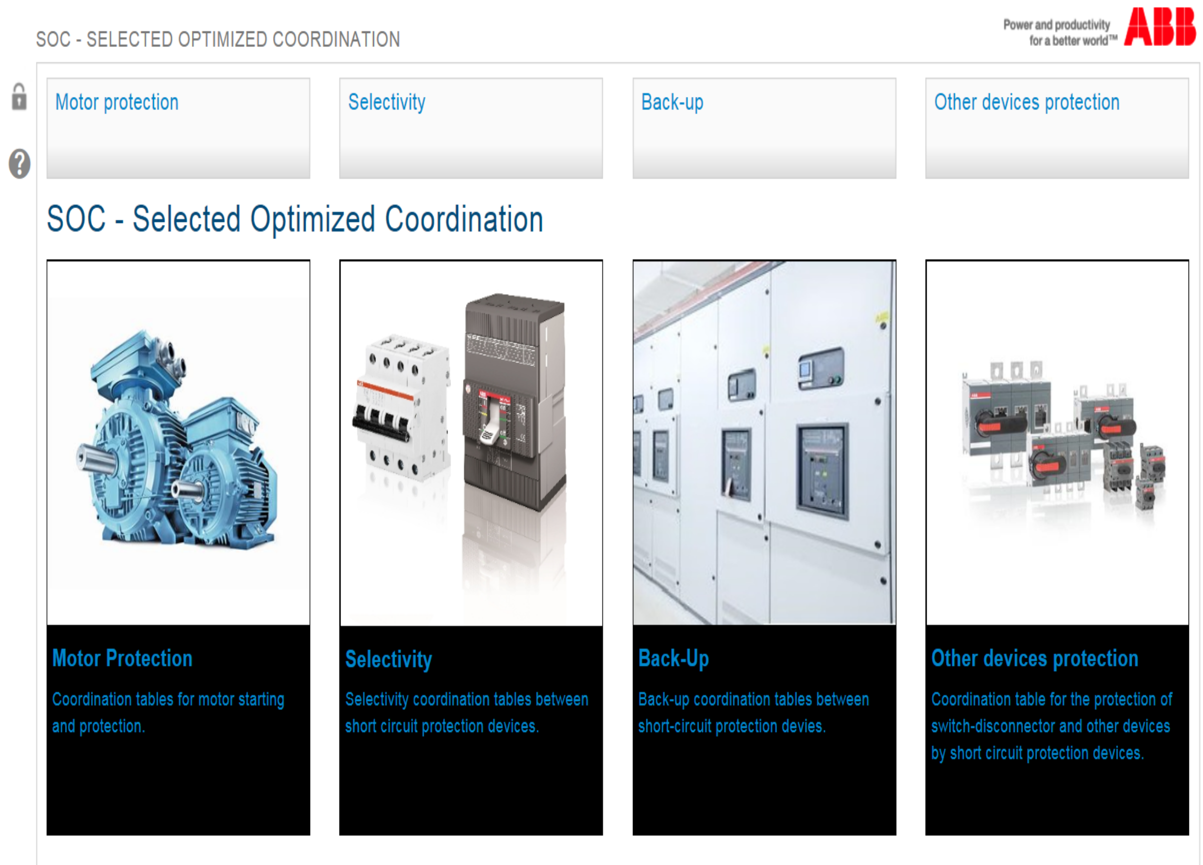
Energy selectivity

Basic concept

Energy selectivity is based on the current-limiting characteristics of some circuit breakers

Current-limiting circuit breaker has an extremely fast trip time, short enough to prevent the current from reaching its peak

The ultimate current selectivity values are given by the manufacturer (Coordination tables)



Low voltage selectivity

Selectivity techniques

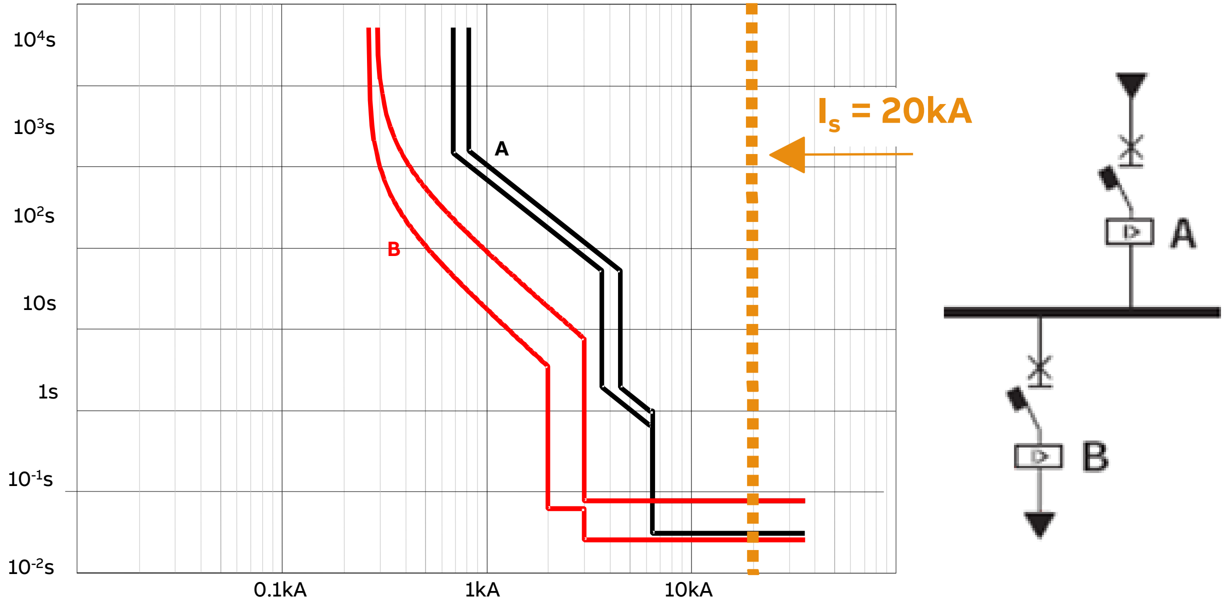
Energy selectivity

Example

Circuit breaker A settings:

I3 = OFF

S protection is used for time selectivity



Low voltage selectivity

Selectivity techniques

Energy selectivity

Pros & Cons

Pros
High selectivity values
Reduced tripping times
Low stress and network disturbance

ENERGY SELECTIVITY

Cons
Increasing of circuit breakers size

Selectivity techniques

Traditional solutions

- **Time current selectivity**
- **Current Selectivity**
- **Time Selectivity**
- **Energy Selectivity**

Advanced solutions

- **Zone selectivity ZSI**
- **Selectivity using Goose**

Selectivity techniques

Time selectivity

Zone Selectivity

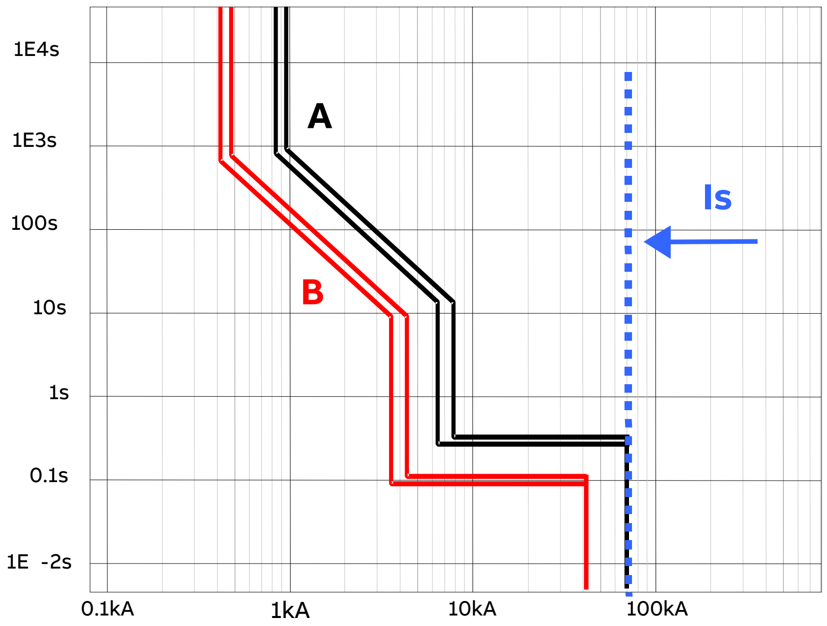
Zone selectivity ZSI

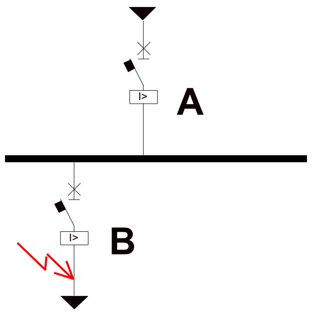
Type of devices

Breakers with high Icw values

Breakers with high performance trip units

Time Selectivity



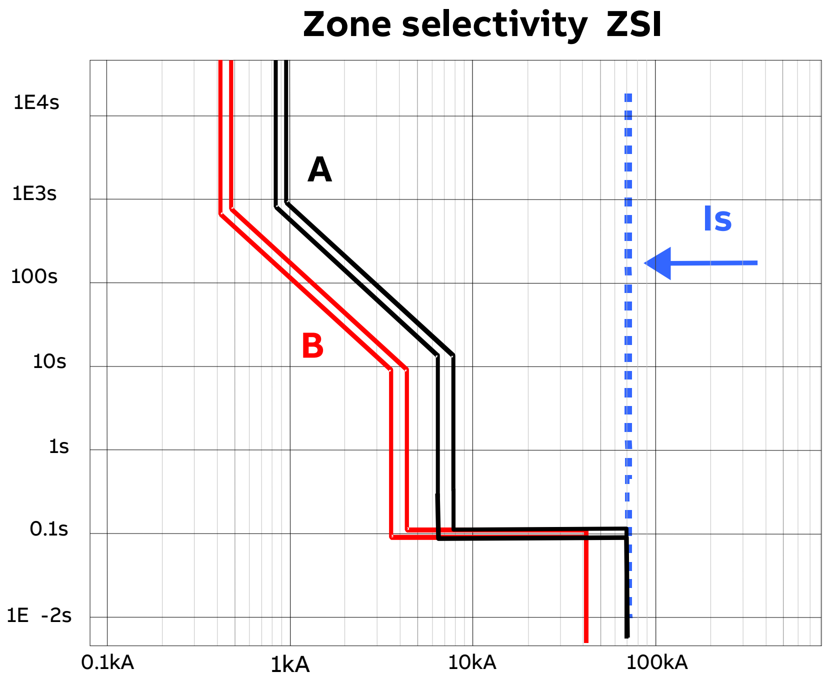


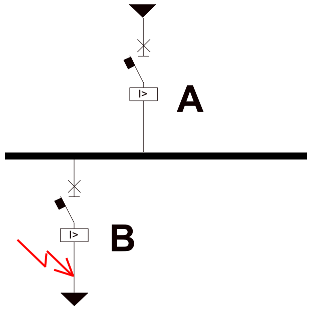
Zone selectivity ZSI

Type of devices

Breakers with high Icw values

Breakers with high performance trip units

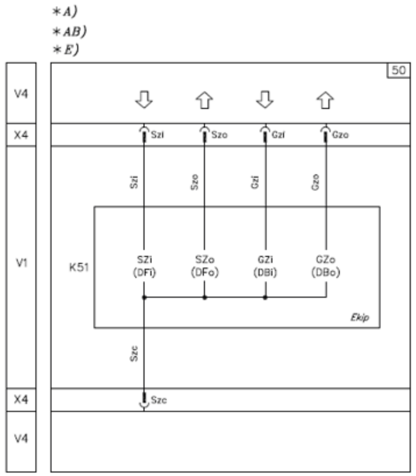


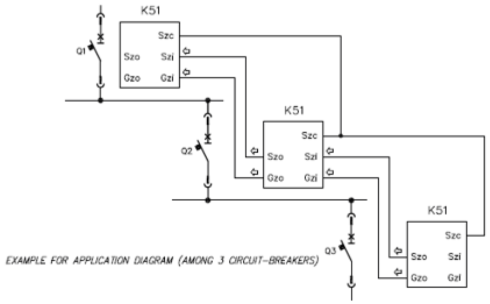


Interlock S and G function (or for D function)

Zone Selectivity

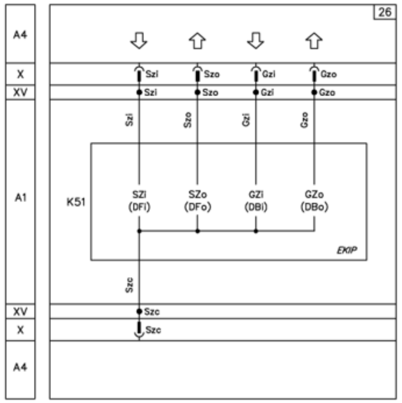
XT zone selectivity



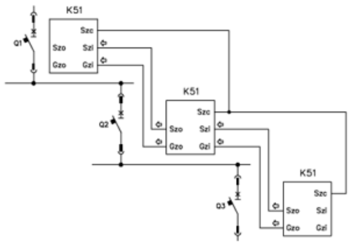


Emax 2 zone selectivity

26) Zone selectivity



Example for application diagram (among 3 circuit-breakers)



A) The presence of an auxiliary supply is required
for the local bus and zone selectivity functions (see Fig. 41-78).

AB) Use two-pole shielded cable type BELDEN 8762/8772 or equivalent. The shield must be earthed on the selectivity input side (for zone selectivity) or on both sides (for other applications

E) Only for XT5.

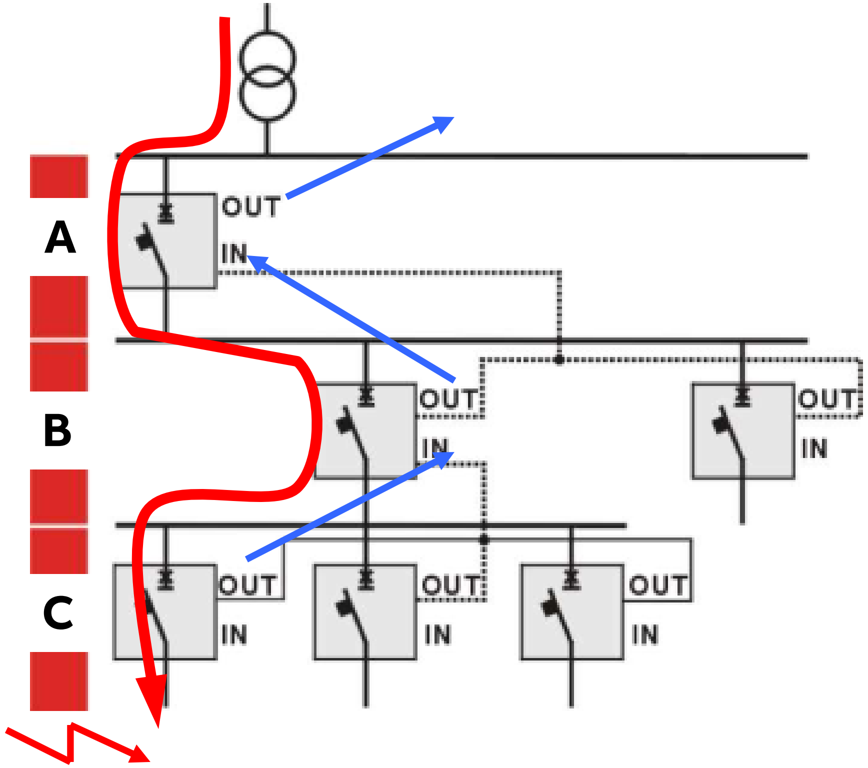
From the circuit wiring diagram, it is clear both XT and Emax2 are wired the same

Zone Selectivity

How works Zone selectivity

The C breaker sends a signal to Breaker B and this in turn only Time at the normal “S” protection setting (so slower)

If the fault is here the Breaker C trips in the Zsel Time,(so it is faster)



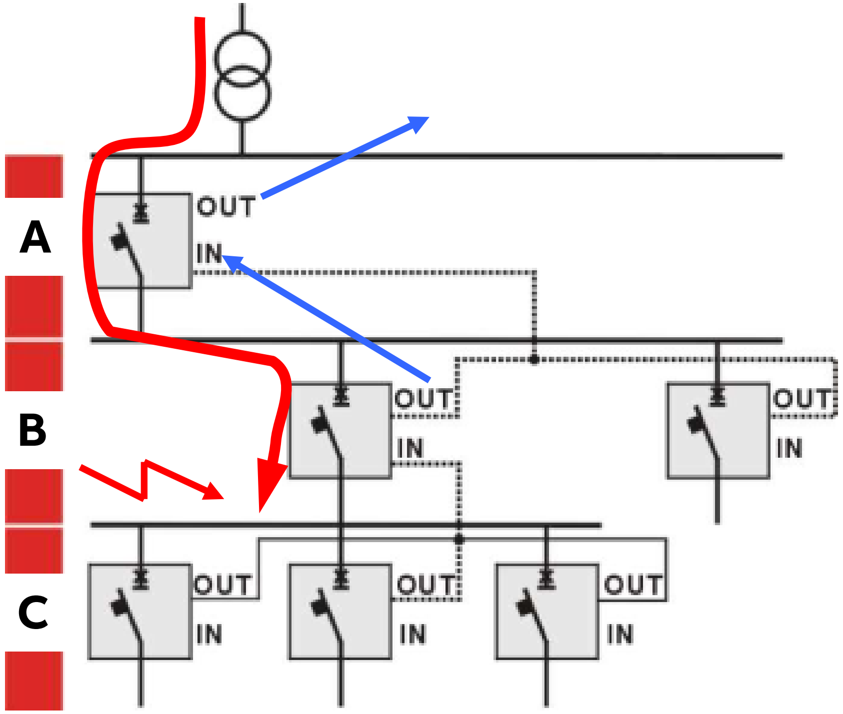
C sees the fault and sends a signal to A & B to remain in their normal “S” protection

Zone Selectivity

How works Zone selectivity

The B breaker sends a signal to Breaker A and this in turn only Time at the normal “S” protection setting (so slower)

If the fault is here the Breaker B now trips in the Zsel Time,(so it is faster)



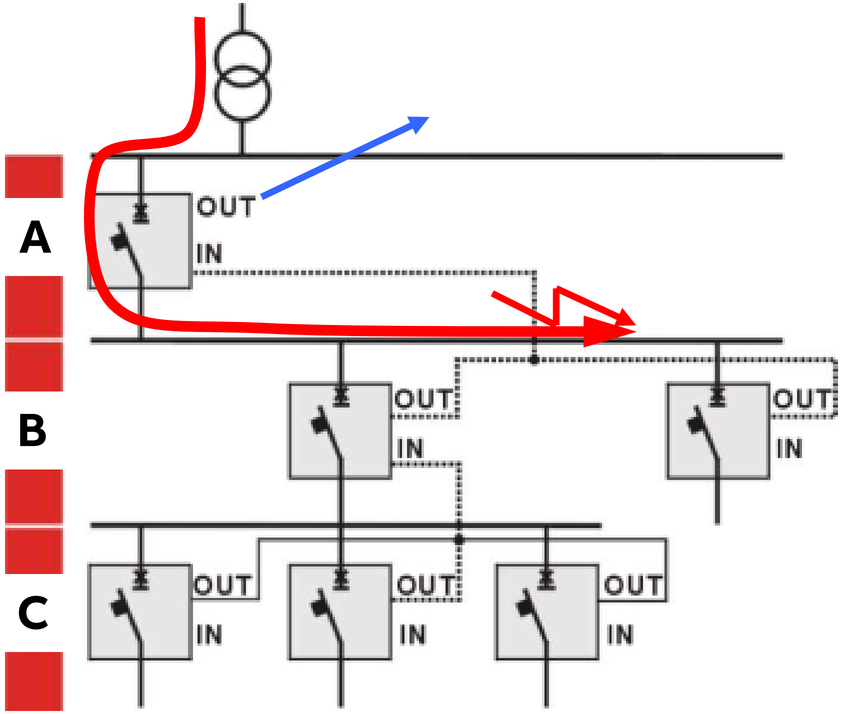
B sees the fault and sends a signal to A to remain in their normal “S” protection

Zone Selectivity

How works Zone selectivity

The A breaker sends a signal to Breaker upstream if needed

If the fault is here the Breaker A now trips in the Zsel Time,(so it is faster)



‘A’ see the current and OPEN’s

Zone selectivity

The **zone selectivity**, which is applicable to protection functions S and G, can be enabled in the case where the curve with fixed time is selected and the auxiliary power supply is present.
This type of selectivity allows shorter trip times for the circuit-breaker closest to the fault than in the case of time-selectivity.
It is a type of selectivity suitable for radial nets.
The word zone is used to refer to the part of an installation between two circuit-breakers in series. The fault zone is the zone immediately on the load side of the circuit-breaker that detects the fault. Each circuit-breaker that detects a fault communicates this to the circuit-breaker on the supply side by using a simple communication wire. The circuit-breaker that does not receive any communication from those on the load side will launch the opening command within the set selectivity time (40÷200ms).

We have to consider that the circuit-breakers receiving a signal from another trip unit will operate according to the set time t_2.

If, for any reason, when the “selectivity time” has elapsed, the circuit-breaker delegated to opening has not opened, it makes the locking signal towards the other circuit-breakers cease to eliminate the fault.

To realize correctly the zone selectivity the following settings are suggested:

S	t2 ≥ selectivity time + t opening
I	I3 = OFF
G	t4 ≥ selectivity time + t opening
Selectivity time	same setting for each circuit-breaker

Low voltage selectivity

Selectivity techniques

Zone selectivity

Pros & Cons

ZONE SELECTIVITY

Pros

Trip times reduced
Low thermal and dynamic stress
High number of hierarchical levels
Can be made between same size circuit breakers

Cons

Cost and complexity of the installation
Additional wiring and components

Selectivity techniques

Traditional solutions

- Time current selectivity
- Current Selectivity
- Time Selectivity
- Energy Selectivity

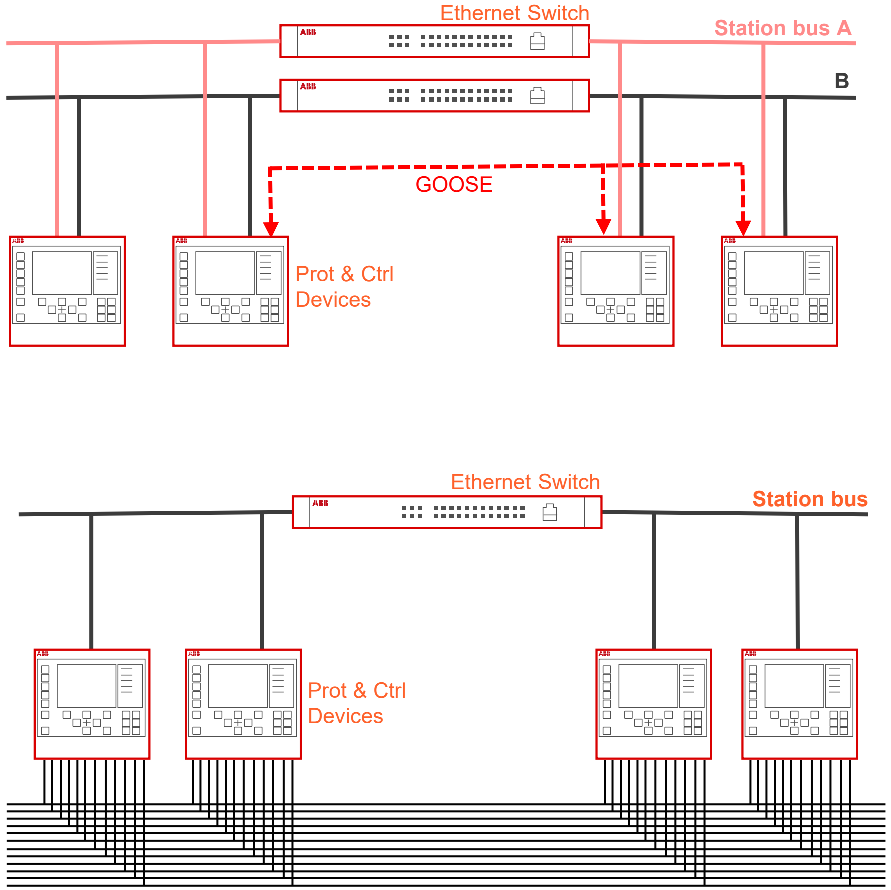
Advanced solutions

- Zone selectivity ZSI
- Selectivity using Goose (IEC61850)

What is GOOSE?

- GOOSE (Generic Object Oriented Substation Event)
- It is a ABB mechanism for the fast transmission of substation events, such as commands, alarms, indications (as messages)
- A single GOOSE message sent by an IED (can be received and used by several receivers).
- GOOSE takes advantage of the powerful Ethernet and supports real-time behaviour
- It is used for e.g.
- tripping of switchgear
- starting of disturbance recorder
- providing position indication for interlocking

GOOSE – Advantages vs conventional wiring



Higher availability

– Less equipment and auxilliary relays required

– All signals are continuously supervised

– Optional link redundancy

Better performance

– No intermediate relays with delay times

Optimized costs

– No wiring between panels

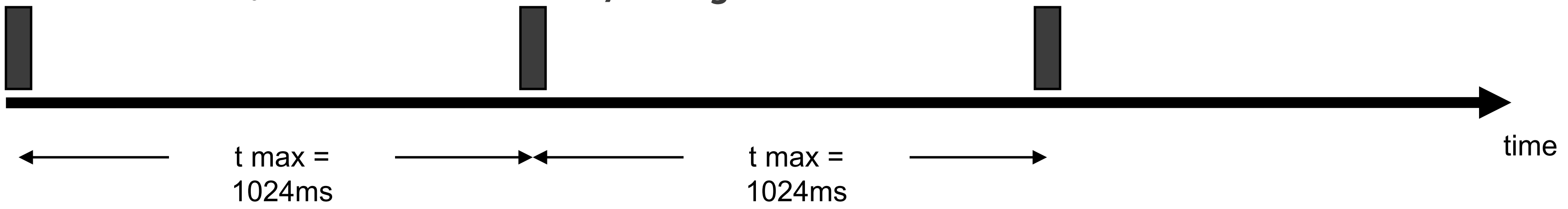
– Less I/Os at IEDs required

– Off-line testing through simulation

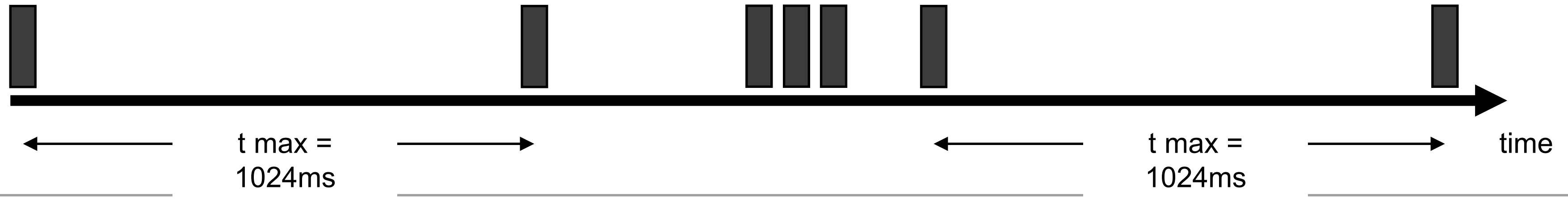
GOOSE – Real time communication

The **unconfirmed** GOOSE **messages** may transport important time critical information like a block or a trip. Therefore, a **special mechanism** has **to guarantee** a **reliable transfer** of these data

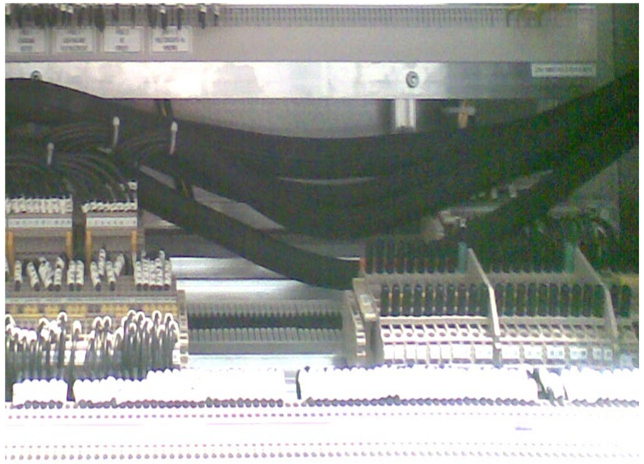
Without any changes, the GOOSE-message is repeated with T_{max} until the next event / change.



In case of a information-change, the GOOSE-message will be repeated within T_{min}.
The repetition frequency is lowered until T_{max} is reached.



GOOSE Performance (IEC61850 / Open protocal)



	From / to protection and control IEDs	From / to other devices	Total
Number of I/O wires			
Inter bay signalling	104	116	220
Automation system	85	47	132
Other externals, i.e. load management system	383	252	635
Total	572	415	987

Use case:

UniGear switchgear with 10 bays

- Load management system, as well as control system interface

70% of the LV signals are between the IEDs

With GOOSE. There's a great potential to:

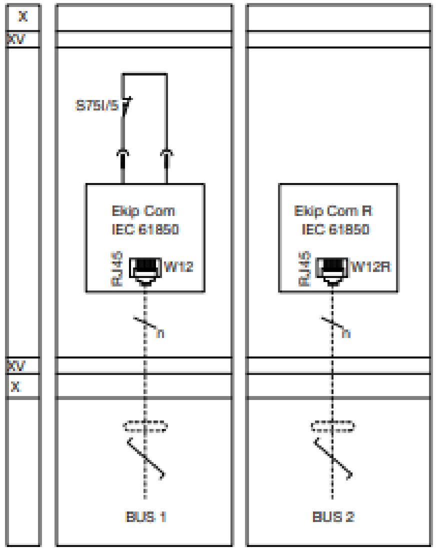
- Simplify
- Make it more flexible
- Make it more efficient
- Make it more cost-efficient
- Make it more reliable

GOOSE Performance (IEC61850 / Open protocal)

4.2.2 Connection to the Ethernet network

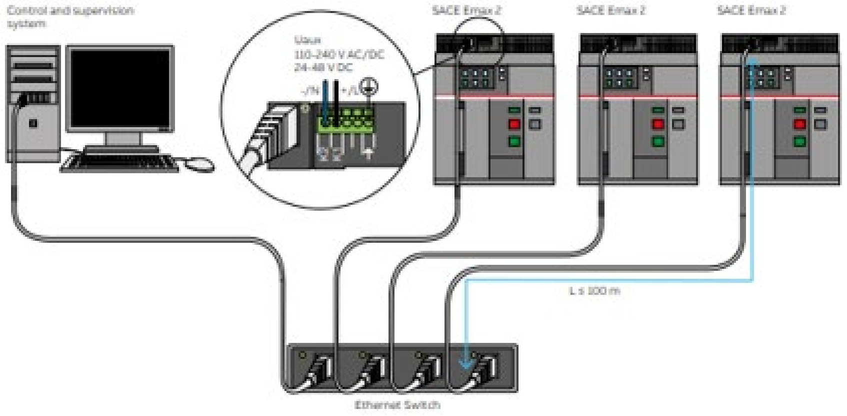
The circuit-breaker is connected to the Ethernet network through the RJ45 female connector (W12) of the Ekip Com Modbus IEC61850 module, according to the diagram shown in the following figure. The connector is usually linked to an Ethernet cable that, in turn, connects the circuit-breaker to one of the port of an Ethernet switch. The use of the cable Ethernet Cat6 S/FTP is recommended.

Wiring diagram

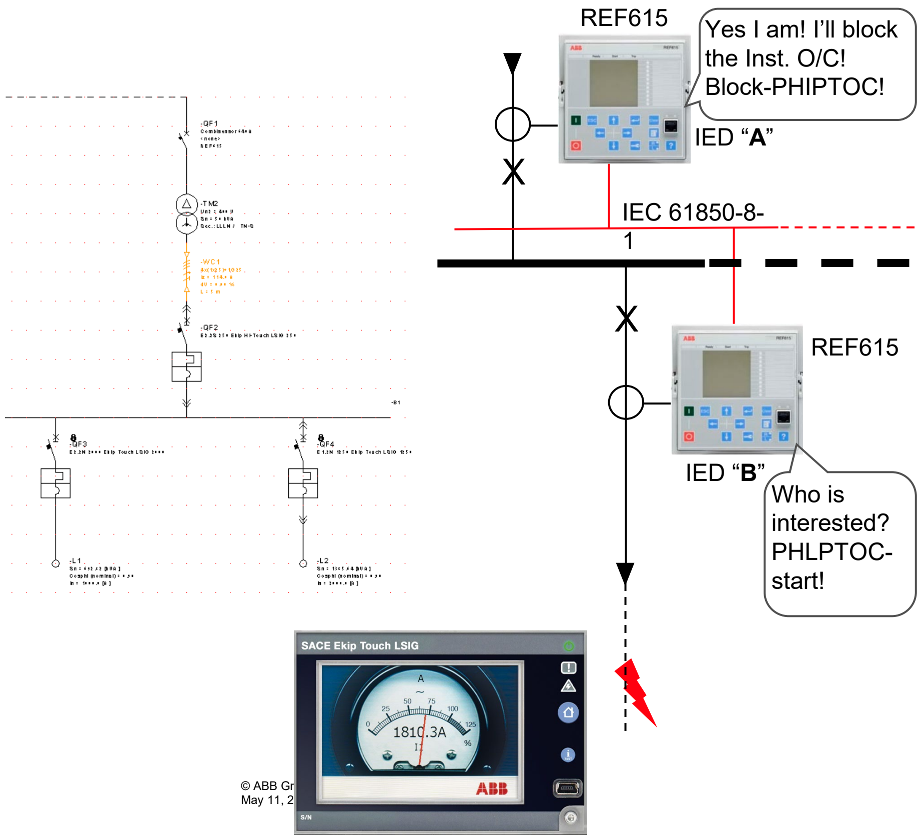


For the implementation of the communication network, which is the customer's responsibility, it is fundamental to comply with the standard installation procedures of the industrial Ethernet networks in terms, for instance, of maximum length and type of cables. Choice and installation of the Ethernet switches are customer's responsibility. It is also his responsibility to make sure that the switches can be used in the Ethernet networks with the IEC61850 communication protocol. The maximum length of the cable for the connection from the Ekip Com IEC61850 module to the switch is about 100 m (Ethernet Cat6 S/FTP cable).

Note:
X: Connector for the auxiliary circuits of the circuit-breaker in withdrawable version
XV: Terminal box for the auxiliary circuits of the circuit-breaker in fixed version
S75I/5 = Contact for signalling circuit-breaker in racked-in position (available only for circuit-breakers in withdrawable version).
When more Ekip Com modules are present, or in the presence of the module Ekip Com Modbus TCP Redundant, the contact S75I/5 must be connected to one single module only once, and never to the redundant module.
Bus 1/Bus 2: Ethernet cable.

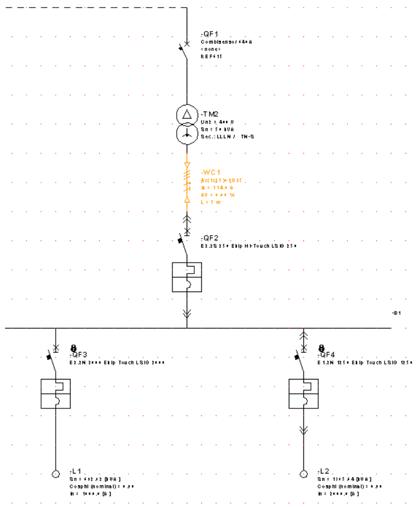


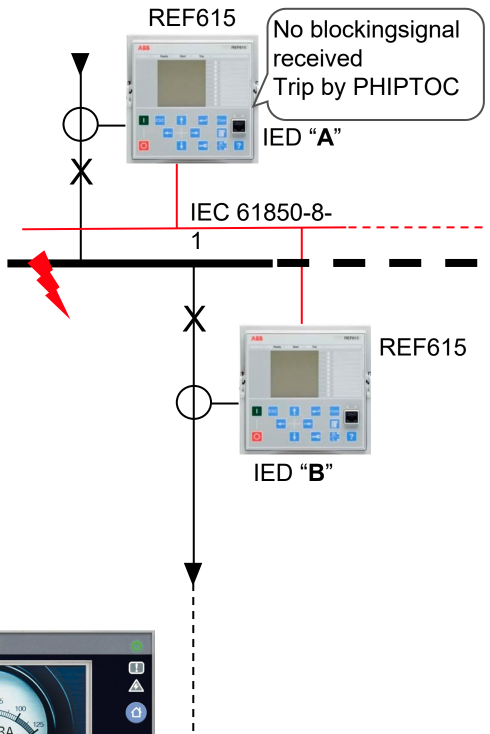
Application examples
Blocking-based busbar protection



- IED B (outgoing feeder) detects a fault on the line by its over-current protection. The "start signal" of the OC protection is sent to 'IED A' of the incoming feeder as a GOOSE message
- The GOOSE message is used to block the instantaneous OC protection of 'IED A'
- The fault is selectively cleared by 'IED B' tripping the outgoing feeder breaker

Application examples
Blocking-based protection





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May 11, 2

- 'IED B' (outgoing feeder) doesn't detect a fault on the busbar's by its over current protection. No "start signal" of the OC protection is sent
- After the set operating time the fault is cleared by 'IED A' tripping the incoming feeder breaker

IEC61850 other applications:

- Dual Settings
- Circuit breaker Failure
- Arc Monitoring

Copper wiring	<37ms
GOOSE	<23ms

Low voltage selectivity

Selectivity techniques

GOOSE selectivity

Pros & Cons

Pros

Trip times reduced
Low thermal and dynamic stress
High number of hierarchical levels
Can be made between same size circuit breakers
MV/LV connectivity
Reduced number of inter cables
RJ45 continuously monitored.

GOOSE SELECTIVITY

Cons

Complexity of the installation
Different Testing philosophy

ABB

Low voltage selectivity

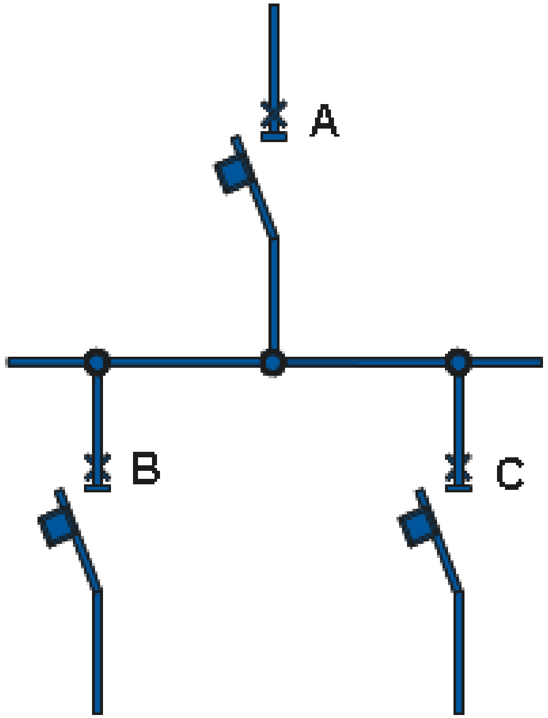
Back-Up Protection

What is Back-Up protection?

Back-Up protection (or Cascading)

Is a type of coordination of two protective devices in series which is done in electrical installations where continuous operation is not an essential requirement.

Back-up protection
excludes the use
of selectivity!!!



Low voltage selectivity

Back-Up protection

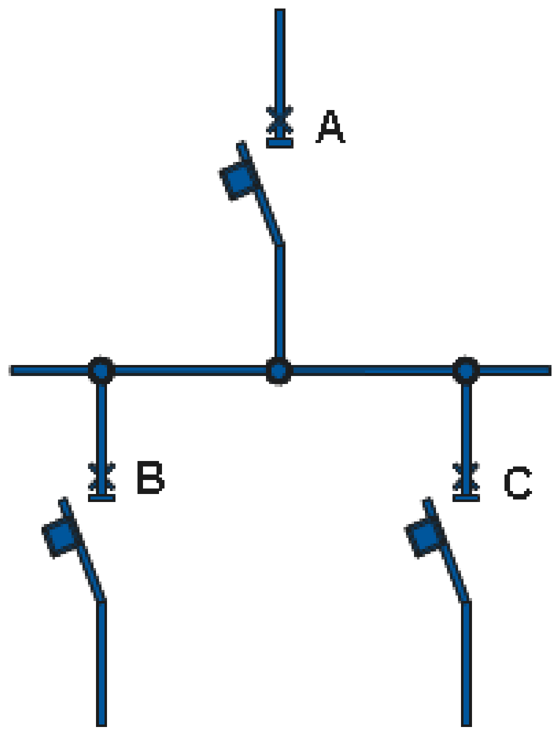
Back-Up protection

Basic concept

Back-up is used by those who need to contain the plant costs

The use of a current-limiting circuit breaker on the supply side permits the installation of lower performance circuit breakers on the load side

Both the continuity of service and the selectivity are sacrificed

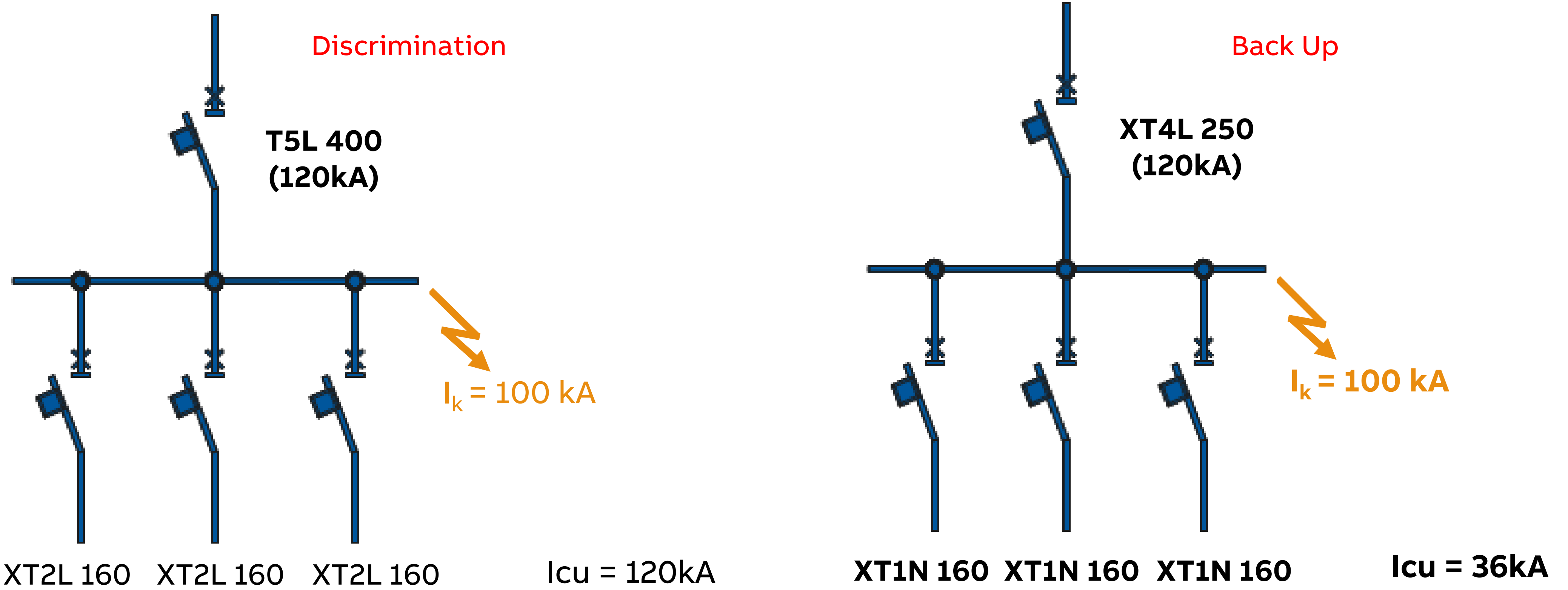


Low voltage selectivity

Back-Up protection

Back-Up protection

Example

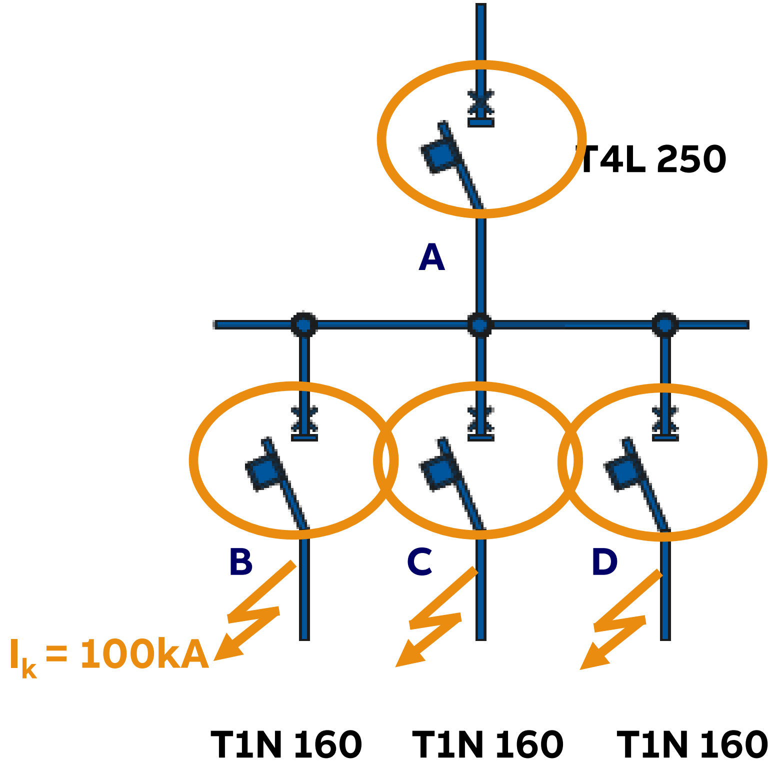


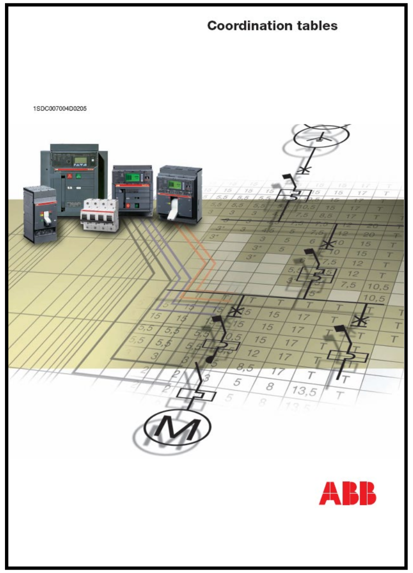
Low voltage selectivity

Back-Up protection

Back-Up protection

Example





Icu (T4L+T1N) = 100kA

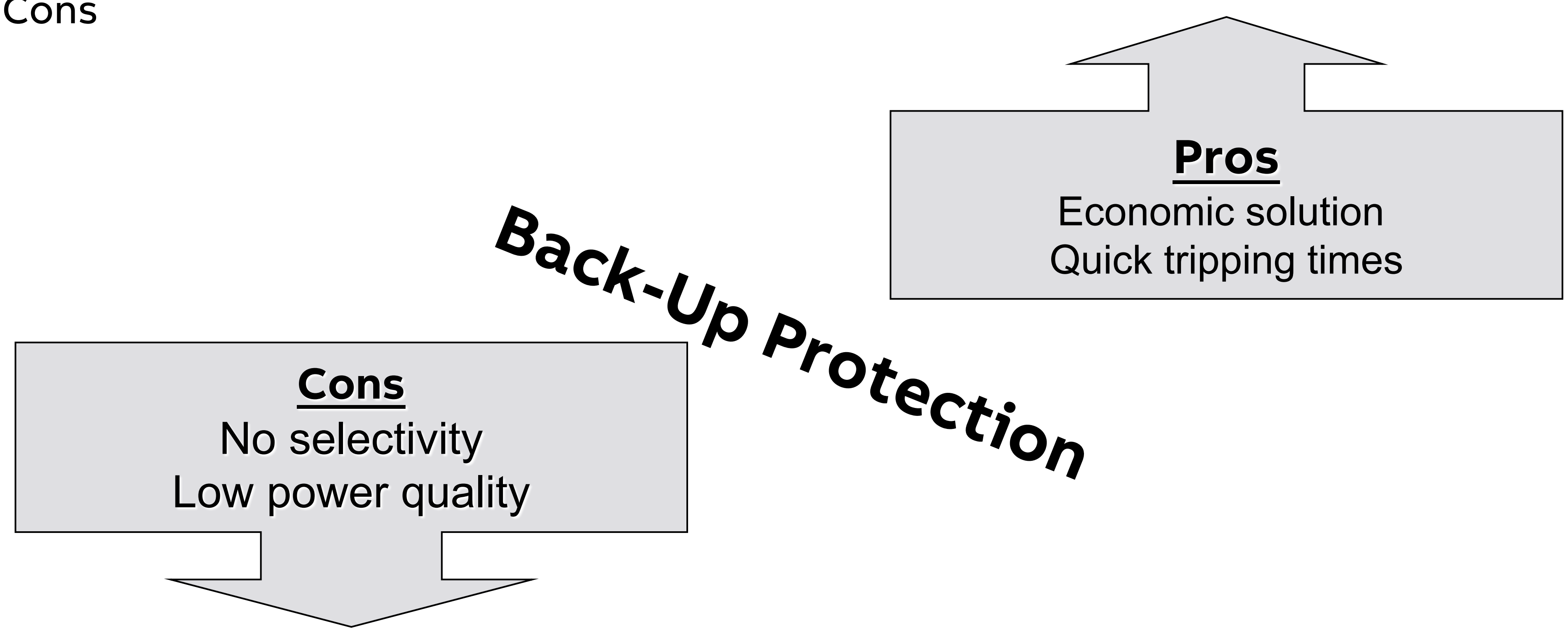
General power supply is always lost

Low voltage selectivity

Back-Up Protection

Back-Up protection

Pros & Cons

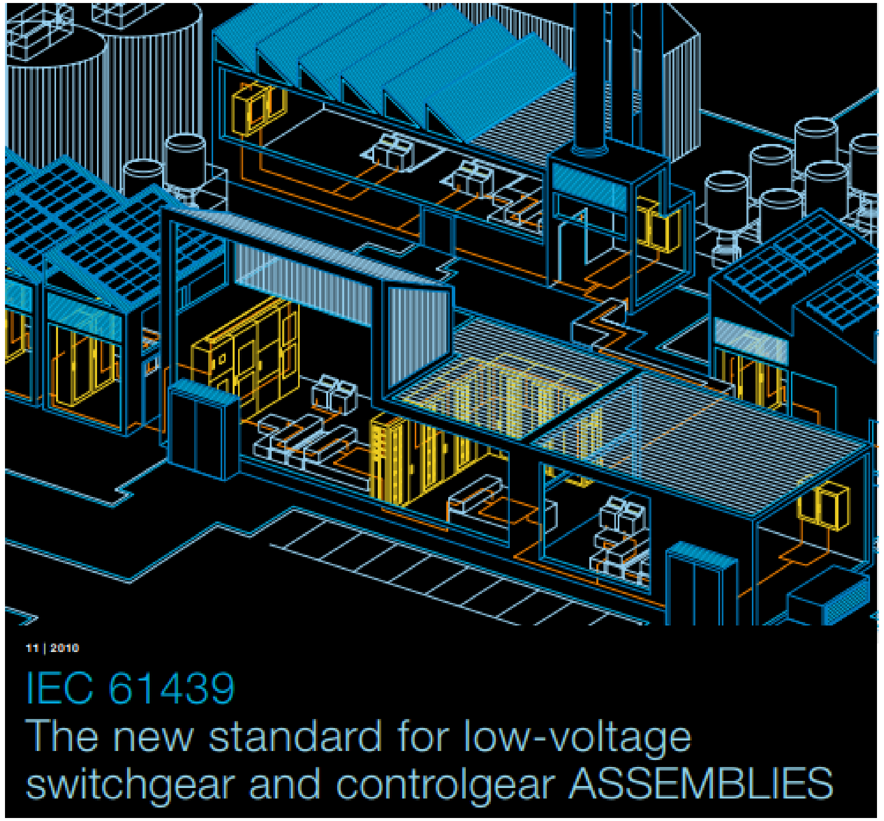


Photo’s

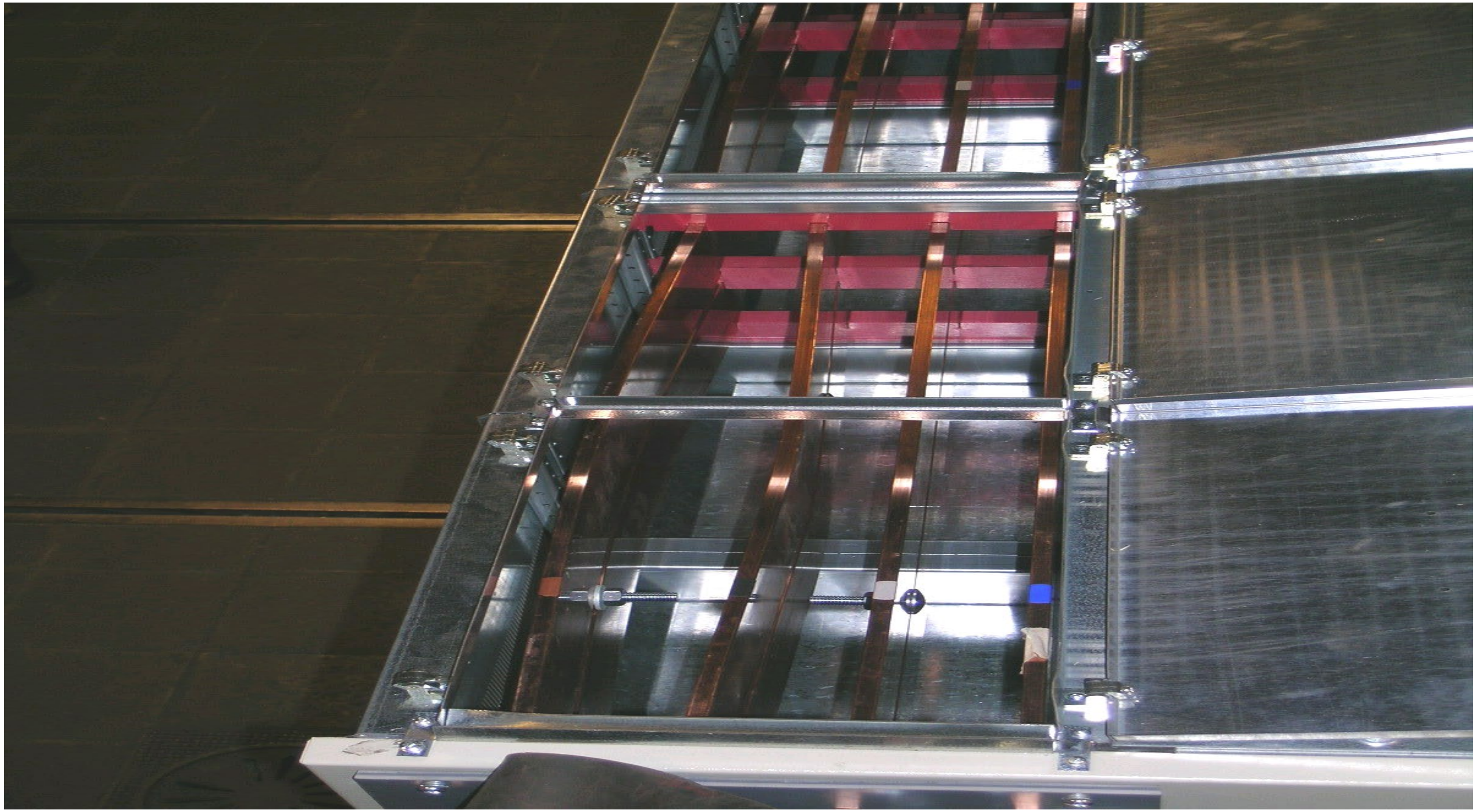
From the test lab. Under control conditions.

IEC 61439- 2 (EN IS 61439-2)

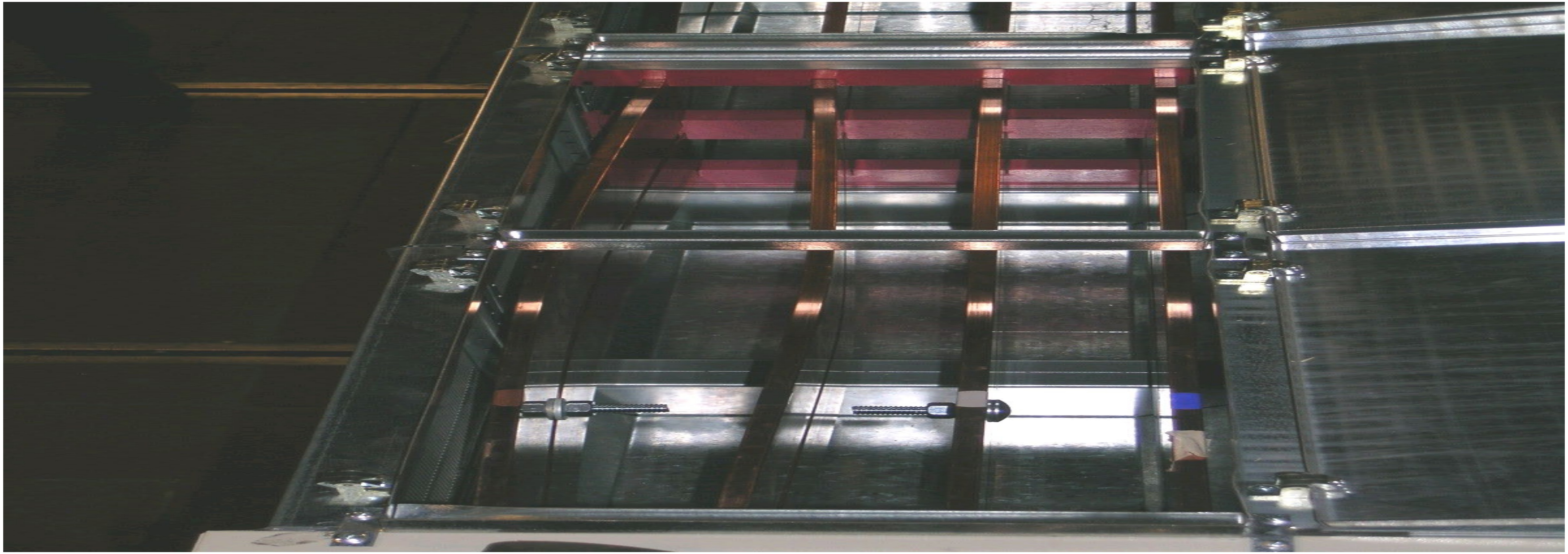
https://library.e.abb.com/public/57756bd5fffd72fac12579ca002d8907/k0119_the_new_iec_web.pdf



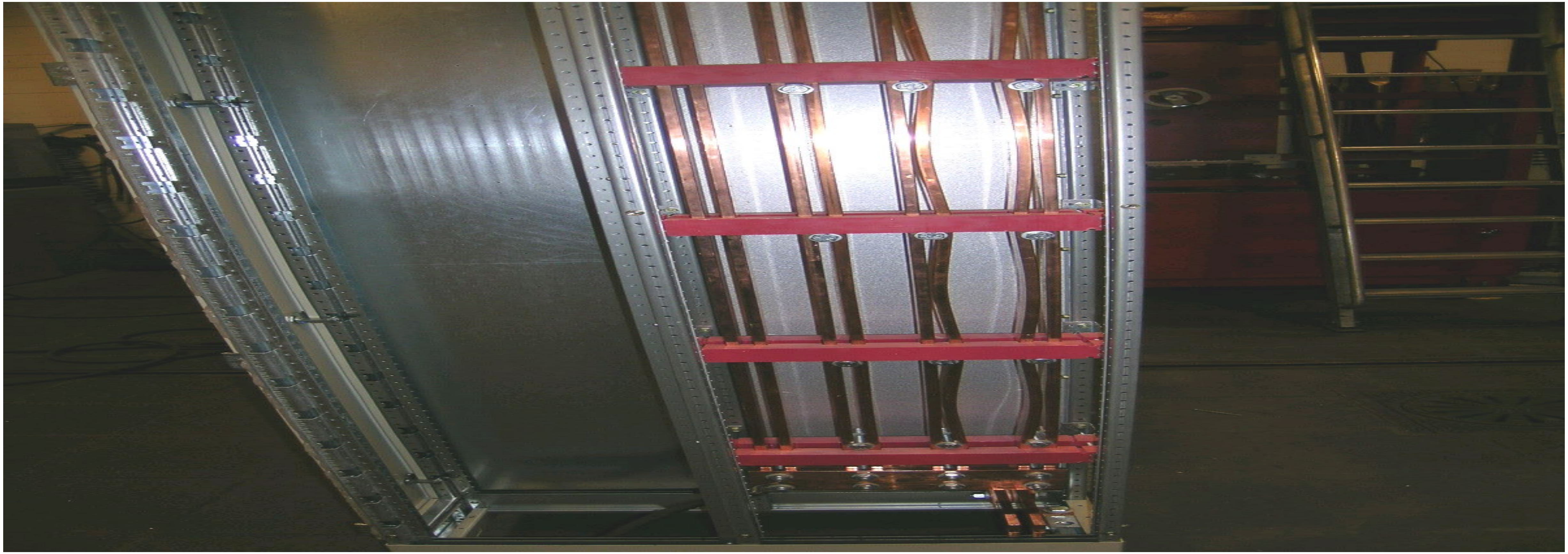
80kA / 70 mS



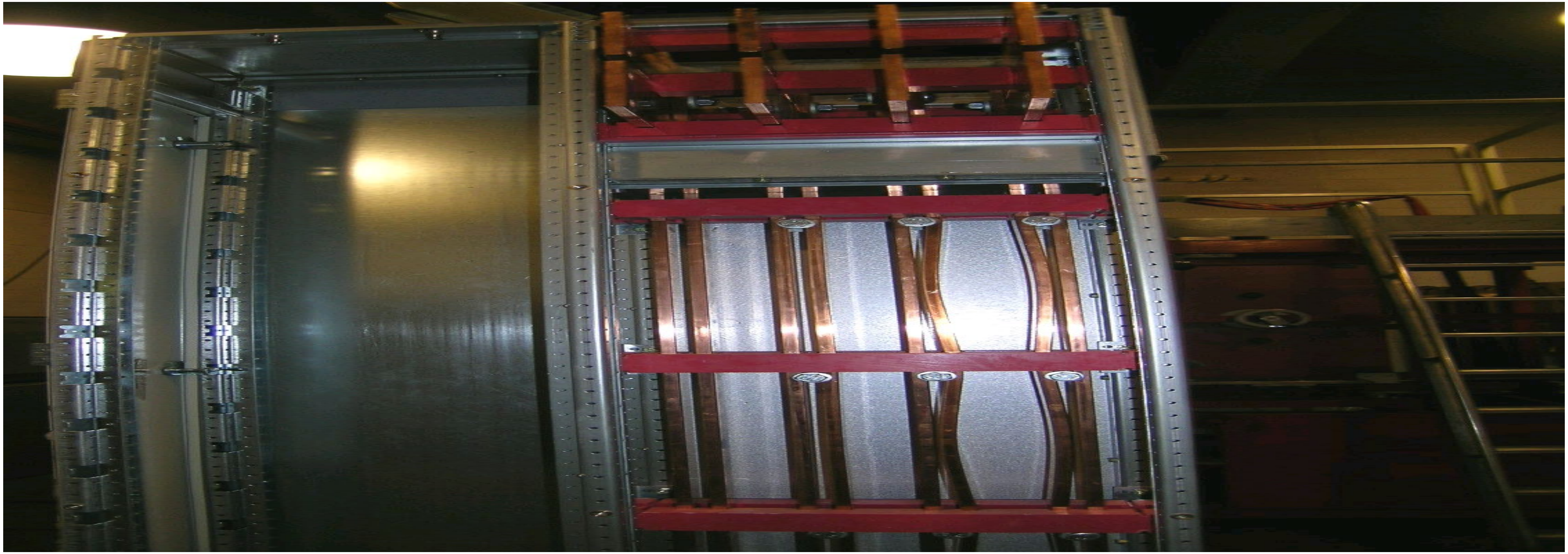
80kA / 70 mS



80kA / 70 mS



80kA / 70 mS



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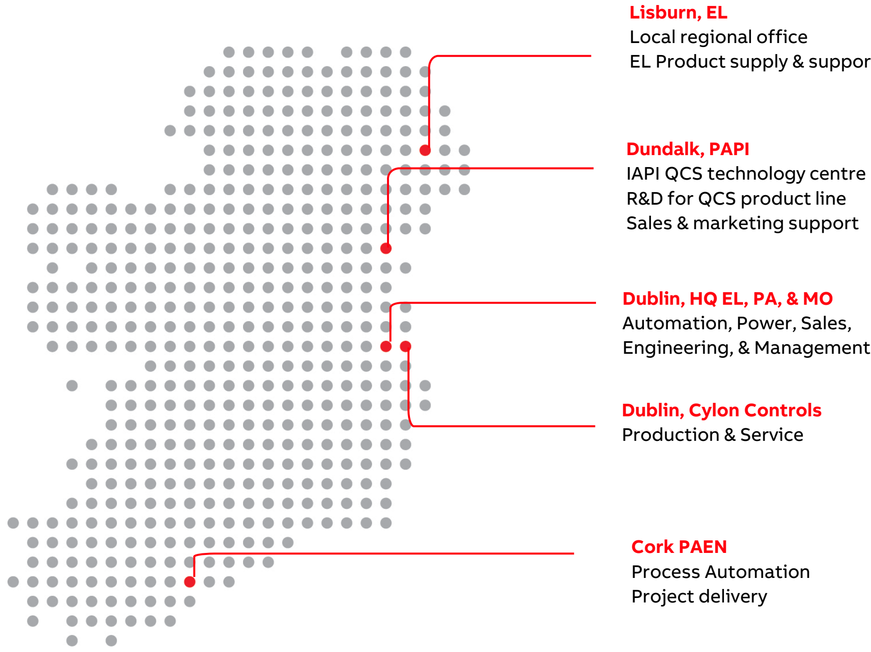

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