Powerful-CB

Closedown Webinar

18/08/2022

Agenda

10:00 – 10:10	**Welcome and introduction** Loukas Douvaras, UK Power Networks and Tobias Hintzen, ABB
10:10 – 10:20	**Project overview** Loukas Douvaras, UK Power Networks
10:20 – 10:40	**What we did** Jesper Magnusson, ABB and Jack McKellar, UK Power Networks
10:40 – 10:55	**The results and next steps** Jesper Magnusson and Martin Kropf, ABB
10:55 – 11:00	**Summary and close** Loukas Douvaras, UK Power Networks
11:00 – 11:30	**Q&A** Whole team

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This is your event

Get involved

You will be automatically set to mute, but please select ‘raise hand’ if you would like to ask a question, and we’ll unmute you

Use the chat or Q&A in Zoom to ask us questions or share your thoughts (you can select ‘post anonymously’)

Polling/Q&A

Questions for our audience in polling sessions

‘Raise hand’ to ask a question at any point and we’ll unmute you, or put a question in the comments

If you have a different idea, tell us in the chat

Best experience

Please use the Zoom app if possible; some functionality not supported in browser view, such as polling

Recording

Please note this webinar is being recorded

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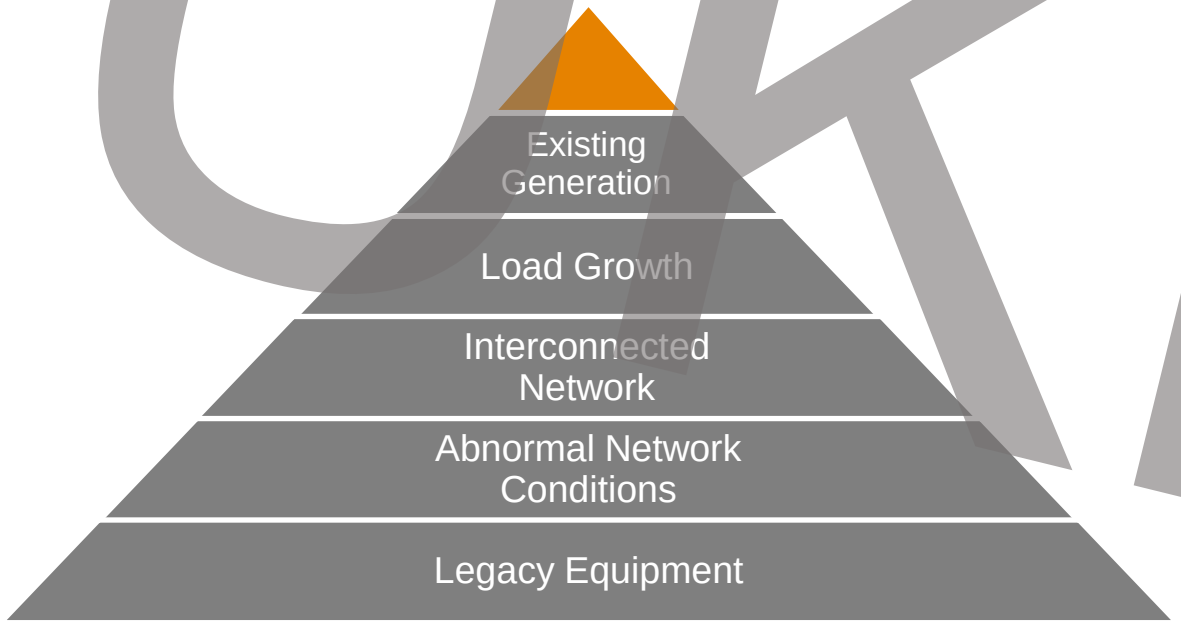
Project motivation

Short circuit current situation



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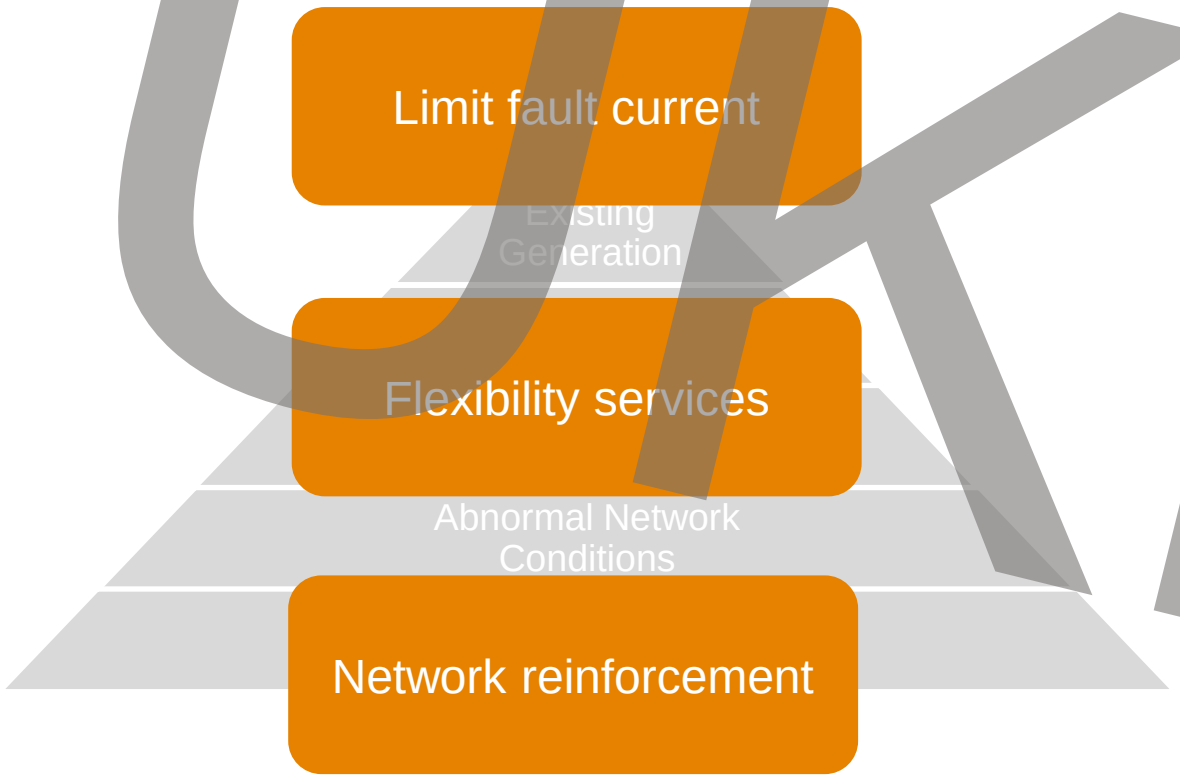
Project motivation

Short circuit current situation



Challenges

- Existing infrastructure at capacity limit
- London target: Net Zero by 2030
- Existing Fault Limiting Mitigation Technologies unfit for purpose within London Power Network

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Polling

Share your thoughts

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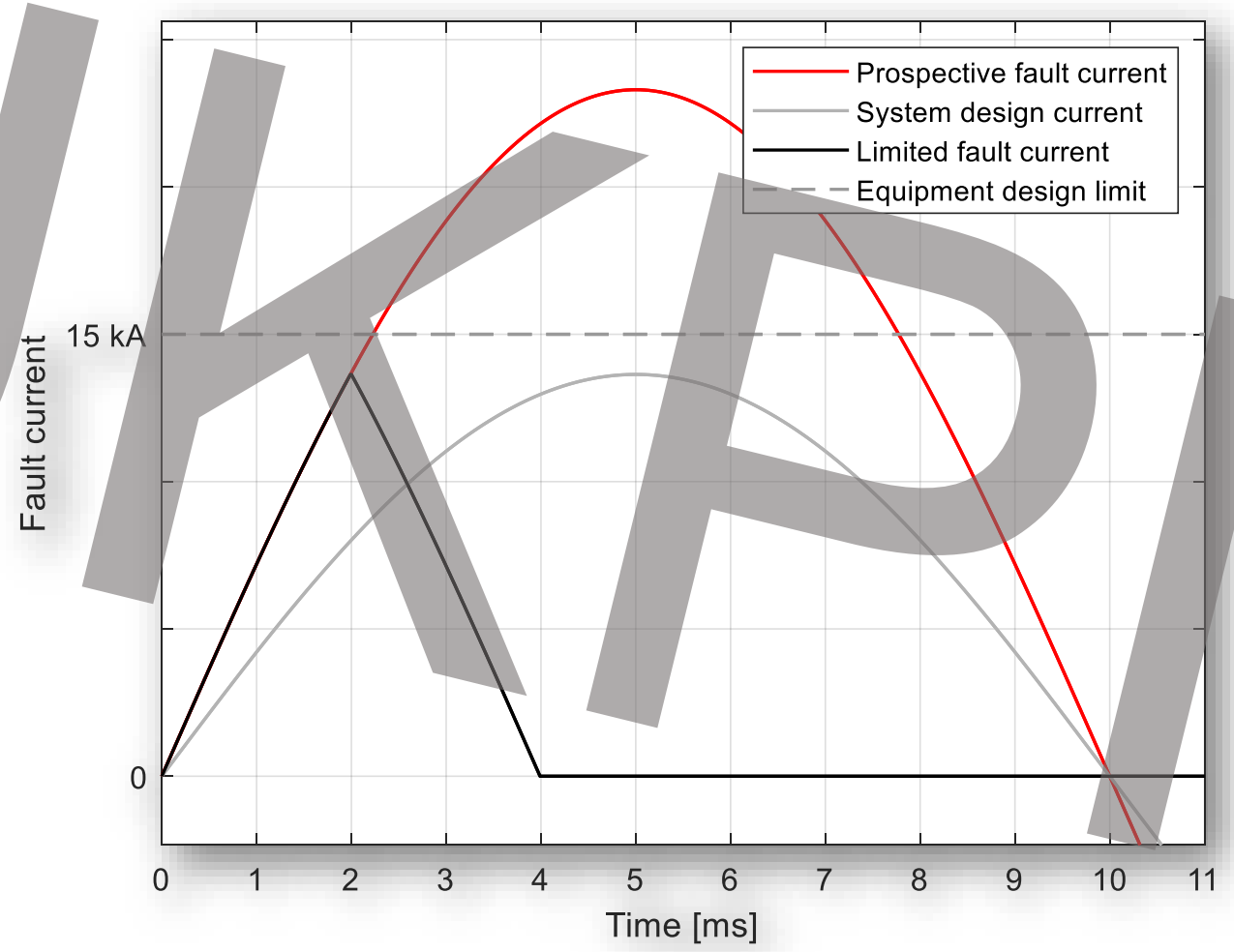
FLCB operation principles



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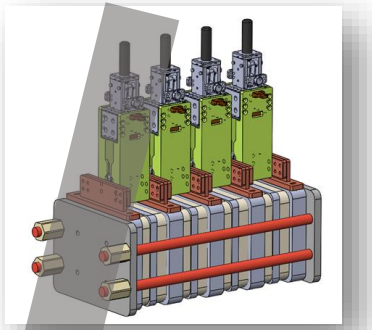
Powerful CB project outline



Idea and requirements

2017

2018

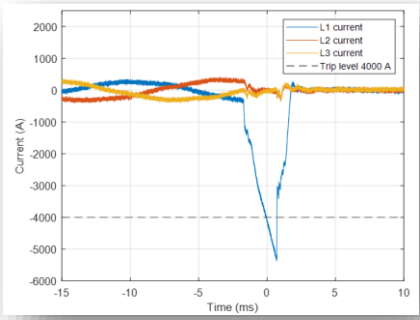
Design and implementation

Verification

2019

2020

Commissioning



Monitoring of pilot

2020-2022

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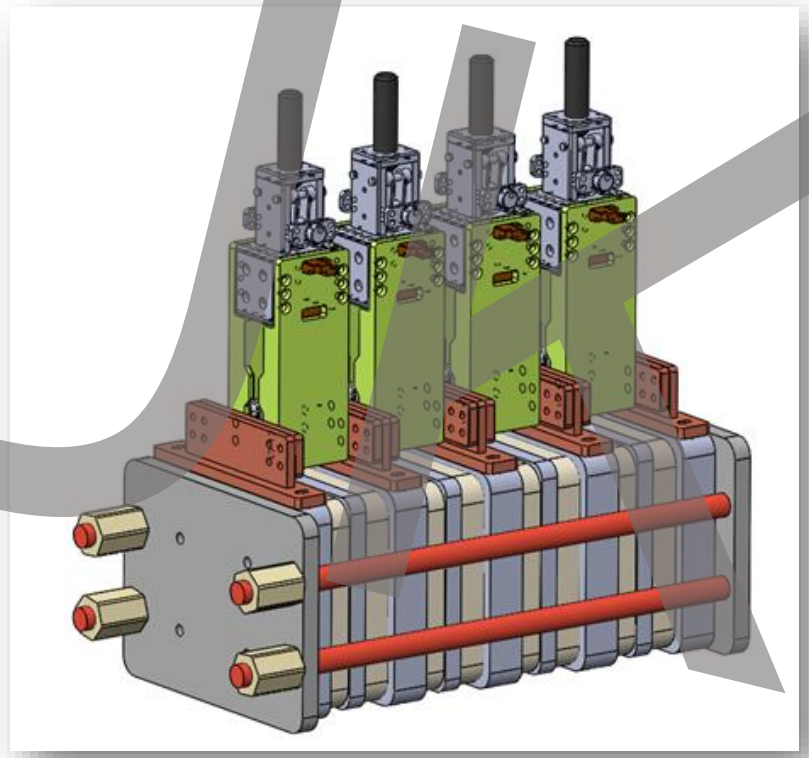
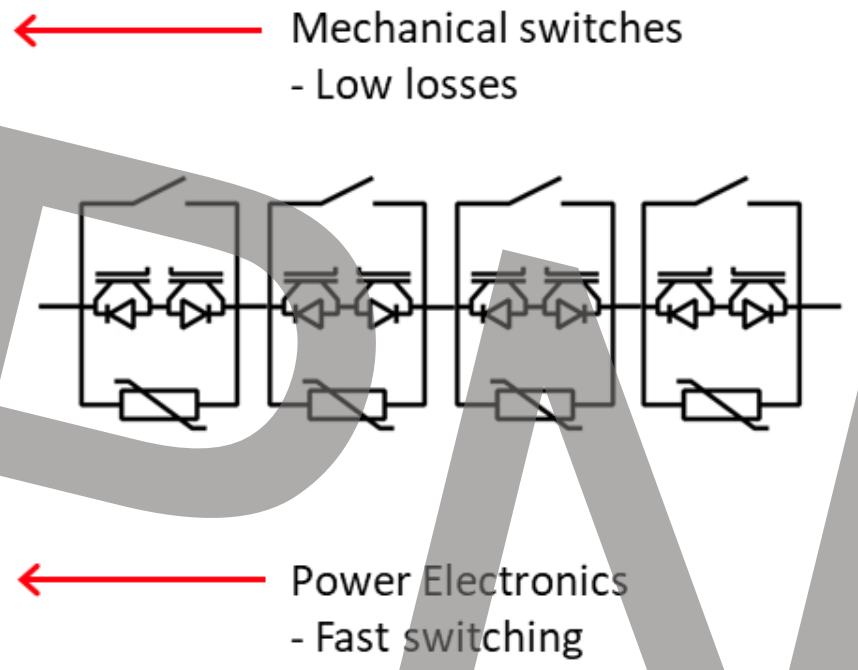
Hybrid technology concept





Combines the best of two technologies, power electronics and mechanical switches

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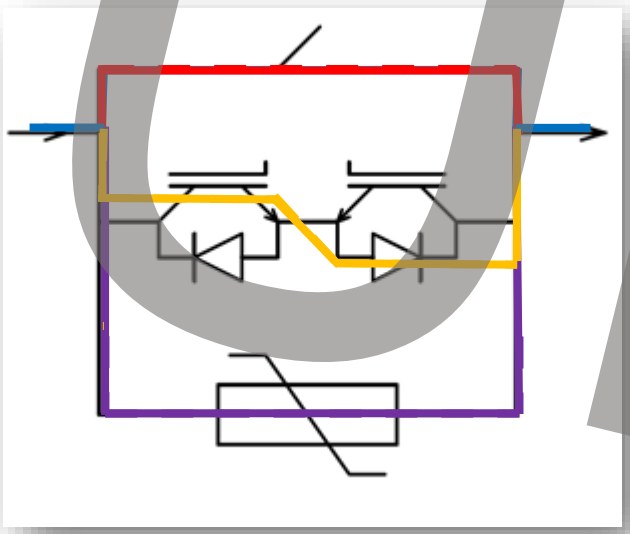
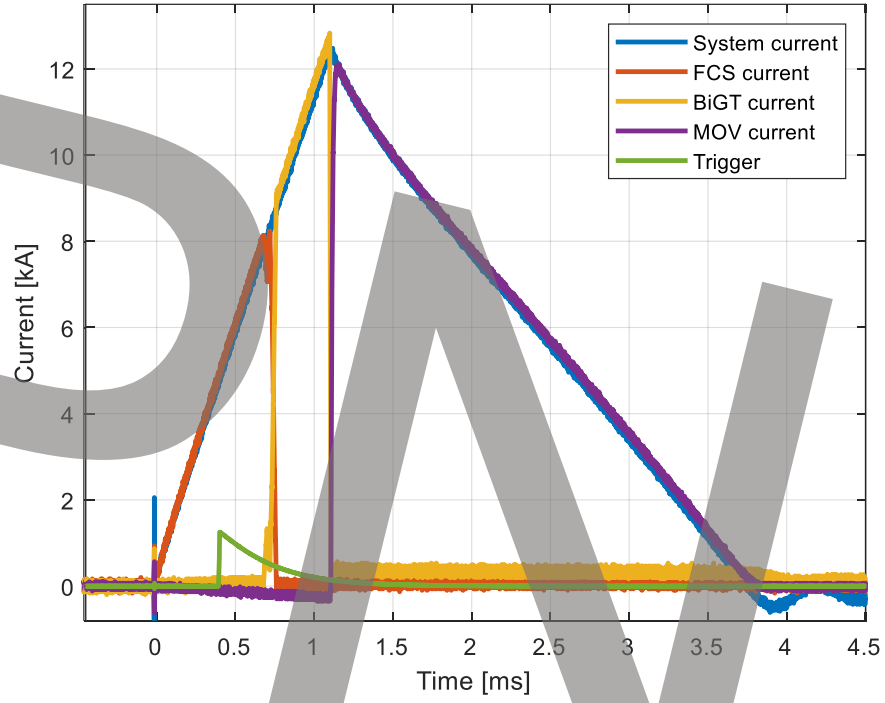
Hybrid technology concept



Fast commutation switch (FCS)

Semiconductor switch (BiGT)

Metal-oxide varistor (MOV)



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Design according to requirements agreed with UKPN

Ultra fast – limitation within 1 ms

Low losses – No active cooling

Compact – Compared to existing solutions

Multiple operations

Commercially available	Specifically developed
BiGT	FCS
MOV	Control software
Panels	Gate drive units
QR6	
REF	

Nominal voltage	11 kV	(12 kV)
Nominal current	1250 A	(2000 A)
Prospective fault current	16 kA	(25 kA)
Limited peak current	13 kA	
Interruption time	< 1 millisecond	
Mechanical endurance	(2000 operations)	
Electrical endurance	(100 operations)	
Actual grid values, pilot design levels in parenthesis		

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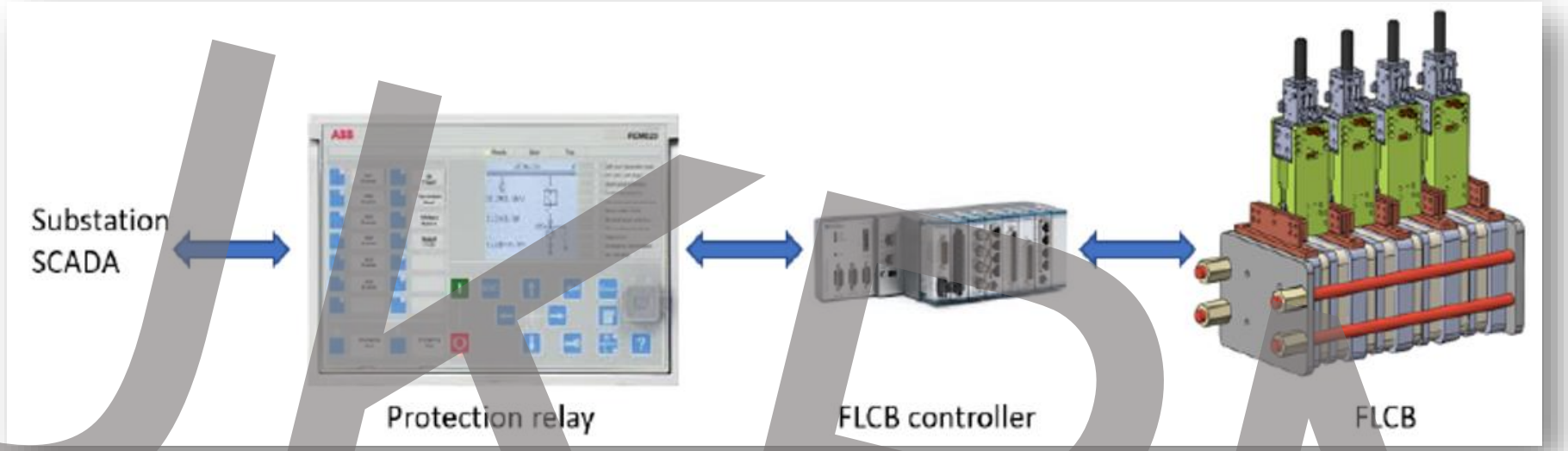
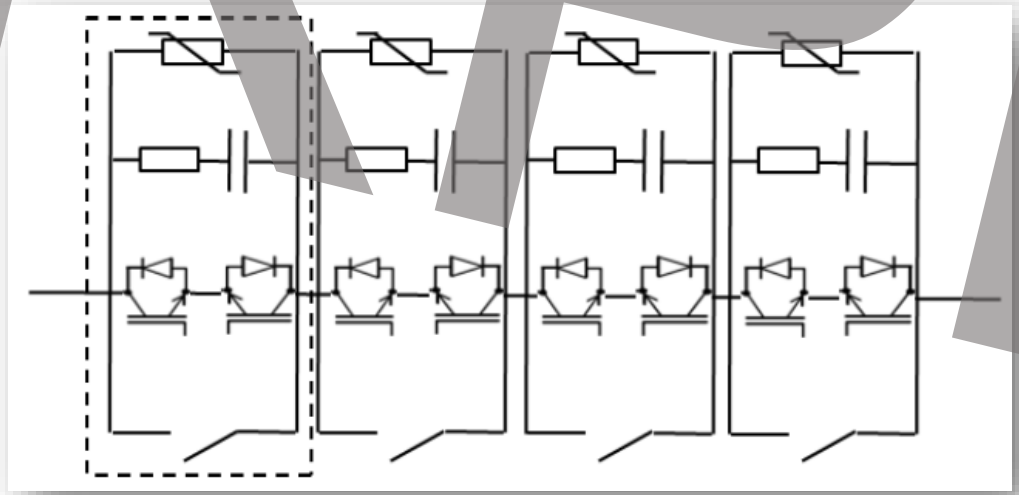
High focus on reliability





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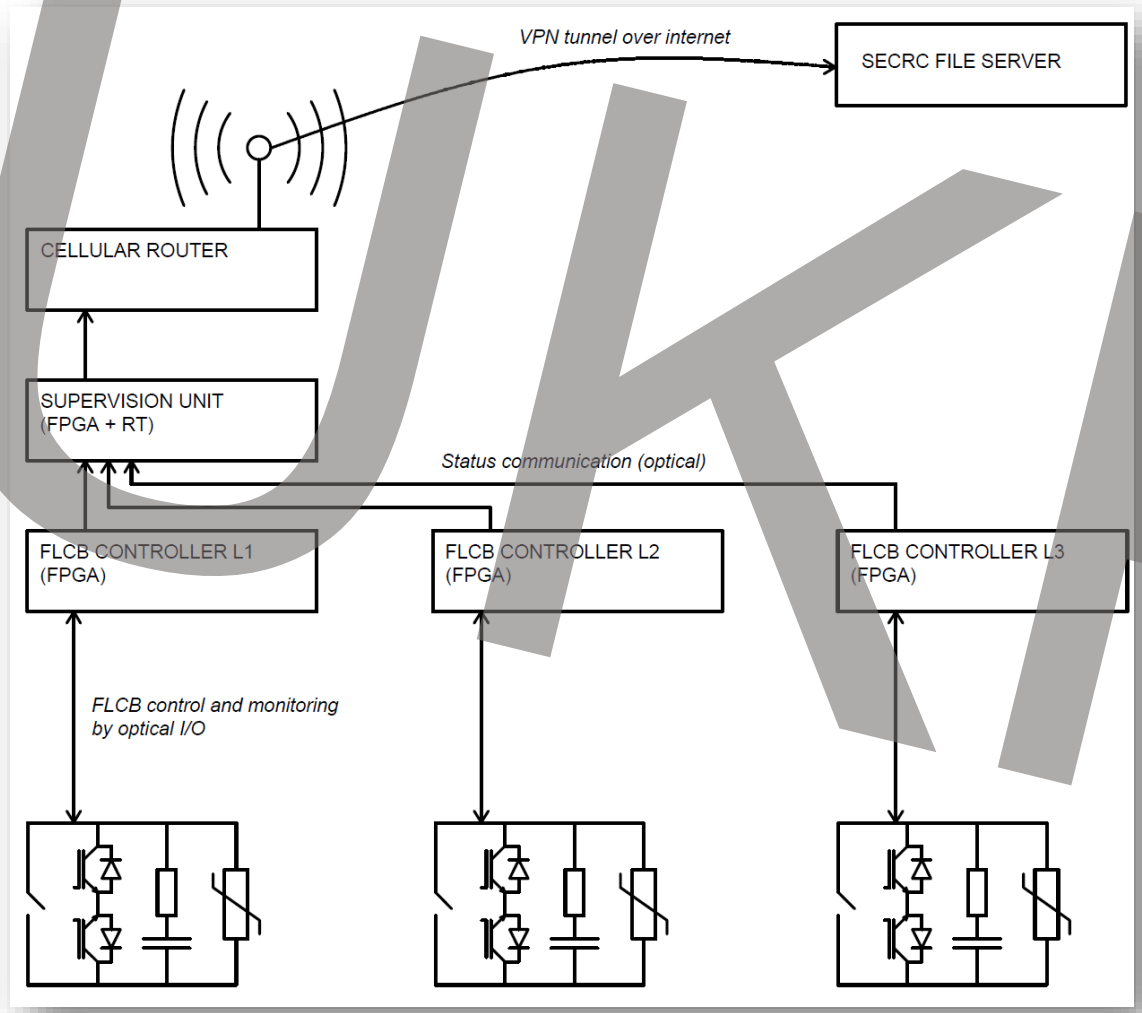
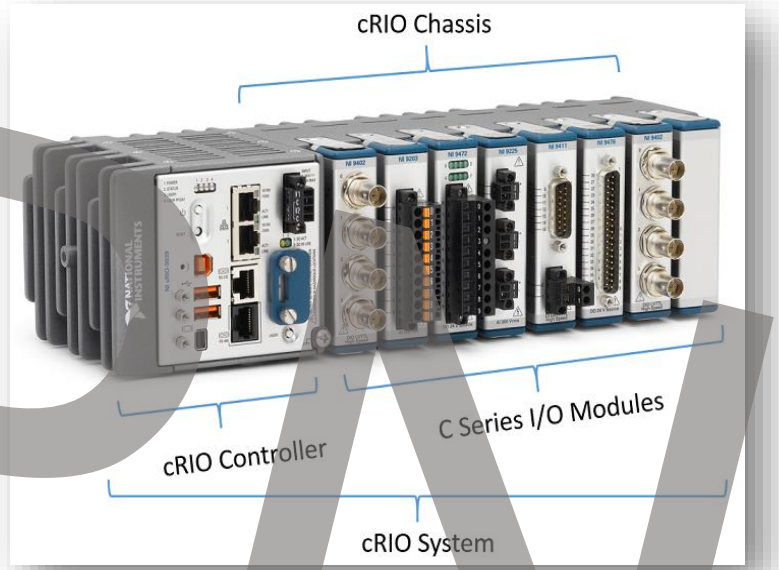
FLCB control and monitoring system





Control system based on National Instruments Compact-RIO platform

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Polling

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Requirement and verification

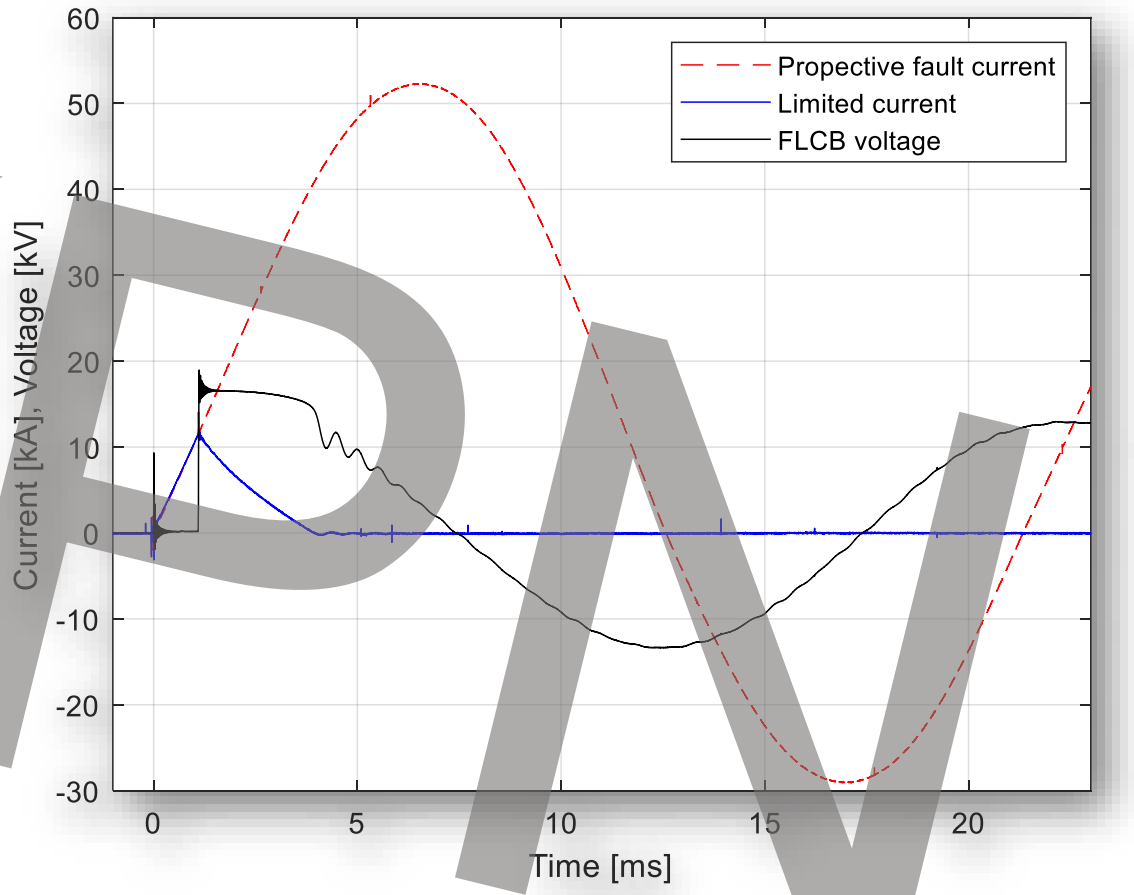
Nominal voltage	11 kV	(12 kV)
Nominal current	1250 A	(2000 A)
Prospective fault current	16 kA	(25 kA)
Limited peak current	13 kA	
Interruption time	< 1 millisecond	
Mechanical endurance	(2000 operations)	
Electrical endurance	(100 operations)	
Actual grid values, pilot design levels in parenthesis		

Testing according to standard (IEC 62271-100)

Interruption, 25 kA prospective
Close-Open, 25 kA prospective
28 kV AC, 1 min
75 kV BIL
2000 A temperature rise
STC, 25 kA, 1 s
Internal arc testing

Additional tests for pilot (Agreed with the customer)

Current limited 0.7 ms after trip
Current peak limited to < 13 kA
Mechanical endurance
Electrical endurance
EMC
STC, 16 kA, 3 s



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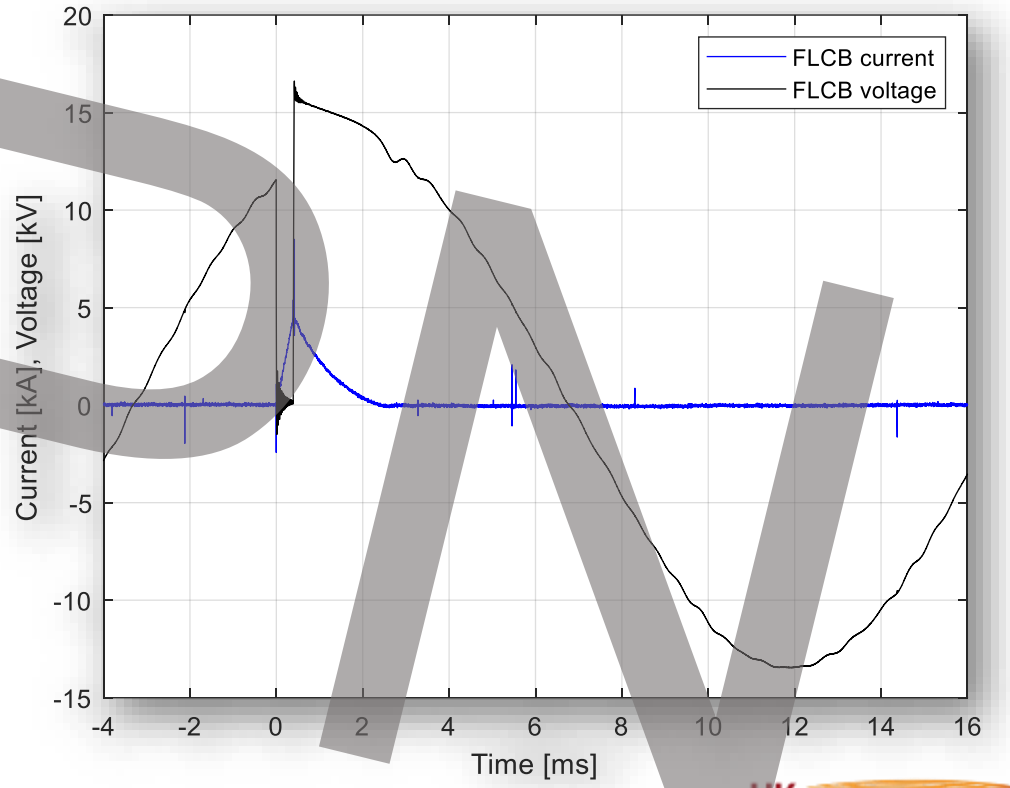
Additional testing according to standard

CO-CO with full prospective SC current

(3 min)

Test No.	HQ 136 F 001 /		27	28	29
Operating sequence and time intervals			CO	CO	CO
Applied voltage		kV	9.38	9.43	9.44
Peak current		kA	52.3	4.44	4.18
Current at tripping		kA	-	4.20	4.46
Breaking current (r.m.s.)		kA	25.3	-	-
Recovery voltage (r.m.s.)		kV	9.19	9.35	9.36
Transient recovery voltage	Peak value u_c	kV	17.5	16.8	16.7
	Time t_3	µs	68.7	-	-
	Time delay t_d	µs	12.9	-	-
	Rate of rise u_c/t_3	kV/µs	0.26	-	-
	Time to peak t_2	µs	-	27.4	26.8
	Rate of rise u_c/t_2	kV/µs	-	0.61	0.62
	Current duration	ms	42.1	2.4	2.5
	Clearing time	µs	-	19.9	19.7
Occurrence of NSDD			no	no	no
Test result			-	P	P



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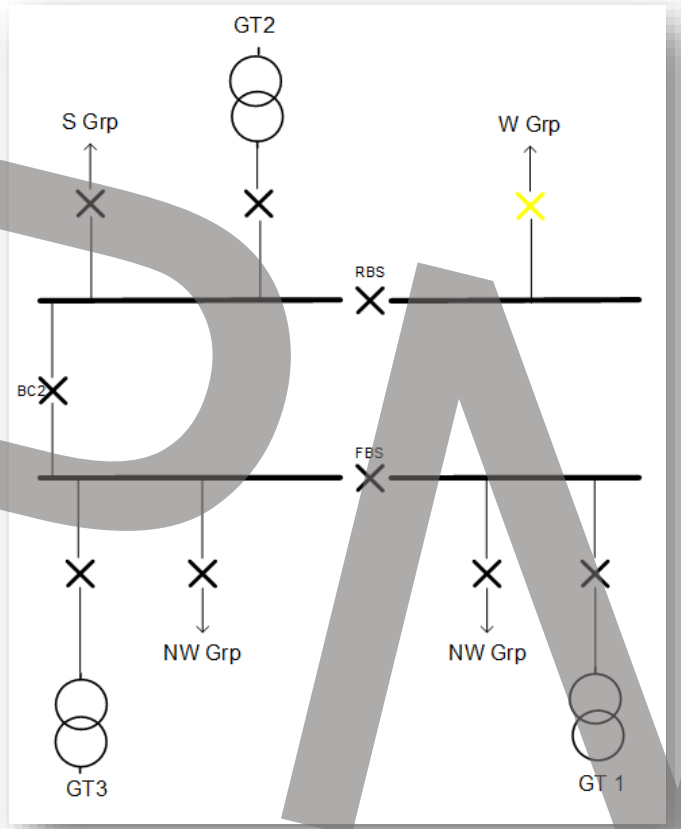
Trial selection

- High incidence of fault
- Existing protection would be sufficient
- Spare room in the substation
- LPN dense urban environment area

Glaucus Street site layout



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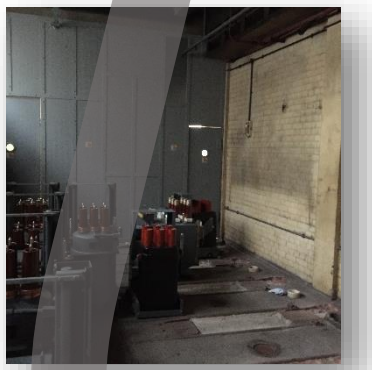
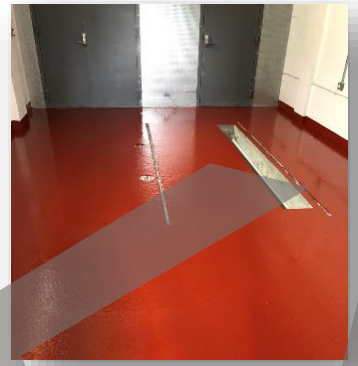
Installation activities

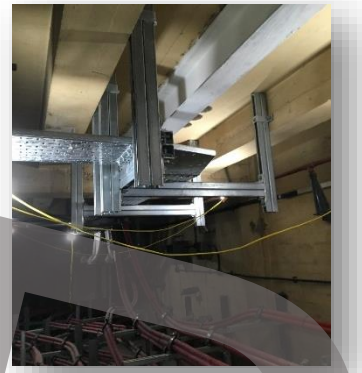


Room cleared of spare equipment ready for FLCB installation

Room prepared, floor levelled and holes made for HV cables and multicore cables



Floor finished ready for installation of FLCB



Installed supporting steelwork and cable trays

Asbestos containing walls replaced with fire-rated durasteel walls

Installation activities

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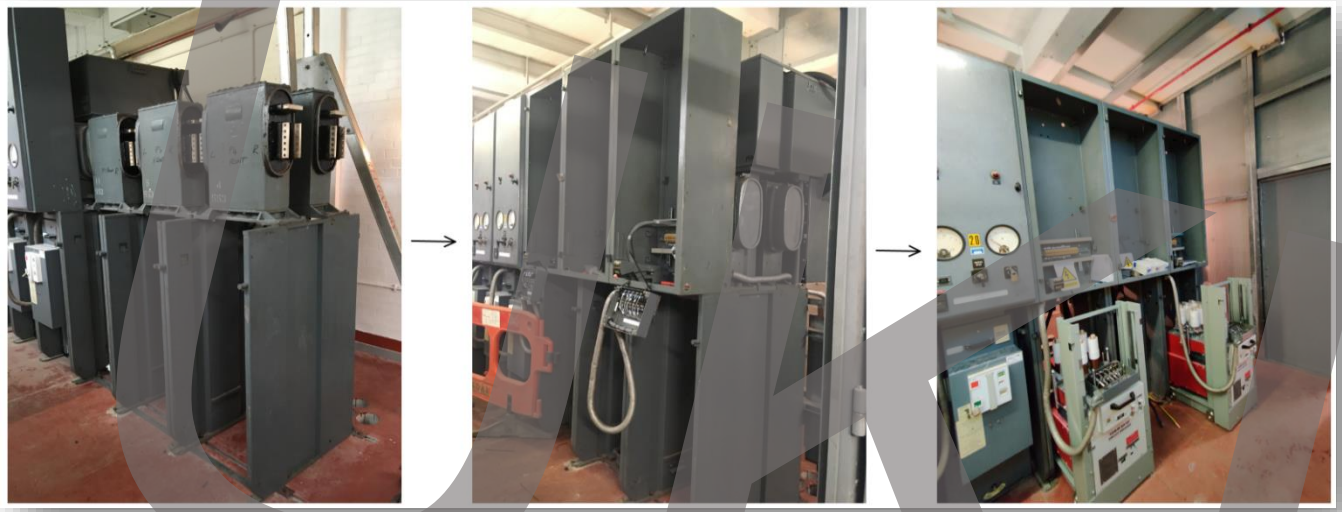
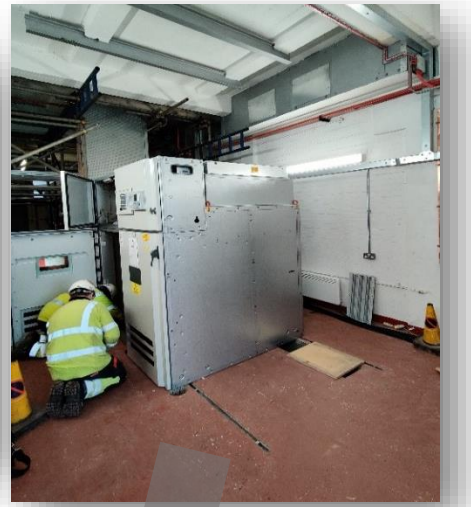
Installation activities





Extension of existing busbar to include 2x feeder panels

Retrofit vacuum circuit breakers installed

Delivery of FLCB to site

Installation of FLCB

Installation activities

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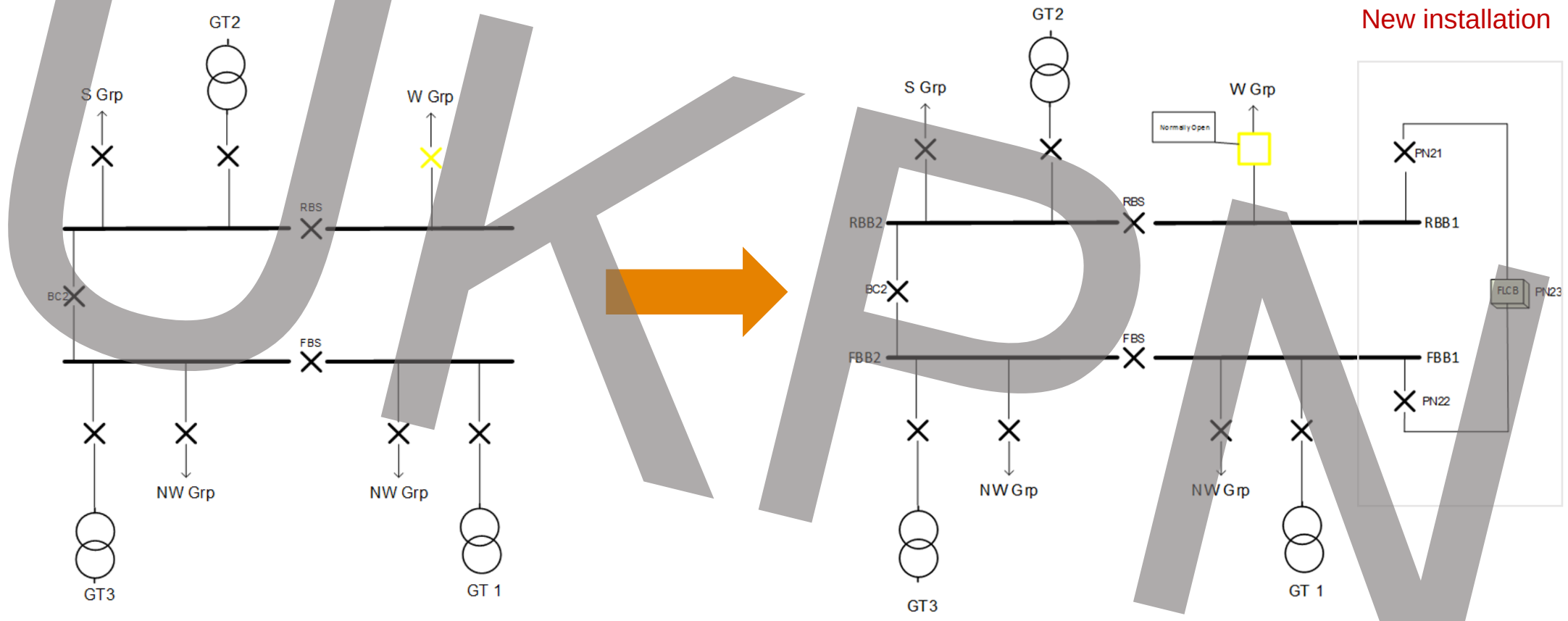
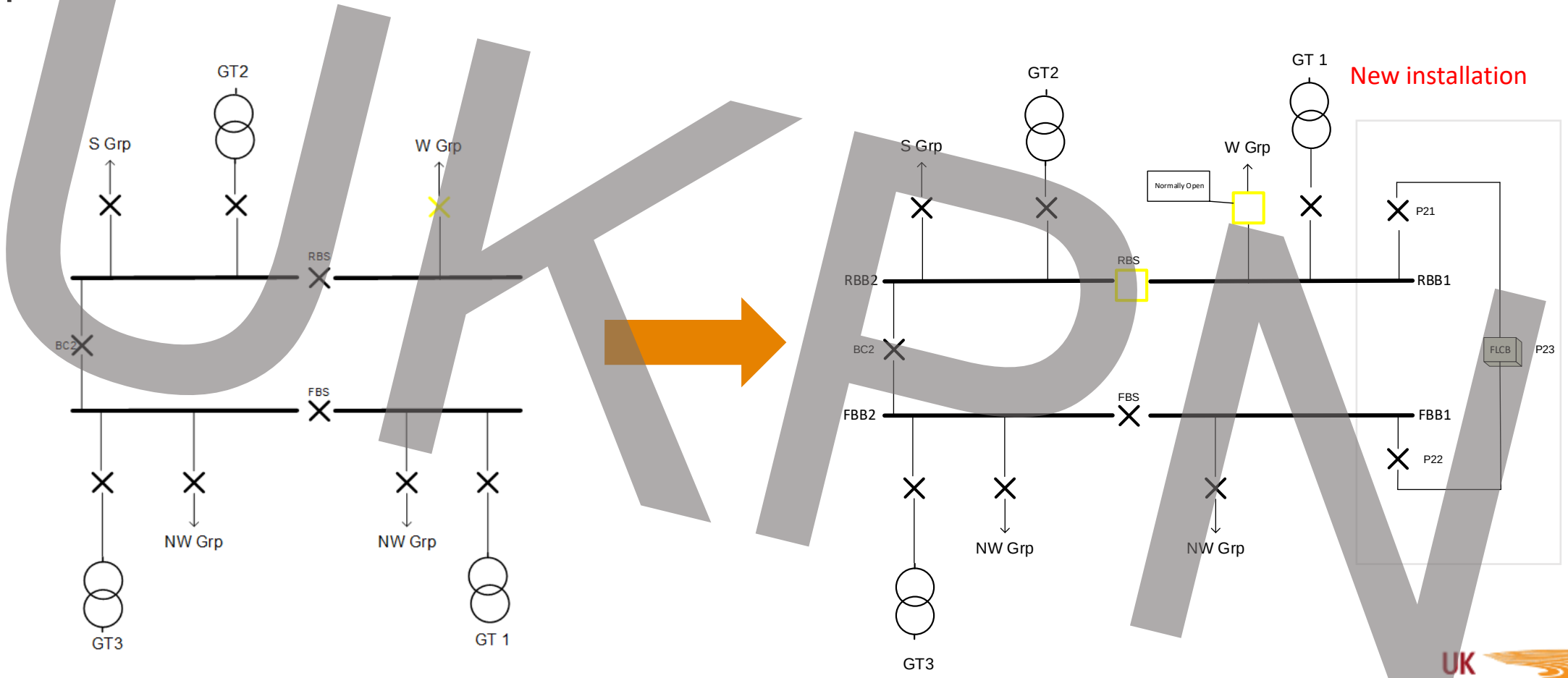
Trial arrangements

Option 1 – Parallel to existing bus coupler



Trial arrangements

Option 2 – Incomer transformer feeder



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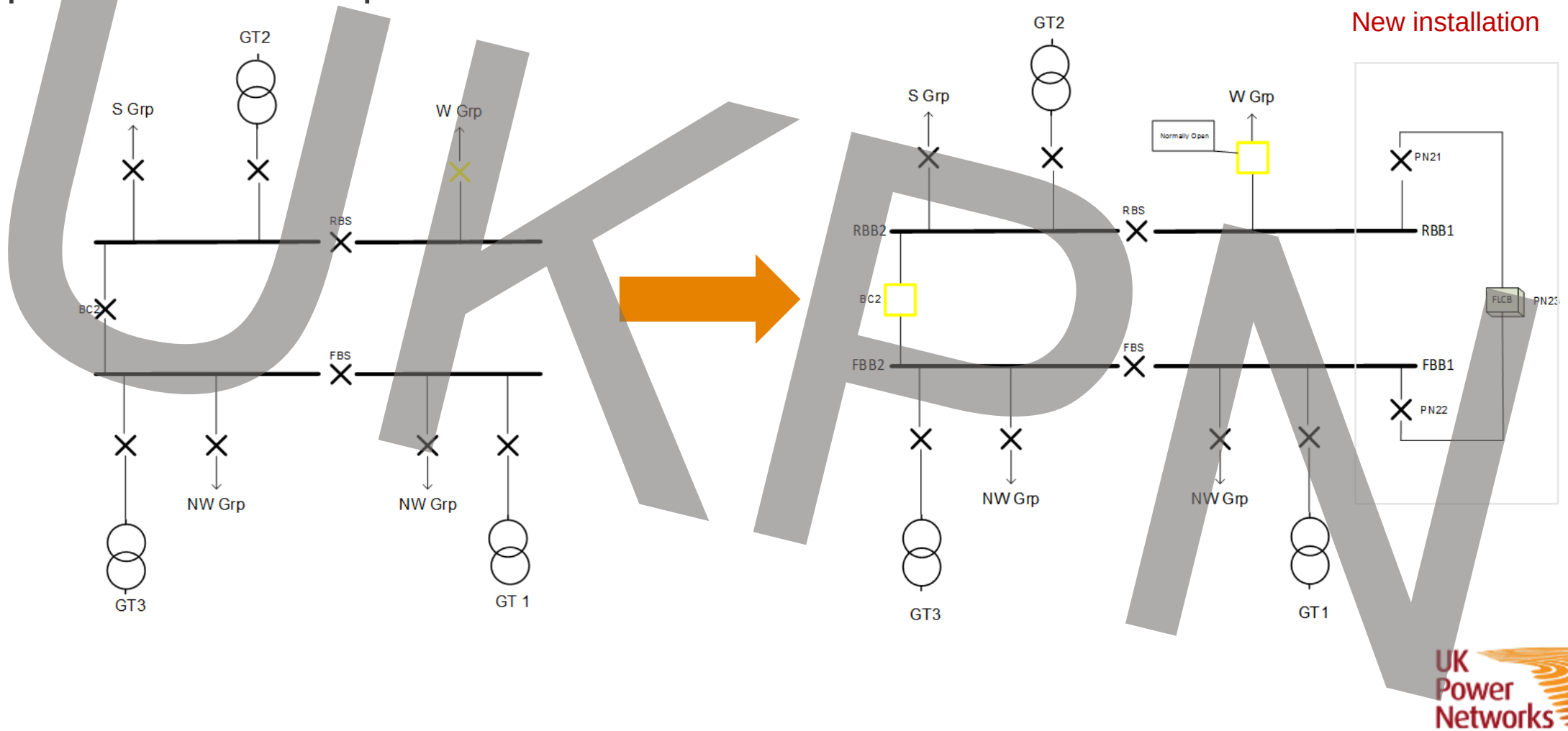
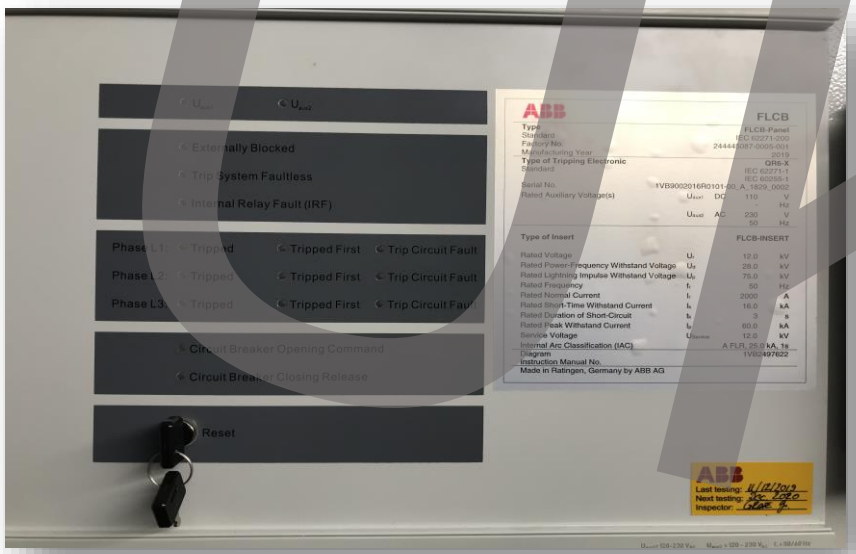
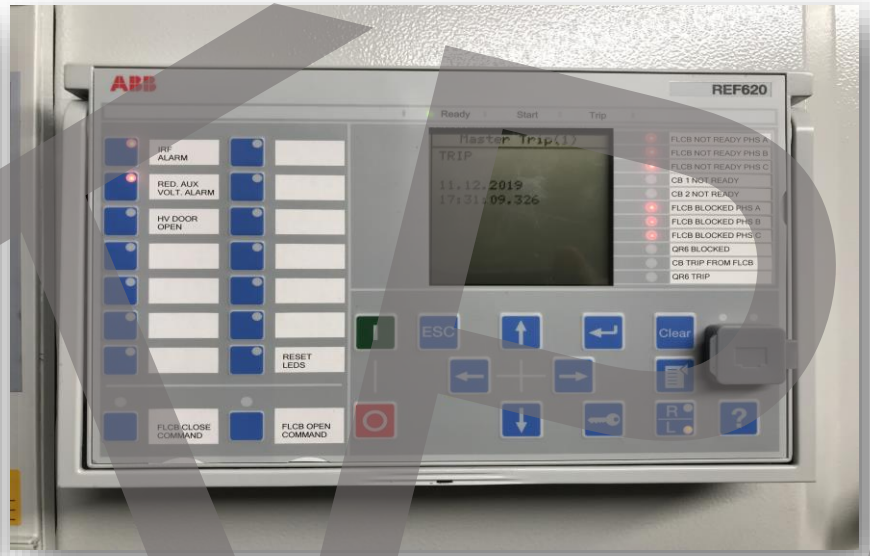
Trial arrangements

Option 3 – Bus coupler



Commissioning





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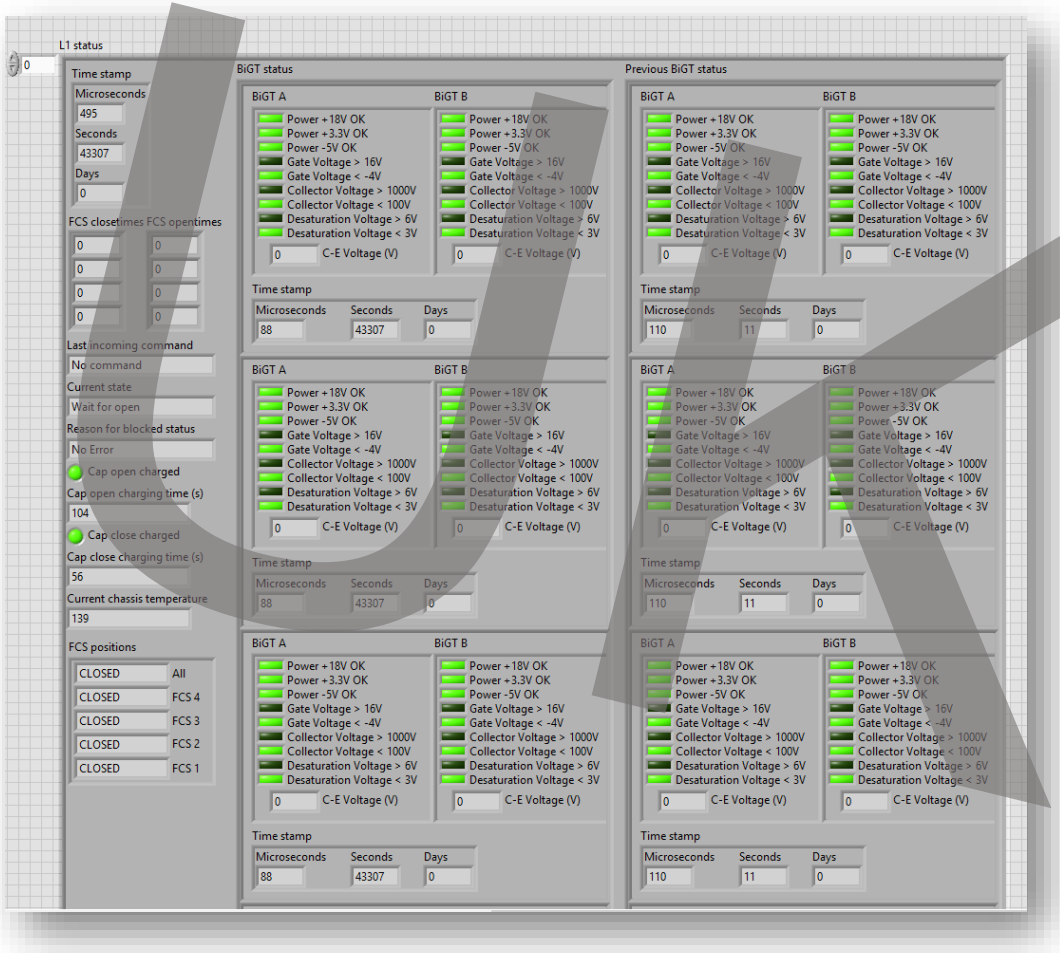
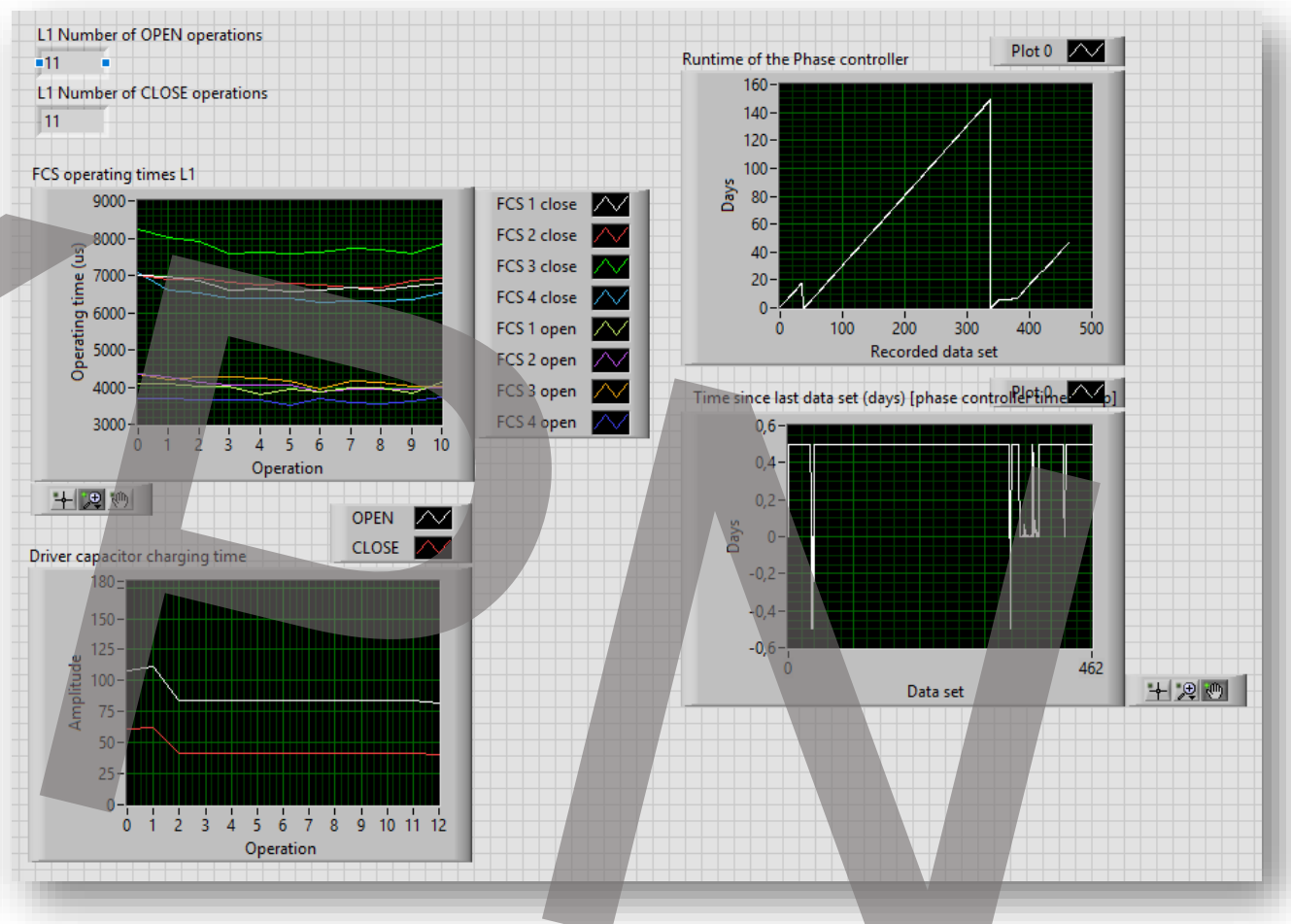
FLCB operation & performance



Status panel



Trending data

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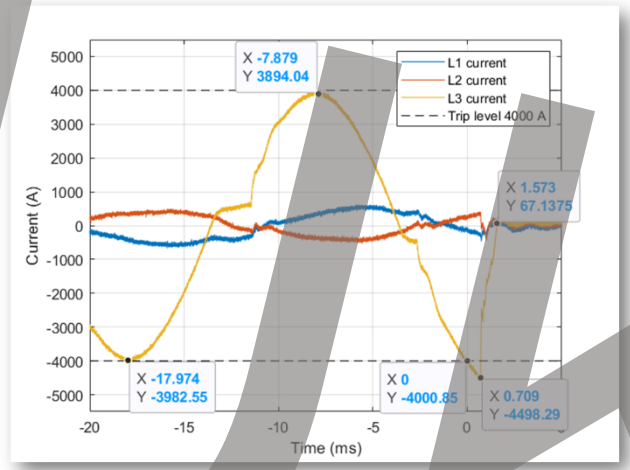
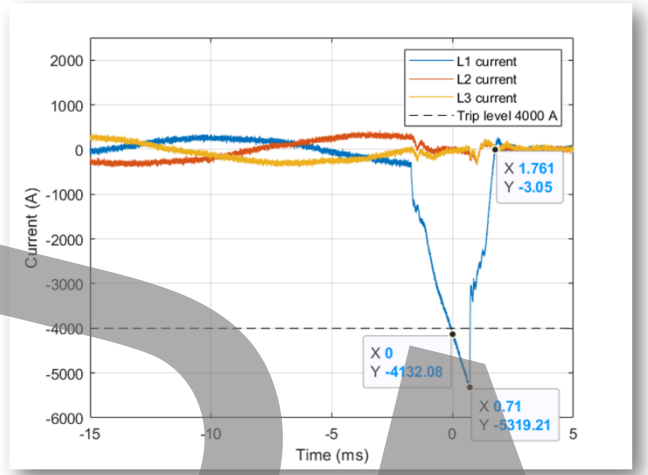
FLCB trip events 2020-2022

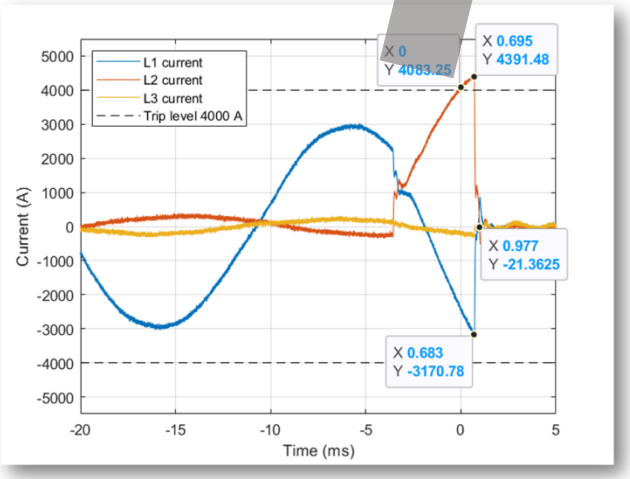
24 March 2021



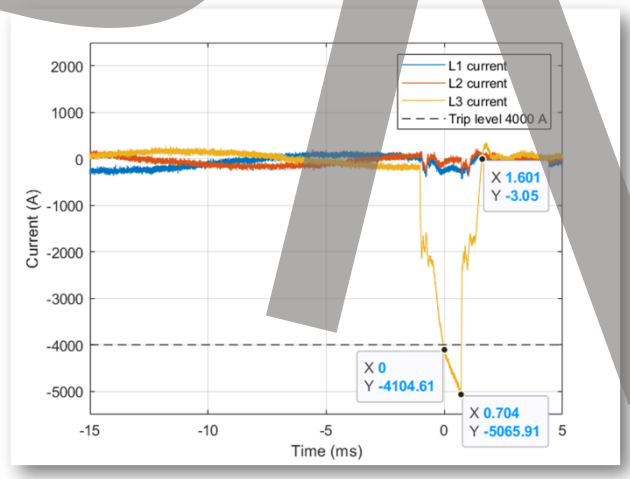
15 April 2021



03 February 2022



30 March 2022



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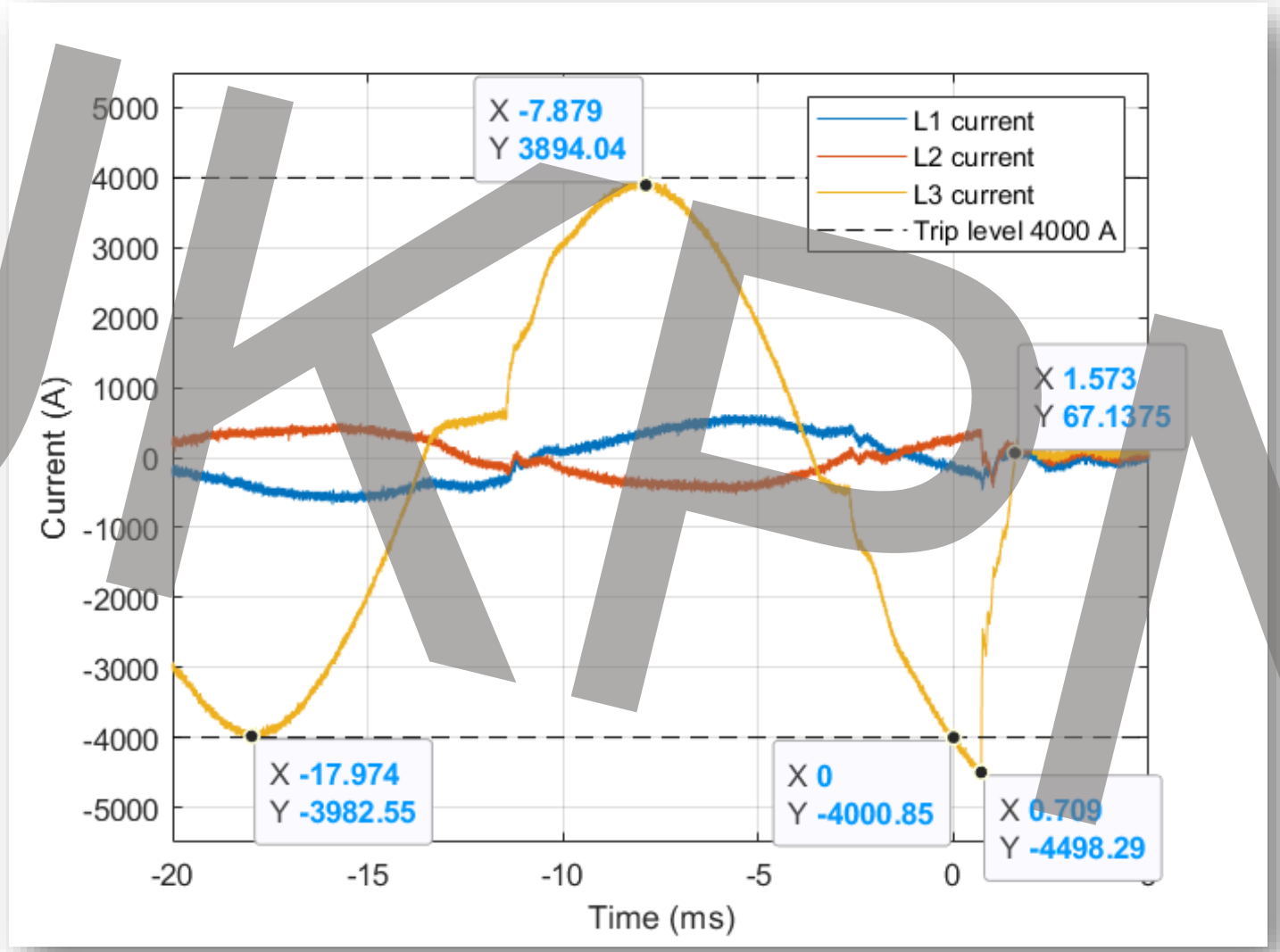
FLCB Trip event 24 March 2021



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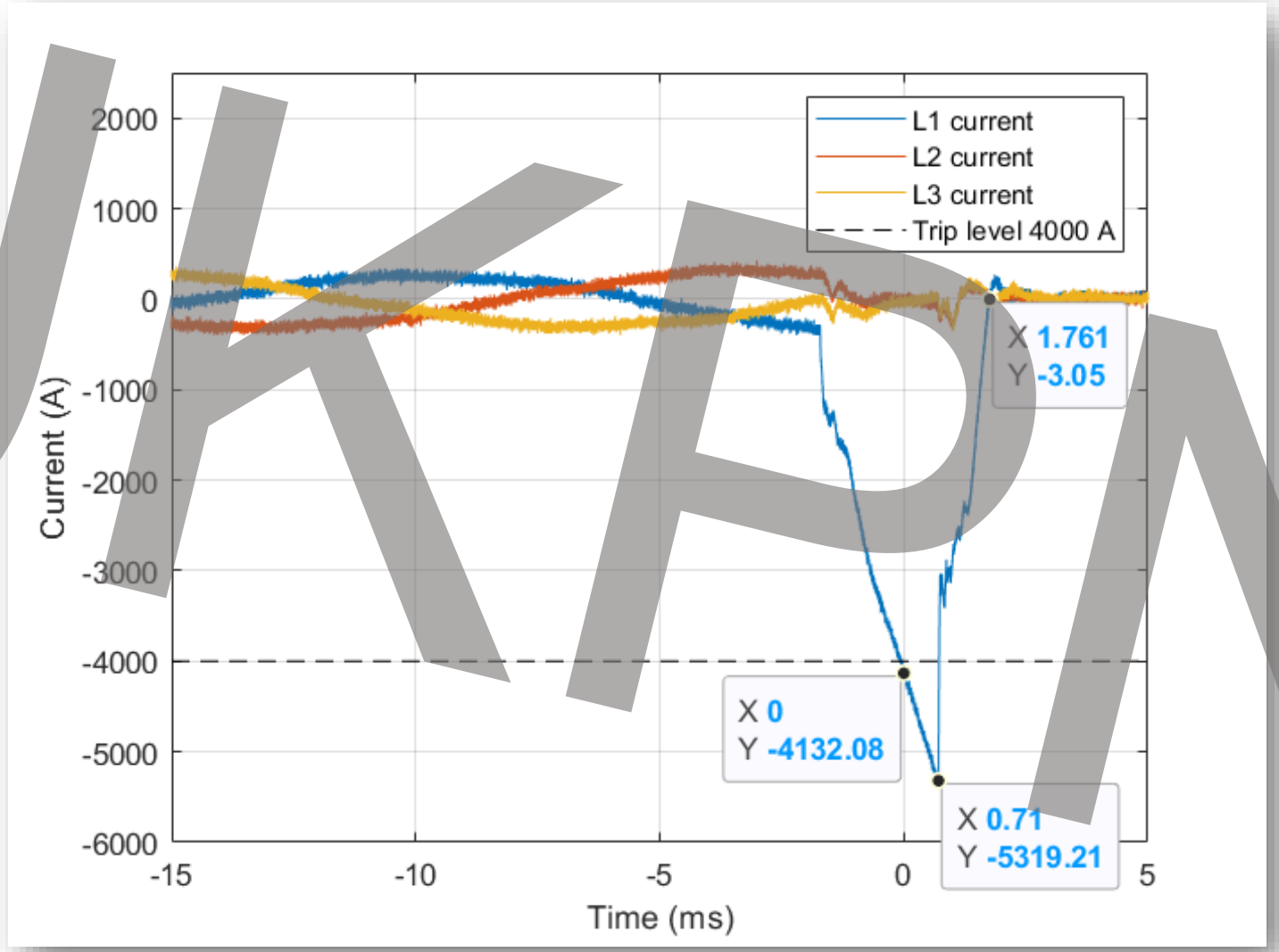
FLCB Trip event 15 April 2021



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Service visit (28-30 September 2021)

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ABB Portfolio – Fault Current Limiter Solutions

I_S-Limiter - Advanced fault-current limiter for complex applications

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ABB Portfolio – Fault Current Limiter Solutions

Safety & protection

Optimized protection by extended tripping criteria providing highest stability and reliable tripping

Optimum interface

Tailored to customer needs due to project related detailed engineering with flexibility to adapt to later system changes

Process continuity

For individual solutions that fulfill the highest requirements of critical applications like achieving Tier 4 availability level for data centers

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Fault Current Limiter (FCL) Portfolio of ABB

	FCL Portfolio - **ACTIVE**
Rated Voltage	0,75-40,5 kV
Rated Current	… 4000 A
Short-circuit current, device/panel	… 210 / 50 kA_{rms}
Comments	Different panel solutions available (fix/withdrawable), **One shot only**

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Fault Current Limiter (FCL) Portfolio of ABB

	FCL Portfolio - **ACTIVE**	FLCB - **PILOT**	Higher Ratings?
Rated Voltage	0,75-40,5 kV	… 12 kV	Detailed evaluation with R&D involvement required Detailed input on higher ratings needed, welcome!
Rated Current	… 4000 A	… 2000 A	
Short-circuit current, device/panel	… 210 / 50 kA_{rms}	... 25 / 25 kA_{rms}	
Comments	Different panel solutions available (fix/withdrawable), One shot only	3 panel arrangement for pilot installation, 100 electrical operations maintenance free	

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FLCB – Status update of product

Other Pilots?

ABB is interested in additional pilot installations

Pilot estimated time:
approx. 12 months

Time to market?

Confirmed ratings, once decision taken: 2-3 years to market

Higher ratings, once technically confirmed: 3-4 years to market

Price of a FLCB

Full industrialization and market introduction required

Approx. cost for a new pilot (confirmed ratings) 500 kUSD – to be reviewed together

Feel free to contact us anytime: martin.kropf@de.abb.com

Polling

Share your thoughts

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innovation@ukpowernetworks.co.uk

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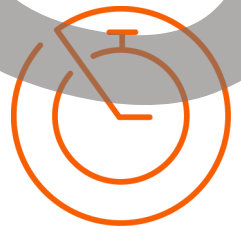
Summary

Commercial advantages

Cheaper than switchgear upgrades



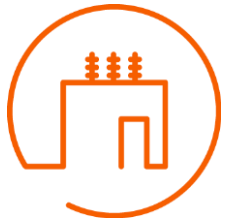
Increased uptime through multi-shot functionality

Compact and no cooling required

Technical solution features

Pilot ratings of standalone solution:
12 kV – 2000 A – 25 kA;

Connect multiple renewables without reinforcing the network



Based on proven ABB components, SF_6 free

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Share your questions

Our experts are available to answer

Loukas Douvaras

Innovation Project Lead at UK Power Networks

Martin Kropf

Head of Product Marketing of the ABB Fault Current Limiting Factory in Germany

Jack McKellar

Innovation Lead - Bid & Opportunities at UK Power Networks

Thomas R. Eriksson

Team Manager Switching and Systems at ABB

Jesper Magnusson

Senior Scientist Switching and Systems at ABB

Tobias Hintzen

Local Product Group Manager for Indoor Apparatus, Ratingen - Germany

Please use the chat to ask your questions, we'll call out your question and unmute you

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