Siemens Worldwide Experience in Nuclear Power Plants Protection Systems

SIPROTEC

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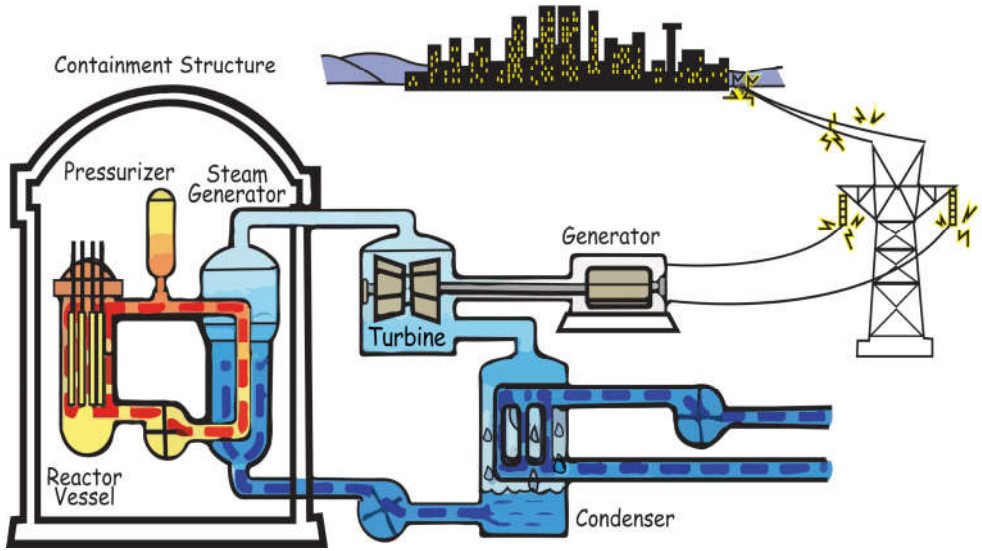
General

NPPs are steam power plants,
were the steam producer
is nuclear reactor.

From the turbine they consisting
of conventional technology.



Except **Protection of Emergency Diesel Generator**, which **is treated** special.

Experience with Siemens Protection in Nuclear Power Plants

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History

- since 1950th.
  - analog electronic by end of 1970th.
    - Konvoi (1981-1989)
    - Service and Refurbishment by 1998

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Reference List — Siprotec Protection Devices in NPP's

Stand / Status: 04.2013

Kunde Customer	Anlage Projekt	Land Country	Lieferjahr Delivery Date	Installiert in Installed in			Bemerkungen Remarks
				controlled area	conventional area	Siprotec V4	**Numerical Protection Devices (IED's)**
Essent	Borselle	Netherlands	1997		yes		V3 - Gen. Emergency Diesel
TVO	Olkiluoto 1, 2	Finland	1997		yes		V2 - Unit Protection
JNPC	Tian Wan	China	1998	yes			V3 - Gen. Emergency Diesel
Bohunice	Bohunice	Slovakia	1998	yes			V3 - Gen. Emergency Diesel
NEK	Kozloduy	Bulgaria	2001	yes	yes		Unit Protection, Gen. Emergency Diesel, Station Supply
Ringhals	Ringhals	Sweden	2003		yes	yes	7VE6
Mochovce	Mochovce	Slovakia	2003	yes			V3 - Gen. Emergency Diesel
Texas Utility	Comache Peak	USA	2003		yes		V3 - Gen. Emergency Diesel
Forsmark	Forsmark	Sweden	2004		yes	yes	7SA5, 7SJ6
VSE	Gösgen	Switzerland	2004	yes		yes	Station Supply
Trillo	Trillo	Spain	2005		yes	yes	Transformer Protection
Neckarwestheim	Neckarwestheim	Germany	2005	yes	yes	yes	Transformer Protection
TVO	Olkiluoto 3	Finland	2006		yes	yes	Unit Protection
VSE	Gösgen	Switzerland	2006		yes	yes	Transformer Protection
Neckarwestheim	Neckarwestheim	Germany	2006		yes	yes	Unit Protection
Gundremmingen	Gundremmingen	Germany	2006		yes	yes	7UM6/7UT6 / 7SJ6
VSE	Gösgen	Switzerland	2007		yes	yes	Unit Protection
China Nuclear Power Engineering Co.	Ling Ao	China	2007	yes		yes	7UM62 - Gen Emergency Diesel
China Nuclear Power Engineering Co.	Qinshan	China	2007	yes		yes	7UM62 - Gen Emergency Diesel
Fortum	Loviisa 1	Finland	2008		yes	yes	Unit Protection
EON	Grafenrheinfeld	Germany	2010		yes	yes	Transformer Protection
Fortum	Loviisa 2	Finland	2010		yes	yes	Unit Protection
EON	Grafenrheinfeld	Germany	2011		yes	yes	Unit Protection
CNNC & CGNPC	Fuqing, Fangjiashan, Yangjiang	China	2010-2013	yes		yes	Gen. Emergency Diesel
TVO	Olkiluoto 3	Finland	2009	yes		yes	Gen. Emergency Diesel
Guangdong Nuclear Power Company	Ningde NPS	China	2011		yes	yes	Unit Protection
Guangdong Nuclear Power Company	Hongyanhe NPS	China	2011		yes	yes	Unit Protection
Guangdong Nuclear Power Company	Daya bay NPS	China	2011		yes	yes	Unit Protection

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Protection Philosophy

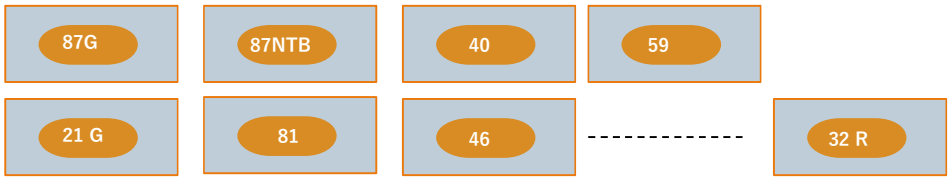
Industry Standard (IEC60255) >3 year experience

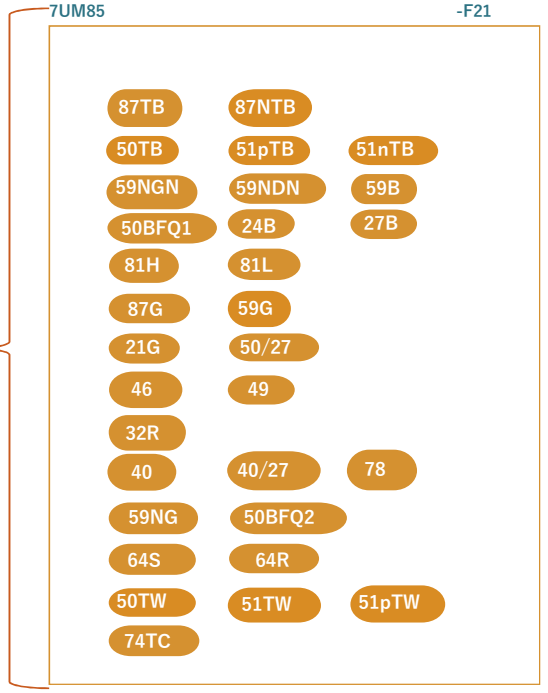
Full Redundancy

- *Measurement*
- *Battery*
- *Protection Devices*
- *Tripping Circuits*

Trend

From dedicated functionality devices → *to multifunctional IEDs*





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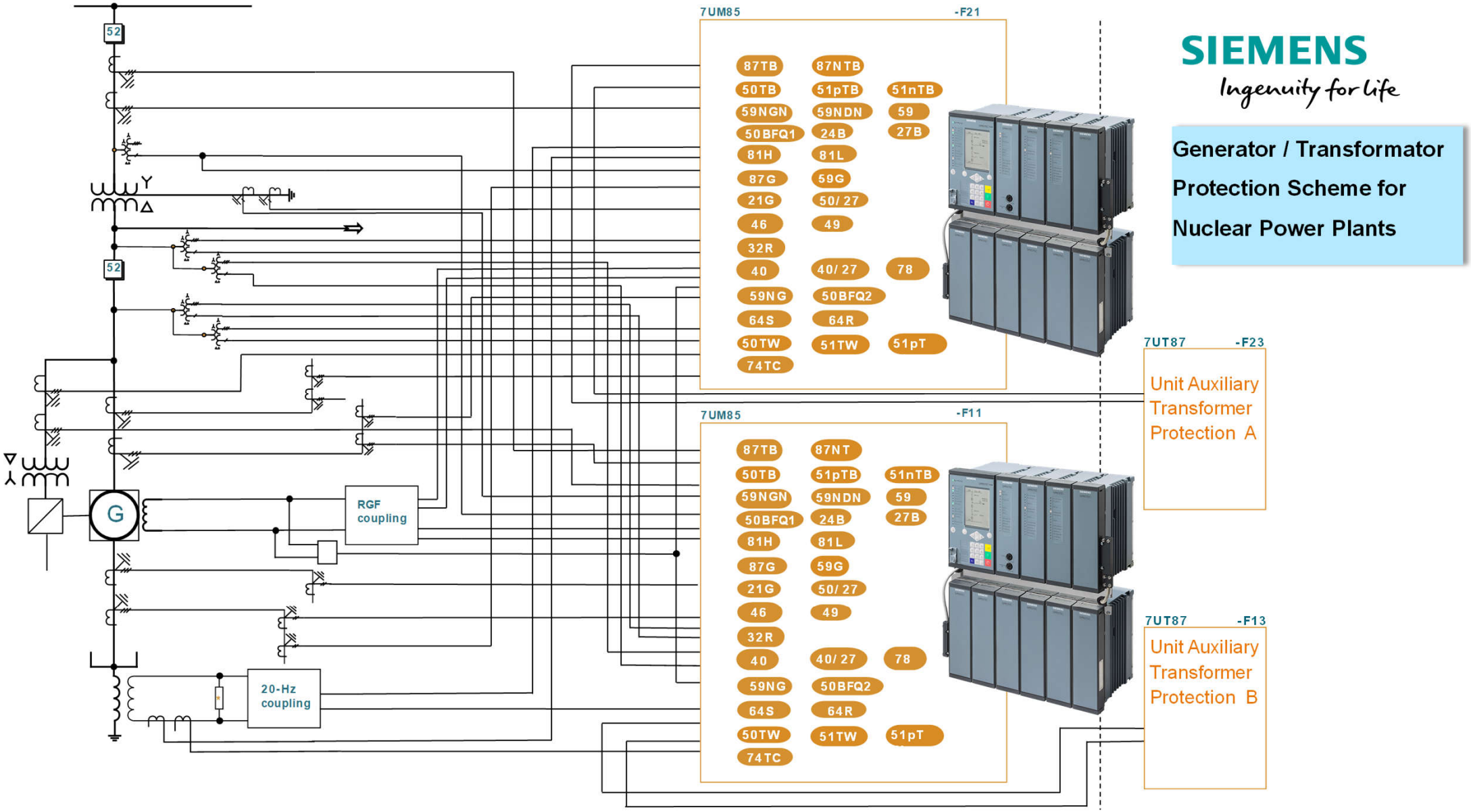
Perfectly Tailored Fit

With the **SIPROTEC 5** modular system

you get exactly the device

that you need.



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Generator / Transformator Protection Scheme for Nuclear Power Plants

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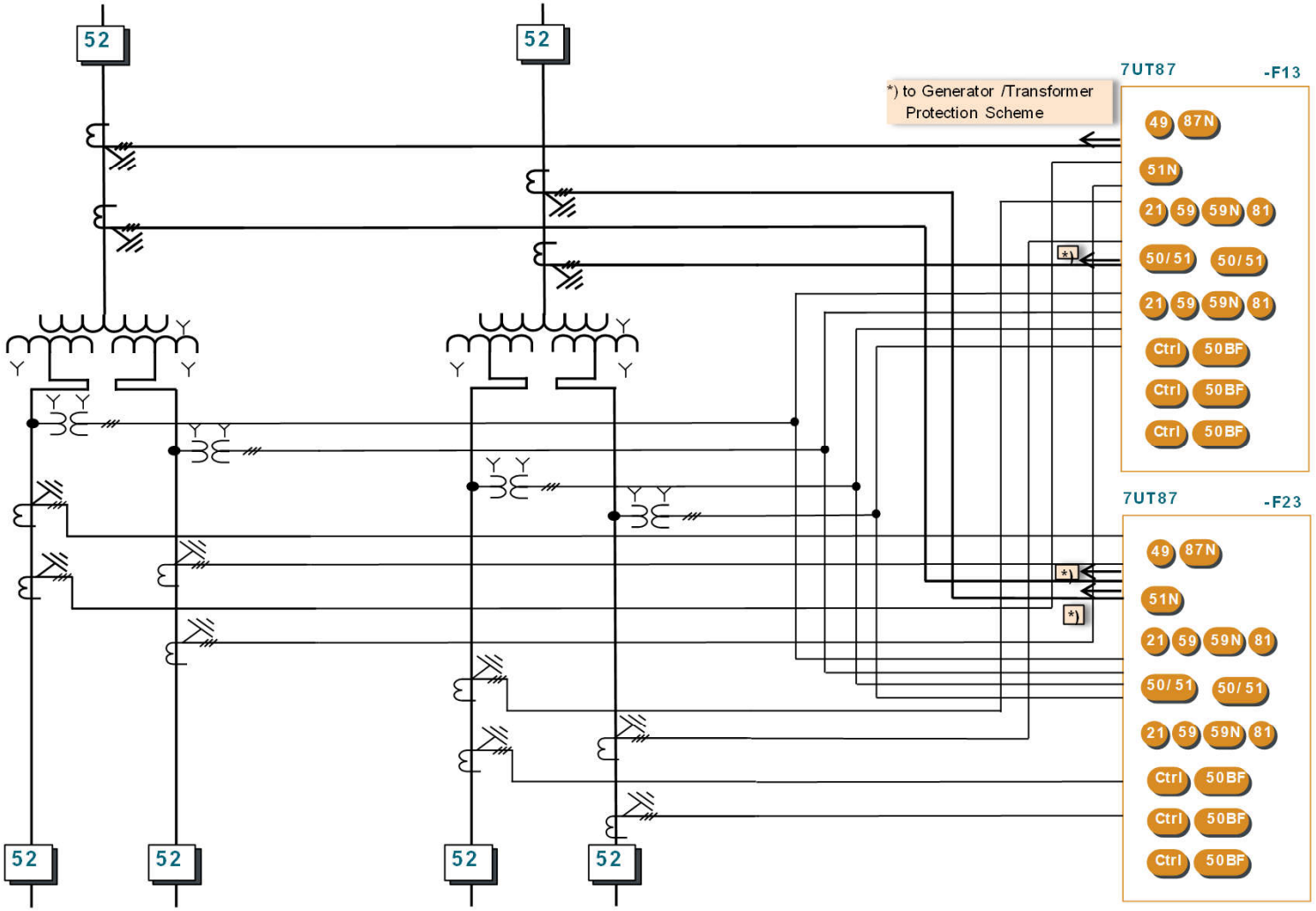
Unit Auxiliary Transformer Protection in Nuclear Power Plants



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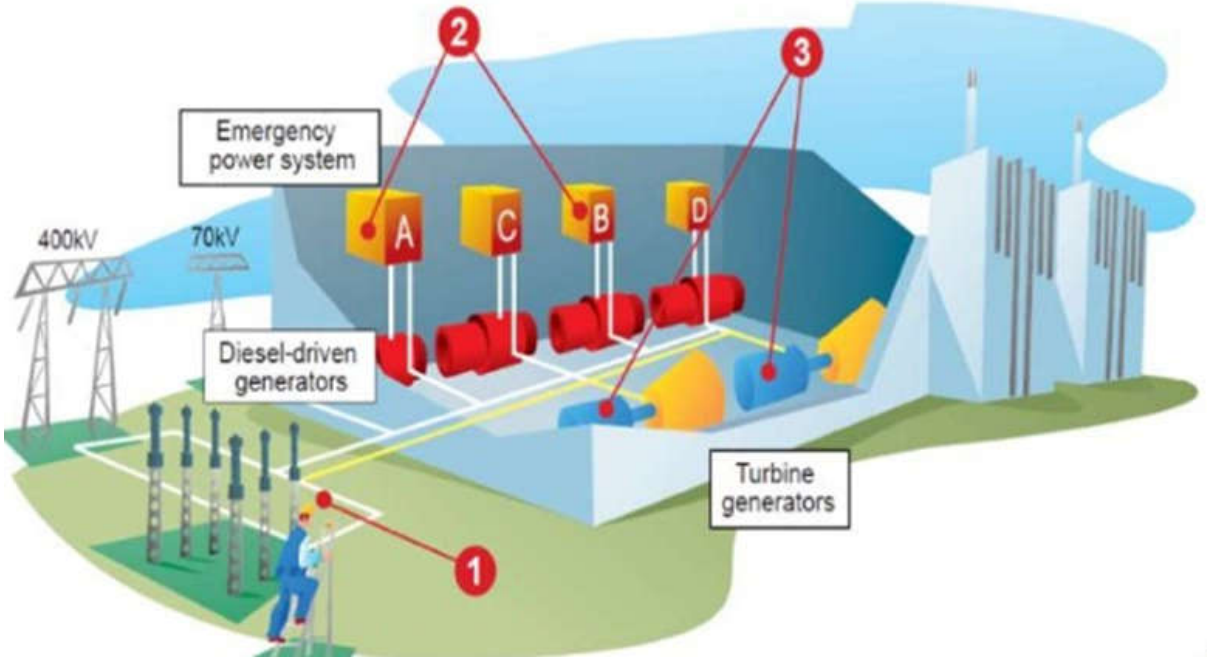
Emergency Diesel Generator Concept

- 4 x Medium Voltage EDG;
  - 1 x out of order,
  - 1 x in revision,
  - 2 x in operation (1 out of 2)

- 4 x Low Voltage EDG;
  - 1 x in revision,
  - 1 x out of order,
  - 2 x in operation (1 out of 2)



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International Safety Standards

- IEEE
- RCC-E
- KTA; i.e. KTA 2201.4; Design of Nuclear Power Plants against Seismic Events; Part 4: Components
  - Cabinets/Construction verification by analysis

Protection of Emergency Diesel Generator

- 2 x	**- SIPROTEC - 7SJ62; V6.x**	**Over Current** protection certified for E1 operation (2 out of 2)
- 1 x	- SIPROTEC - 7UM85	Multifunctional IED for test operation

Emergency Diesel Generator Protection in Nuclear Power Plants

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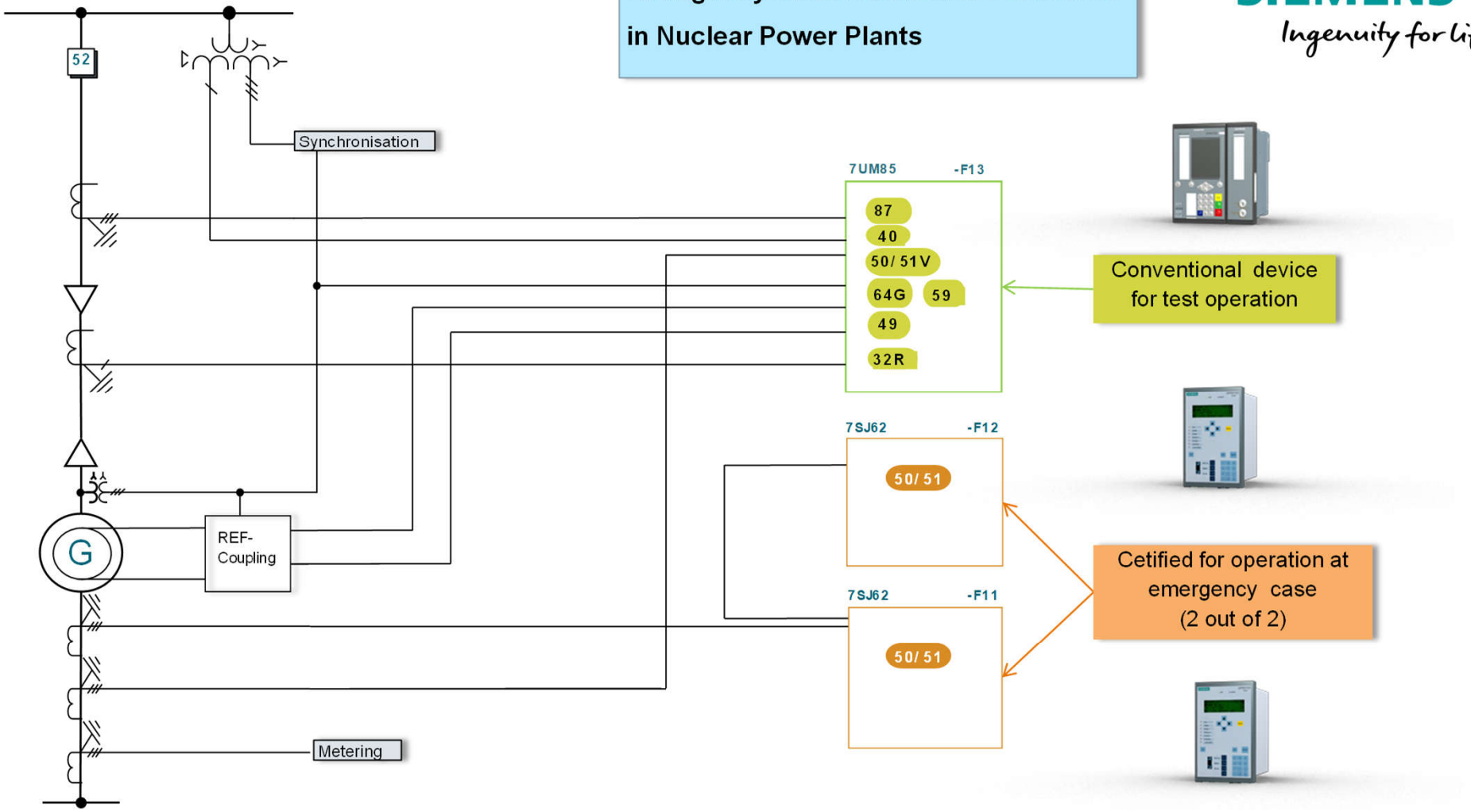

Emergency Diesel Generator Protection in Nuclear Power Plants

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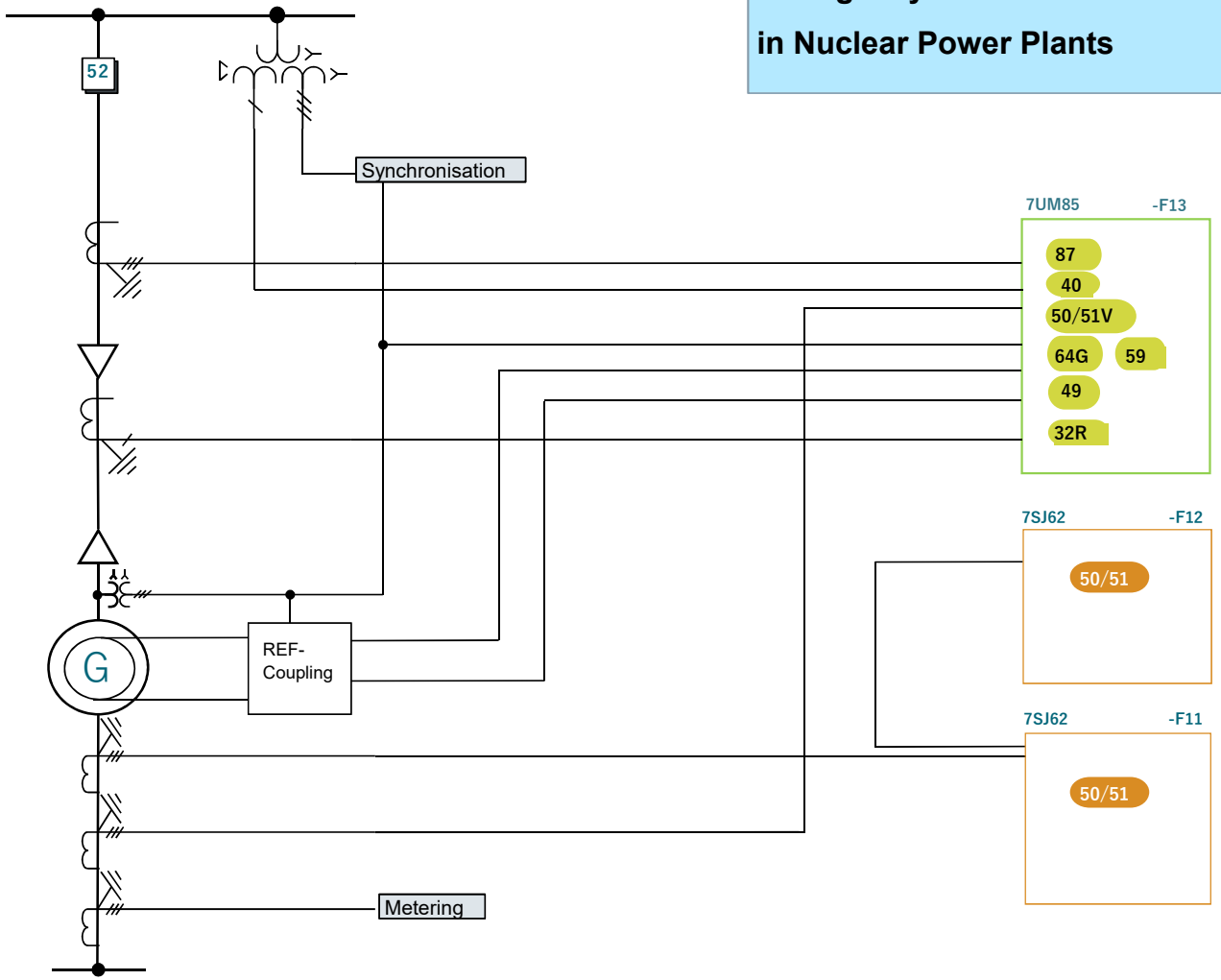

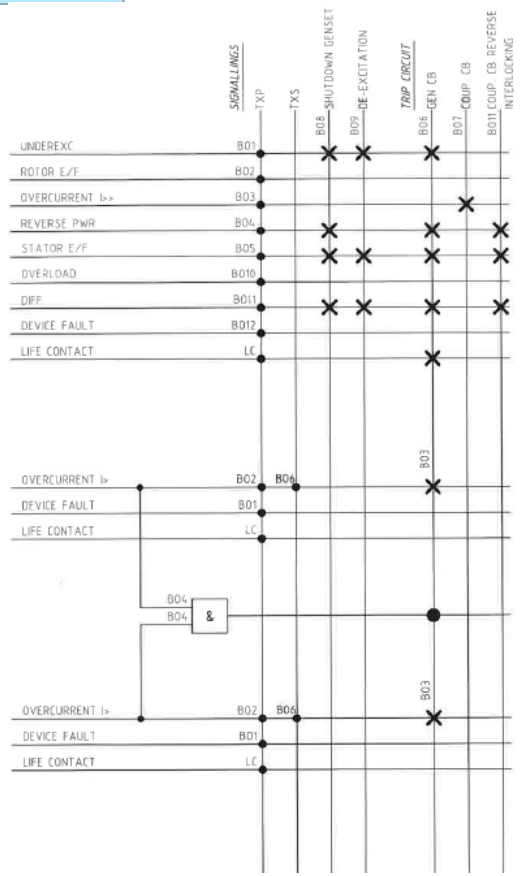

● = Signal is active at Emergency run and parallel operation

✕ = Signal is inactive at Emergency run

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Experience

Modernization / Refurbishment with hard wired channels for tripping and signalization

New-Installations -> selected trip signals hard wired,
alarm signals via communication interface

Synchronization; -> 2 x automatic Synchronizing devices,
no manual synchronization

Authorisation Procedure

- QS Requirements
- Documentation vs. Engineering - Costs

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Udo Faubel

Product Promotion
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