



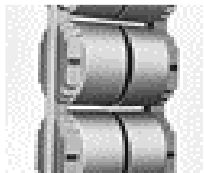
Annie-Qingwen Guo, Chief Engineer, ABB Xi'an Power Capacitor Co., Ltd., November, 2016

New UHV Capacitor with Low Noise, Small Footprint, Anti-seismic

ABB capacitors & filters

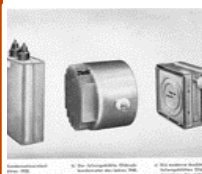
Focus on technology knowhow & customer needs

1910S



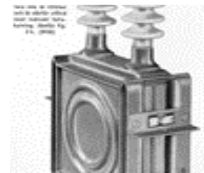
Acquired
Liljeholm
ens

1920S



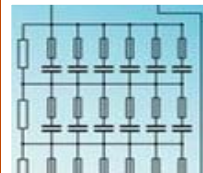
Entered
Capacitor
Field

1930S



to
produce
series
capacitor
s, and
promote
to the
world

1950S



Innovate
internal
fuse tech

1960S



Design &
produce
HVDC
capacitors

1970S



World 1st of
commercial
thyristor-
switched
capacitor
installation

2000S



to serve
global
needs

ABB capacitors & filters

Worldwide footprint to close to customer needs



ABB Xi'an Power Capacitor Global feeder factory

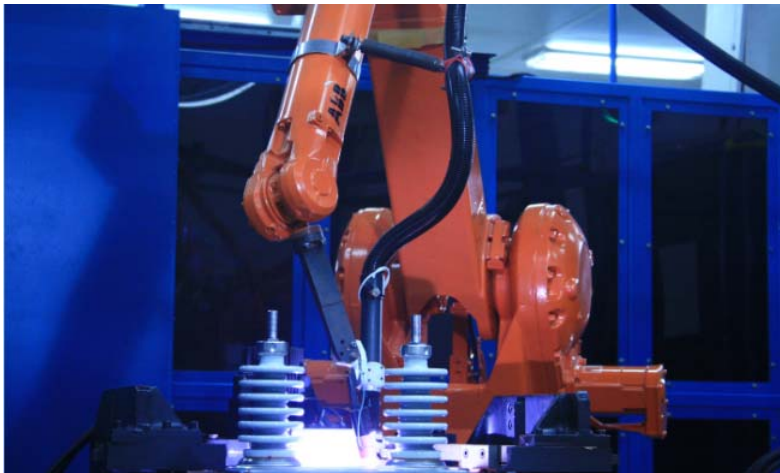


ABB Xi'an Power Capacitor Products and service



Capacitor unit

Design for heavy load operation, three configuration of fuse. ingle/three-phase. Maximum output: 1200 kvar



Shunt capacitor installation

Improve power factor, reduce the network losses. Compact design, full protection and easy maintenance



Filter capacitor installation

Reduce the harmonic content in the network and improve the power quality



Series capacitor installation

Improve transmission capability, reduce loss, improve the stability of power grid



Capacitor installation for HVAV & HVDC

Reduce harmonics, supply reactive power, improve transmission capacity.



Low voltage power quality

Low voltage power factor correction components and solution; low voltage power active filter.



Accessories

The range of high quality accessories for capacitor applications



Services

Installation and test, spare part, maintenance and on-site service, training, etc.

HVDC capacitors

HVDC capacitors

Improve system capacity and power quality

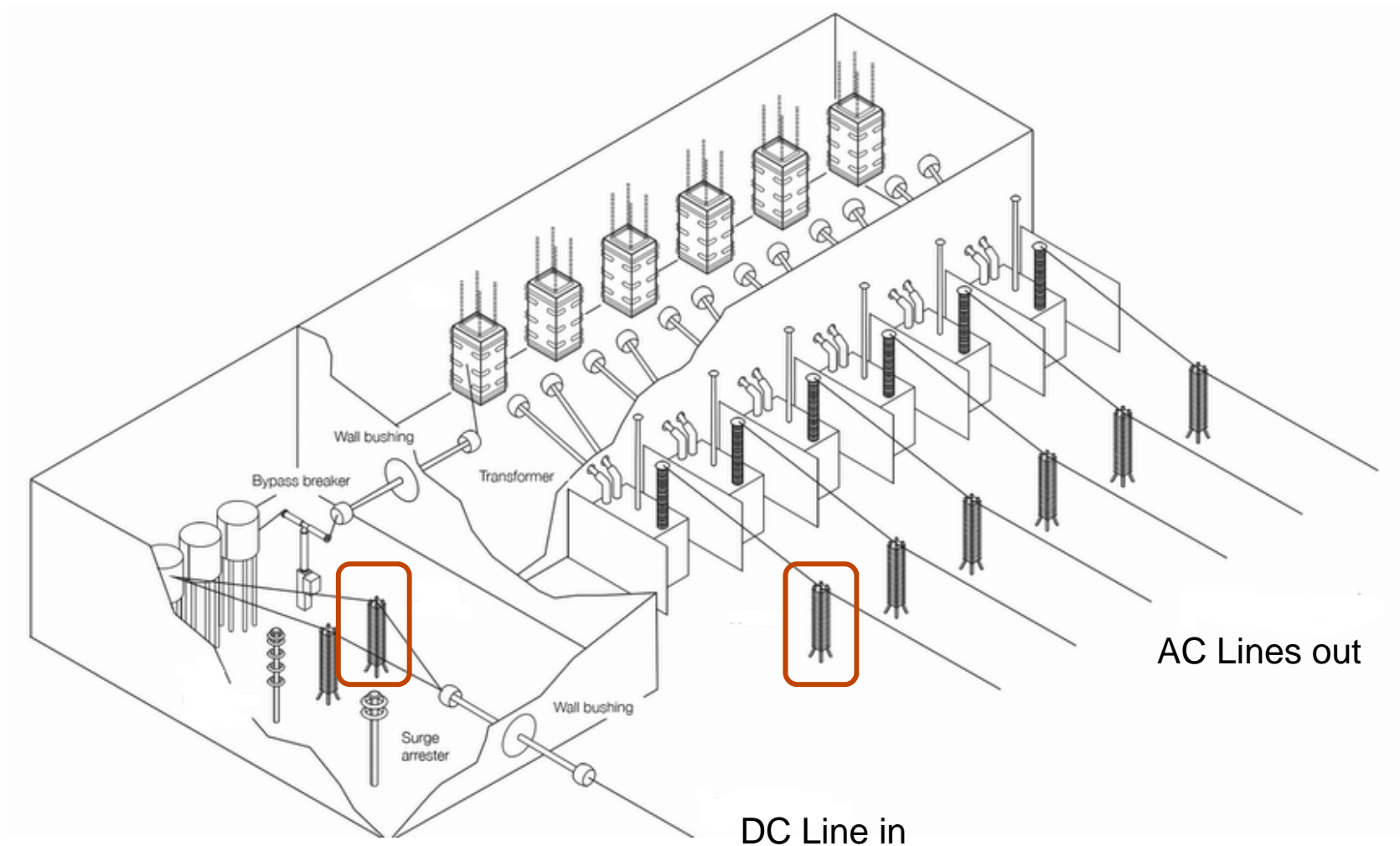


ABB DC filter capacitors for HVDC project

Design feature



- For 1100kV DC filter capacitor, C1 capacitance is 0.6uF, and adopts single stack design, which is similar to one capacitor stack of 800kV project, with 29 layers and 24.5m in height. The unit storage energy capacity is 3.88kJ.
- 800kV DC filter capacitor banks are usually 30 layers, and 3 stacks facing each other. Rigid connections between the layers to achieve best mechanical properties and seismic performance.
- In 500kVHuaxin/Yidu convert station, ABB DC filters adopt unit of DAM14.442-41.6W with the storage energy capacity of 4.34kJ.
- Yulong convert station adopts ABB DC capacitors of DAM24.34-11.6W, with the storage energy capacity of 3.44kJ, which gives reliable operation with no failure.
- Able to offer bigger internally fused capacitor unit, with small footprint, and less maintenance workload.

ABB DC capacitors feature



- Tailor made design

To meet different customer requirements, on different structures like standing type, hanging type, three stacks, twin stacks or single stack structures, as well as different voltages including 500kV, 800kV, 1100kV and different capacitance requirements.

- High precision of equalizing resistance

DC capacitor bank requires high precision of equalizing resistance to ensure reliable operation. ABB strictly guarantees the equalizing resistor deviation does not exceed $\pm 1\%$, while for other competitors, this configurator is bigger. The deviation of Vishay capacitors operating in CSG 800kV Yunguang project is about 15%, with high failure rate.

- Capacitor unit is with large energy storage capacity, up to 5kJ/unit, while domestic product is up to about 3.4kJ/unit

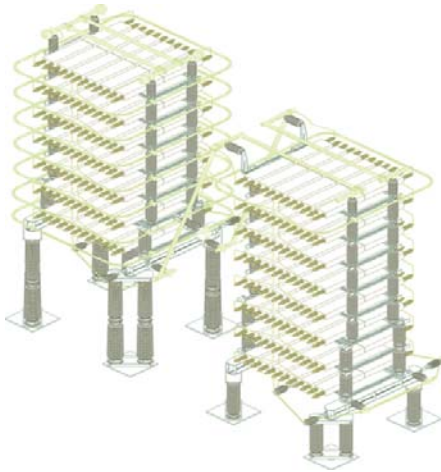
- special DC film

Special material to ensure product reliability. ABB DC capacitors has been operating in many projects worldwide.

- Advance noise reduction technology

ABB AC filter capacitor for HVDC system

Design feature



- Single bank with bigger capacity. Operation installed capacity is up to 480Mvar.
- Larger capacitor unit, less maintenance workload.
 - Actual operated largest unit capacity is 890kvar.
- More units for one phase, maximum 180 units for one phase in actual operated projects.
- Advanced noise reduction technology (optional according to customer requirements)
 - Apply ABB noise reduction technology inside capacitors, i.e. add advanced damping noise reduction element;
 - Externally add rubber pad in the position of lifting lugs, and damping noise reduction gasket between capacitors and racks;
- After seismic analysis by Xi'an Jiao Tong University, the installation meet the seismic requirements ;
- The installation adopts double tower structure, and new type of electrical connection 。

ABB AC capacitors feature



- patent internal fuse technology

AC filter capacitor C1 adopt internal fuse capacitors, which ABB has more than 80 years of history, and has first patented technology.

- High reliability

Using high quality imported raw materials including fuse, good product structure and advance process, to ensure product quality and reliability.

- Zero failure rate

Since Y2002, ABB Xi'an started offering AC filter capacitors to Three Gorges HVDC projects. Many of them has been operating more than 10 years with zero failure rate among tens of thousands of capacitor units.

- ABB fuseless patented technology applied for C2 and C3.

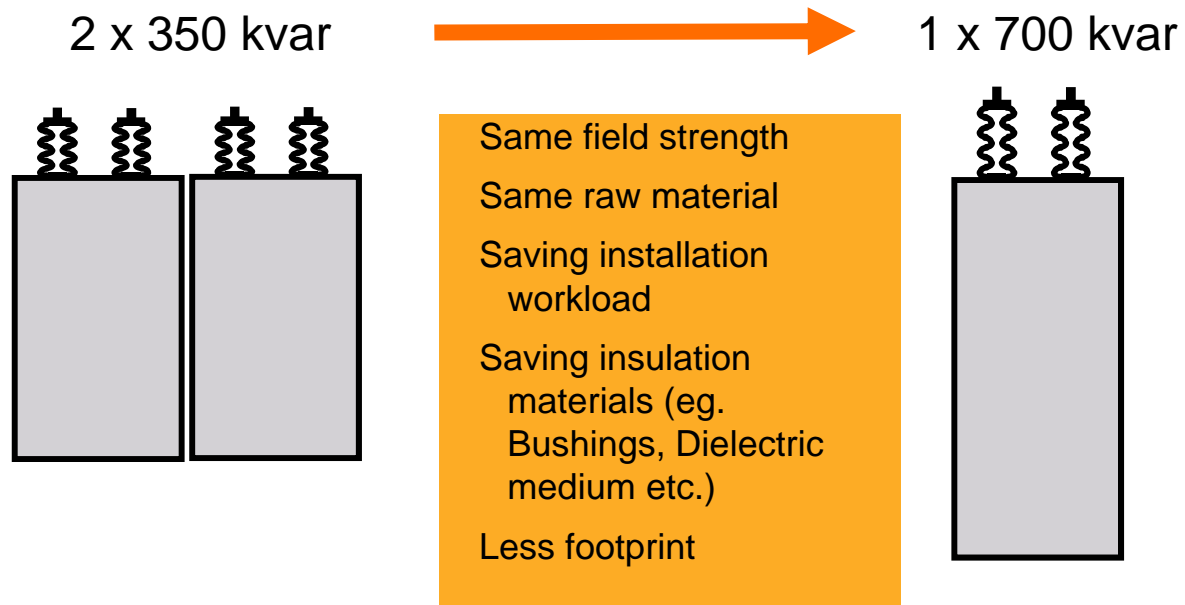
Compared with conventional fuseless technology, it is more reliable and ensures longer lifetime.

- Bigger unit, less footprint. ABB biggest unit is 1000kvar, while domestic unit is about 500kvar~600kvar

- Advance noise reduction technology.

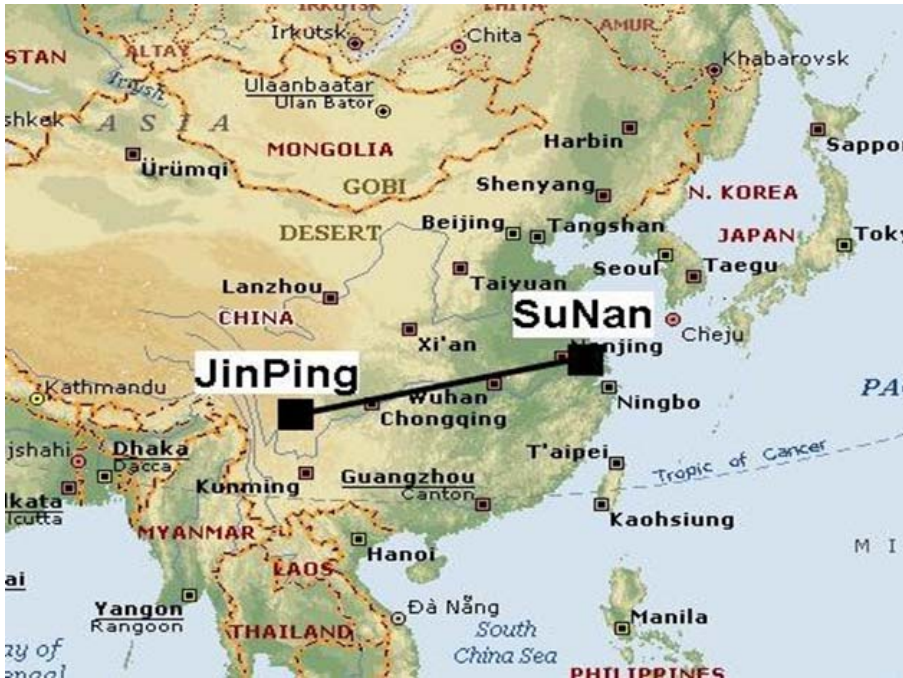
Design feature

Bigger capacitor help customer save costs



±800kV Jinping - Sunan HVDC project

Yulong convert station DC filter capacitors



Altitude of Yulong convert station is 1,850M, which is the functioning ±800kV convert station with the highest altitude in the world.

Customer	SGCC
System	800kV UHV DC system
Substation	Yulong convert station
Delivery time	Y2012

Capacitor specification			unit
HP12-24	C1	DAM23.88-10.15W	244
	C2	AAM17.67-477	15
HP2-39	C1	DAM24.34-11.6	487
	C2	AAM20.4-597	83
Neutral bus capacitor		DAM14.2-34	151
Blocking capacitor		ZAM20-0.52	6

±800kV Xiluodu - Zhexi HVDC project Jinhua convert station DC filter capacitors



Customer	SGCC
System	800kV UHV DC system
Station	Jinhua convert station
Delivery time	Y2013

Capacitor specification			unit
HP12-24	C1	DAM11.94-20.3W	488
	C2	AAM16.799-288	35
HP2-39	C1	DAM11.38-23.2W	975
	C2	AAM16.5-391	84
Neutral bus capacitor		DAM14.424-15W	317
Blocking capacitor		DAM16-0.52W	5

HVDC DC capacitors sales reference

Project	Year	Convert station	Customer	Highlight
± 800kV Jinbei – Nanjing HVDC	2015	Nanjing	SGCC	
± 800kV Ximeng – Taizhou HVDC	2016	Ximeng	SGCC	Low temperature requirement: minus 42° C
± 800kV Dianxibei – Shenzhen UHVDC	2016	Dongfang	CSG	Hanging type design, big capacitor unit and noise reduction solution
± 1100kV Changji – Guquan UHVDC	2016	Changji	SGCC	Current highest voltage in the world

±500kV Three gorges - Guangdong HVDC project Huizhou convert station AC filter capacitors



Customer	SGCC
System	500kV UHV AC system
Delivery time	Y2003

Filter bank	Unit specification	Unit
Double tuned HP11/13 AC filter capacitor installation	C1	AAM6.618-823-1W
	C2	AAM12.285-609-1W

Reliable operation, fulfill system requirement
single tower structure, with height of 13m.

HVDC AC capacitors sales reference

$\pm 400\text{kV}$ HVDC

- 1. Qinghai – Tibet
- Current highest altitude HVDC line, above 4000M, and cold area

$\pm 500\text{kV}$ HVDC

- 2. Guizhou – Guangdong
- 3. Three Gorges - Shanghai
- 4. Guizhou – Guangdong (II)
- 5. Northwest-Central China
- 6. Yunnan - Guangxi
- 7. Yongren - Funing

$\pm 800\text{kV}$ UHVDC

- 8. Yunnan - Guangdong
- 9. Nuozhadu - Guangdong
- 10. Hami - Zhengzhou
- 11. Ximeng - Taizhou
- 12. Shanghaimiao – Shandong
- 13. Zhalute - Qingzhou

$\pm 1100\text{kV}$ UHVDC

- 14. Changji - Guquan

Q & A



Thank you!

Power and productivity
for a better world™

