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## HADA ELECTRIC

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# SINCE 1999

PROVIDE HIGH QUALITY POWER QUALITY

DEVICES FOR GLOBAL POWER TRANSMISSION AND DISTRIBUTION

# HADA ELECTRIC



## ABOUT HADA ELECTRIC

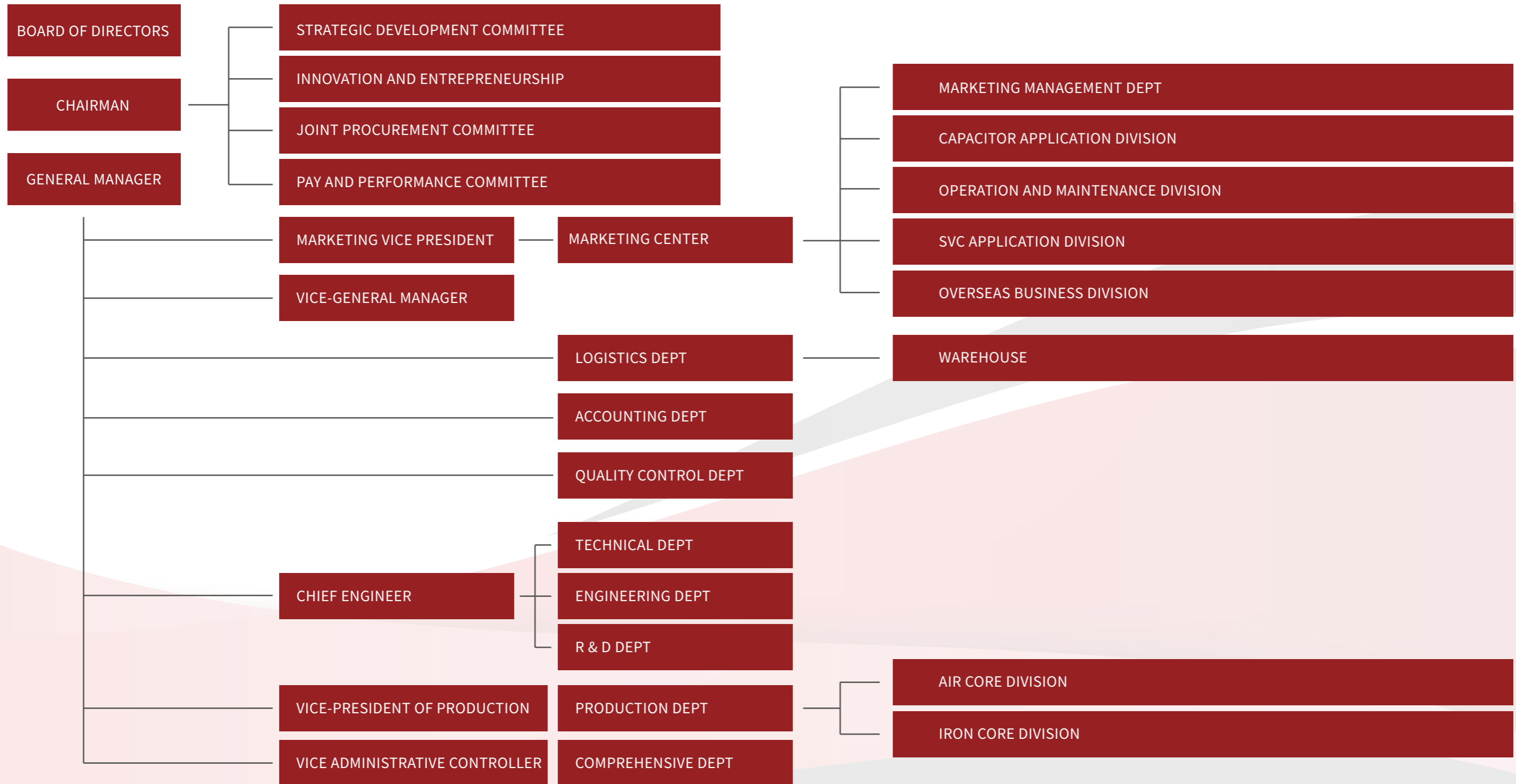
SHAN DONG HADA ELECTRIC CO., LTD. FOUNDED ON JUNE, 9.1999, LOCATED IN YANTAI, CHINA, A BEAUTIFUL COASTAL CITY, SPECIALIZED IN PRODUCING ALL KINDS OF DRY-TYPE AIR-CORE REACTORS AND DRY-TYPE IRON-CORE REACTORS. MAIN PRODUCTS: DAMPING REACTORS, CURRENT LIMITING REACTORS, THYRISTOR CONTROL REACTORS(TCR), FILTER REACTORS, SMOOTHING REACTORS, BRIDGE ARM REACTORS, STARTING REACTORS ETC.

HADA' S WORKSHOP COVERS 22000 SQUARE METERS WHICH IS EQUIPPED WITH HIGH PRECISION AUTO WINDING MACHINES AND INSPECTION EQUIPMENT, CURRENTLY ANNUAL CAPACITY REACHES TO 40MILLION USD. ABLE TO DO ROUTINE TEST FOR ALL KINDS OF AIR CORE AND IRON CORE REACTORS.

HADA REACTORS HAVE BEEN WIDELY USED IN POWER TRANSMISSION AND DISTRIBUTION, METALLURGY, ELECTRIC RAILWAY AND MUNICIPAL ENGINEERING. COVERING MIDDLE VOLTAGE, HIGH VOLTAGE, ULTRA-HIGH VOLTAGE, AND OTHER FIELDS, CAN MEET THE NEEDS OF DRY REACTOR FOR AC AND DC TRANSMISSION. MOST FAMOUS COMPANIES LIKE CHINA STATE GRID, SOUTHERN GRID, ABB, SAMWHA, GE, COOPER, SIEYUAN, NR, CSR AND RXPE ALWAYS TAKE HADA AS THEIR MAIN DRY TYPE REACTOR SUPPLIER. BY FAR, HADA' S REACTORS HAVE BEEN SAFELY OPERATED IN MORE THAN 50 COUNTRIES AROUND THE WORLD. HADA ELECTRIC ACTIVELY PARTICIPATES IN THE CONSTRUCTION OF NATIONAL KEY PROJECTS, AND HAS PROVIDED PRODUCTS AND SERVICES FOR QINGHAI-TIBET NETWORK PROJECT, SICHUAN-TIBET NETWORK PROJECT, SOUTH POWER GRID DC MELTING PROJECT, SHANGHAI TEMPLE  $\pm 800$ KV CONVERTER STATION, SOUTH KOREA KEPCO STATE GRID, COLOMBIA TIBU STATE GRID AND SO ON.

ALL PRODUCTS ARE DESIGNED ACCORDING TO IEEE, IEC, GB AND DL STANDARDS, ALL KINDS OF PRODUCTS HAVE PASSED THE TYPE TEST OF NATIONAL HIGH VOLTAGE ELECTRICAL APPLIANCES QUALITY SUPERVISION AND INSPECTION CENTER (XHARI), CHINA NATIONAL TRANSFORMER QUALITY SUPERVISION TESTING CENTER (STRI) AND CHINA NATIONAL CENTER FOR QUALITY SUPERVISION AND TEST OF ELECTRICAL APPARATUS PRODUCT(EETI)

# ORGANIZATION





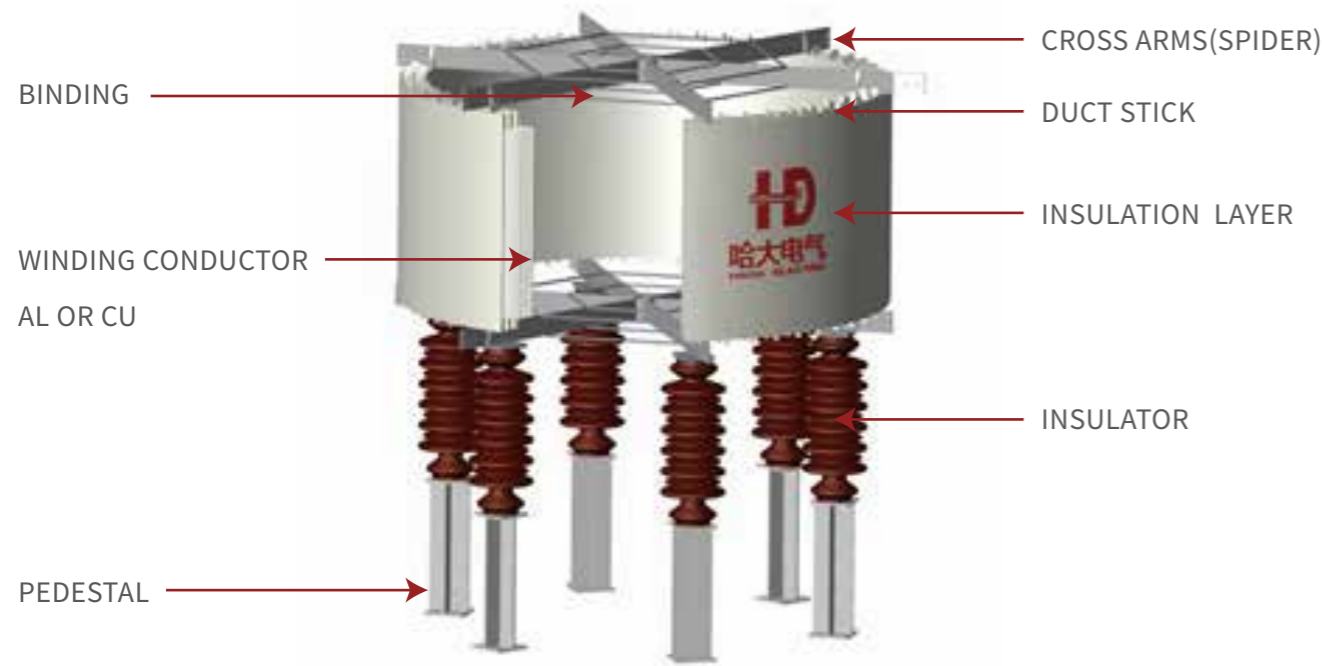
# PRODUCT INTRODUCTION

## 3.1 DRY-TYPE AIR-CORE REACTOR

DRY-TYPE AIR-CORE REACTOR PROVIDE A LINEAR RESPONSE OF IMPEDANCE VERSUS CURRENT WHICH IS ESSENTIAL FOR NUMEROUS APPLICATIONS. THE DRY TYPE DESIGN IS MAINTENANCE FREE AND ENVIRONMENTALLY FRIENDLY.

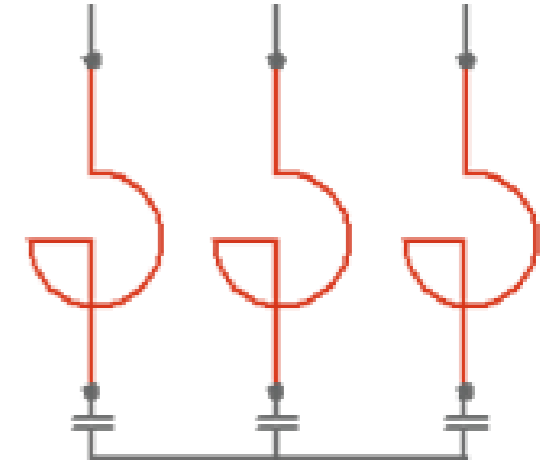
THE ADVANTAGE OF DRY-TYPE AIR-CORE REACTOR

- HIGH MECHANICAL STRENGTH TO WITHSTAND ELEVATED SHORT-CIRCUIT FORCES
- ISOTHERMAL DESIGN METHOD WHICH ENSURES WINDING IN ALL LAYERS ARE THE SAME WITH RESPECT TO THE TEMPERATURE RISE.
- LOW NOISE LEVEL FOR NOISE SENSITIVE APPLICATIONS
- CONSERVATIVE TEMPERATURE RISE FOR EXTENDED SERVICE LIFE
- CUSTOMIZED SPACE SAVING SOLUTIONS FOR INSTALLATIONS IN COMPACT AREAS
- SURFACE TREATMENT FOR PROTECTION AGAINST UV RADIATION AND POLLUTION
- MINIMUM MAINTENANCE REQUIREMENTS AND ENVIRONMENTALLY FRIENDLY



## 3.1.1 DRY-TYPE AIR-CORE DAMPING REACTORS

DRY-TYPE AIR-CORE DAMPING REACTORS IS CONNECTED IN SERIES WITH THE HIGH-VOLTAGE SHUNT CAPACITOR BANK SO AS TO SUPPRESS THE POWER GRID VOLTAGE WAVEFORM DISTORTION AND CONTROL THE HARMONIC COMPONENT FLOWING THROUGH THE CAPACITOR BANK AND ALSO LIMIT THE INRUSH AND OUT RUSH CURRENTS OF CAPACITOR BANKS.



PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	VOLTAGE CLASS	RATED INDUCTANCE
DRY-TYPE AIR-CORE DAMPING REACTOR	CKGKL-	1~500kV	≤20000kVar	0.05~2500mH



±800kV UHVDC CONVERTER STATION (CHINA)





115kV DRY-TYPE AIR-CORE DAMPING REACTOR (COLUMBIA TIBU)

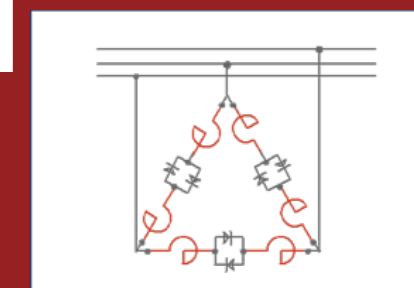


27.5 kV DAMPING REACTOR FOR ELECTRICAL RAILWAY(RUSSIA)



161kV DRY-TYPE AIR-CORE DAMPING REACTOR (KEPCO)

### 3.1.2 DRY-TYPE AIR-CORE THYRISTOR CONTROL REACTOR (TCR)



DRY-TYPE AIR-CORE THYRISTOR CONTROL REACTOR (TCR) IS AN IMPORTANT COMPONENT OF STATIC VAR COMPENSATION (SVC).

SVC SYSTEMS PROVIDE DYNAMIC POWER COMPENSATION FOR UTILITIES AND INDUSTRY NETWORKS. THE MAIN BENEFITS INCLUDE DYNAMIC VOLTAGE SUPPORT, IMPROVEMENT OF SYSTEM STABILITY, POWER OSCILLATION SERIES, REACTIVE POWER BALANCING, FLICKER CONTROL AND REDUCTION OF LOSSES. SVC NORMALLY CONSISTS OF A COMBINATION OF THYRISTOR-CONTROLLED REACTORS (TCR), THYRISTOR-SWITCHED CAPACITORS AND REACTORS (TSC AND TSR), MECHANICALLY-SWITCHED CAPACITOR BANKS (MSC) AND HARMONIC FILTERS (HF). TCR IS CAPABLE TO CHANGE THE REACTIVE POWER CAPACITY AND TO MAINTAIN THE STABILITY OF VOLTAGE DYNAMICALLY.



PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	VOLTAGE CLASS
DRY-TYPE AIR-CORE TCR REACTOR	BKGKL-	1~110kV	≤80000kVar



TCR REACTOR WITH RATED CURRENT 2870A (MEXICO ACEROS)

MISSION: PROVIDE HIGH QUALITY POWER QUALITY DEVICES FOR THE GLOBAL POWER TRANSMISSION AND DISTRIBUTION



35kV TCR REACTOR AT A STEEL PLANT (CHINA)



35kV TCR REACTOR AT A WIND POWER PLANT (CHINA)

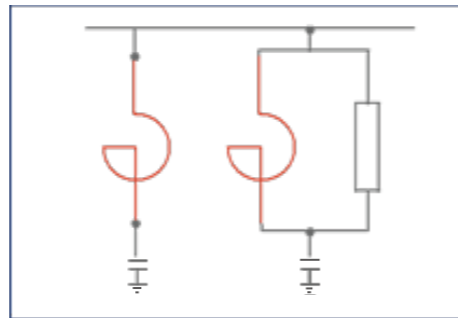


### 3.1.3 DRY-TYPE AIR-CORE FILTER REACTOR

DRY-TYPE AIR-CORE FILTER REACTOR ARE USED IN SERIES WITH CAPACITOR BANKS TO FORM SERIES TUNED HARMONIC FILTER CIRCUITS, SO AS TO REDUCE OR BLOCK THE SPECIFIED ULTRA-HARMONIC, AND TO PREVENT EXCESSIVE HARMONICS ENTRY INTO THE SYSTEM.

THE HARMONIC CURRENTS ARE DISTORTIONS INTRODUCED TO THE NETWORK AS A RESULT OF THE OPERATION OF POWER ELECTRONICS DEVICES, LARGE INDUCTIVE MACHINES, ETC0. THESE HARMONIC CURRENTS CREATE SEVERAL NETWORK PROBLEMS, SUCH AS:

- GREATER LOSSES
- MALFUNCTIONING CONTROL SYSTEMS
- HIGH NEUTRAL CURRENTS
- INTERFERENCE WITH COMPUTERS
- INTERFERENCE WITH TELECOMMUNICATIONS EQUIPMENT.



PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	RATED POWER
DRY-TYPE AIR-CORE FILTER REACTOR	LKGKL-	1~220kV	≤20000kVar



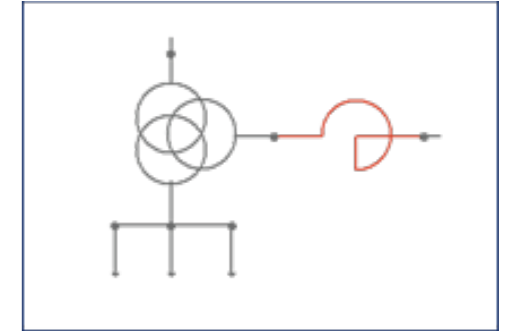
35kV FILTER REACTOR AT A STEEL PLANT (CHINA)



35kV FILTER REACTOR AT A STEEL PLANT (INDIA)

### 3.1.4 DRY-TYPE AIR-CORE SHUNT REACTOR

THESE REACTORS ARE USED IN A PARALLEL CONFIGURATION WITH THE LOW-VOLTAGE SIDE TO COMPENSATE FOR THE CAPACITIVE CURRENTS OF LONG TRANSMISSION LINES OR CABLES. IN A LOW-LOAD SITUATION, SHUNT REACTORS MAY BE USED TO REDUCE THE VOLTAGE RISE DUE TO CAPACITANCE OF THE TRANSMISSION LINE AND REDUCE CORONA LOSSES.



PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	RATED POWER
DRY-TYPE AIR-CORE SHUNT REACTOR	BKGKL-	6~110kV	≤80000kVar



66kV SHUNT REACTOR (AUSTRALIA)



23kV SHUNT REACTOR (SOUTH KOREA KEPCO)



35kV SHUNT REACTOR (RUSSIA)

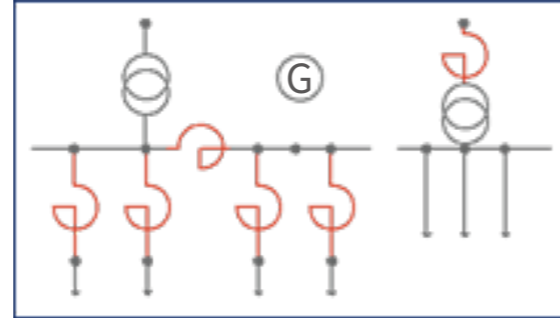


35kV SHUNT REACTOR (MEXICO)



### 3.1.5 DRY-TYPE AIR-CORE CURRENT LIMITING REACTOR

DRY-TYPE AIR-CORE CURRENT LIMITING REACTOR ARE CONNECTED IN SERIES WITH THE SYSTEM CIRCUIT TO STRENGTHEN THE SYSTEM IMPEDANCE. REDUCE THE SHORT-CIRCUIT IN CASE OF MALFUNCTION WITH THE SYSTEM, WHICH WILL LOWER THE FAULT CURRENT TO THE ALLOWABLE VALUE.



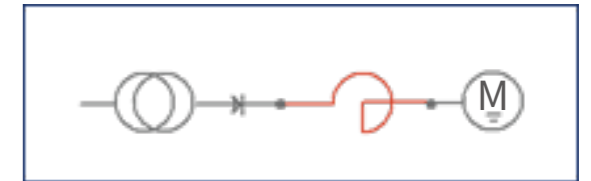
PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	RATED POWER
DRY-TYPE AIR-CORE CURRENT LIMITING REACTOR	XKGKL-	1~500kV	≤6000A



35 kV CURRENT LIMITING REACTOR (CHINA)

### 3.1.6 DRY-TYPE AIR-CORE SMOOTHING REACTOR

DRY-TYPE AIR-CORE SMOOTHING REACTOR ARE USED TO REDUCE THE HARMONIC CURRENTS AND TRANSIENT OVER CURRENTS IN THE DC SYSTEM. THEY ARE USED IN HVDC LINKS AND INDUSTRIAL APPLICATIONS SUCH AS RECTIFIERS, TRACTION SYSTEMS, ETC.



PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	RATED POWER
DRY-TYPE AIR-CORE SMOOTHING REACTOR	PKGKL-	1~500kV	≤5000A

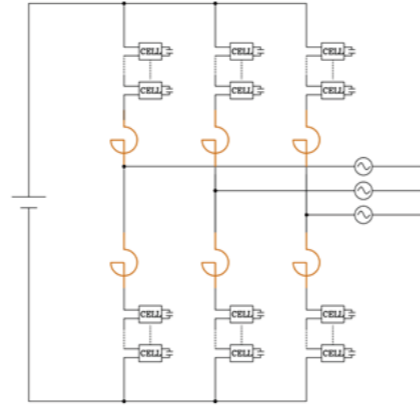


35 kV SMOOTHING REACTOR (CHINA SOUTHERN GRID)



### 3.1.7 DRY-TYPE AIR-CORE BRIDGE ARM REACTOR USED IN HVDC

THE LEAKAGE REACTANCE OF AC SIDE TRANSFORMER WORKS TOGETHER WITH BRIDGE ARM REACTOR AS A CONVERTER REACTANCE, CONVERTER REACTANCE IS A KEY PART OF CONVERTER STATION, CONTROL POWER TRANSMISSION, FILTERING AND SUPPRESSION OF AC SIDE CURRENT WAVES. IN ADDITION, BRIDGE ARM REACTOR CAN RESTRAIN THE BRIDGE ARM CYCLE CURRENT AND RESTRAIN THE EXCESSIVE RISE OF BRIDGE ARM CURRENT IN CASE IF SHORT CIRCUIT.



PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	RATED POWER
DRY-TYPE AIR-CORE BRIDGE ARM REACTOR	QKGKL-	1~350kV	≤5000A



MULTI TERMINAL HYBRID DC POWER TRANSMISSION TECHNOLOGY DEVELOPMENT (CHINA)

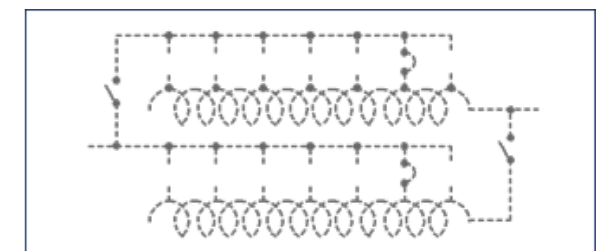


154kV TEST REACTOR WITH TAPS (KEPCO)

### 3.1.8 SPECIAL APPLICATIONS

TEST LABORATORIES REACTORS OFTEN REQUIRE VERSATILE REACTORS WITH TAPS TO ADJUST THE INDUCTANCE VALUE AS WELL AS FLEXIBLE LINKS TO CONNECT THE REACTOR IN PARALLEL OR IN SERIES ACCORDING TO TEST REQUIREMENTS.

USUALLY, THE RATED CURRENT VALUE IS LOW, AND THE BIL OR THE SHORT-TIME CURRENT IS HIGH.

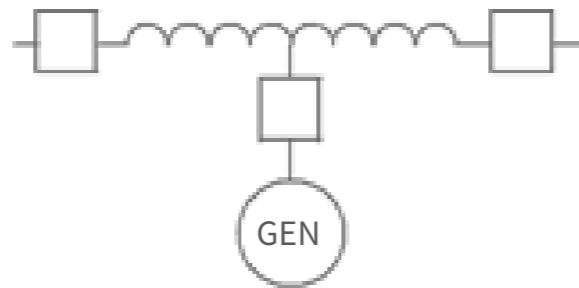




### 3.1.9 DUPLEX CURRENT-LIMITING REACTORS

TEST LABORATORIES REACTORS OFTEN REQUIRE VERSATILE REACTORS WITH TAPS TO ADJUST THE INDUCTANCE VALUE AS WELL AS FLEXIBLE LINKS TO CONNECT THE REACTOR IN PARALLEL OR IN SERIES ACCORDING TO TEST REQUIREMENTS.

USUALLY, THE RATED CURRENT VALUE IS LOW, AND THE BIL OR THE SHORT-TIME CURRENT IS HIGH.



35kV DUPLEX CURRENT-LIMITING REACTORS (CHINA)

### 3.2 DRY-TYPE IRON-CORE REACTOR

DRY-TYPE IRON-CORE REACTOR ADOPTS EPOXY RESIN VACUUM CAST INSULATION SYSTEM WITH NO OIL MEDIUM AND EXCELLENT SAFETY. THE COIL IS CASTED INTO A SOLID ENTIRELY; THE SILICON SHEET IS TAKEN AS THE MAGNETIC CONDUCTANCE AND THE IRON CORE IS TAKEN AS THE MAGNETIC CONDUCTANCE RETURN CIRCUIT FOR MAGNETIC FLOW, WHICH CAUSES NO ELECTROMAGNETIC POLLUTION TO THE SURROUNDINGS AND SUITABLE FOR INDOOR INSTALLATION. THE IRON CORE POST IS CASTED INTO MOLDING AS A WHOLE, WHICH BECOMES A SOLID RIGID BODY WITH SMALL VIBRATION AND LOW NOISE DURING OPERATION;

THE ADVANTAGE OF DRY TYPE IRON CORE REACTOR:

- SMALL PARTIAL DISCHARGE
- HIGH MECHANICAL STRENGTH
- SMALL VOLUME, LOW NOISE AND LOSS

THEY ARE WIDELY USED IN POWER TRANSMISSION AND TRANSFORMING SYSTEMS, ELECTRIFIED RAILWAYS, METALLURGY AND PETROCHEMICAL SECTORS. PARTICULAR APPLIED IN URBAN POWER-GRID SUBSTATIONS, UNDERGROUND SUBSTATIONS WITH LIMITED INSTALLATION SPACE AND SPECIAL FIRE PROTECTION REQUIREMENTS, AND MICROCOMPUTER CONTROLLED STATIONS WITH SPECIAL REQUIREMENTS ON ELECTROMAGNETIC INTERFERENCE.







35kV DRY-TYPE IRON-CORE SERIES REACTOR (CHINA)



10kV DRY-TYPE IRON-CORE SHUNT REACTOR (CHINA)

PRODUCT NAME	PRODUCT MODEL	VOLTAGE CLASS	RATED POWER
DRY-TYPE IRON-CORE SERIES REACTOR	CKSC-	6~35kV	≤10000kVar
DRY-TYPE IRON-CORE SHUNT REACTOR	BKSC-	6~35kV	≤20000kVar

## QUALITY CERTIFICATION

