

# Trihal



October 2011 – RevA

**Schneider**  
Electric

# Trihal - Product Presentation



# Trihal – Cast Resin Transformers

## Common Design – The Range

- Rated power  
100 kVA up to 15 MVA
- HV Insulation voltage  
From 3.6 up to 40 kV  
With 185 kV BIL /AC 85 kV (IEC)
- LV / MV Insulation voltage  
From 1.1 up to 36 kV  
With 170 kV BIL /AC 70 kV (IEC)
- Insulation Class  
Class F – 155 °C (hot point)
- Frequency – Vector Group  
50 - 60 HZ / Star – Delta



# Trihal – Cast Resin Transformers

## Common Design – The Range

- Cooling System  
AN / ANAF / AF (up to +45%)
- Losses Level  
Normal / Reduced (HE)
- Ingress Protection (Indoor type)  
IP00 / IP31
- Thermal protection  
Z protection relay / PTC
- Standard compliance  
IEC 60076, prEN50451
- Tests Certification IEC 60076-11&16  
C3\* E3 F1  $\leq 5pC$



# Trihal – Cast Resin Transformers

## Specific Designs

	Specific requests	Basic offer	Our answers
1	Maximum T° / Altitude	< 40°C / < 1000m	Up to 65°C / 5,000m
2	Optimised Efficiency	Standard Losses	HE Solutions (Trihal HE)
3	Tolerances on losses	+15% max. P0/Pk +10% max. P0+Pk	No tolerance on P0/Pk
4	Impedance voltage	4 or/and 6%	Up to 10%
5	Temperature rise	100K at 40°C	80K at 40°C
6	LV Windings	Pre-impregnated	Cast Resin encapsulated (Trihal Twincast)
7	Regulation	±2*5% (5 positions) Off Circuit Tap Changer	Up to 9 Taps / ±18% (On Load Tap Changer)
8	Voltage per windings	One	HV1/HV2 and/or LV1/LV2
9	Rectifier feeder	Not applicable	6, 12 Pulses

# Trihal – Cast Resin Transformers

## Main Optional Accessories

1. Z protection Relay
2. T protection Relay
3. Enclosure IP31  
(with or without lock)
4. HV Surge Arrestors
5. HV Fixed Plug-in Bushings  
(with or without locking device)
6. Anti-vibration pads
7. Fans (AF cooling system)



1



2



3



4



5



6



7



# Tests Certifications

C3\* E3 F1 5pC



# Climatic test **C3\*** (\*) C2 Thermal shock test carried out at -50°C

## IEC 60076-11 Standard

### Climate **+++**

**C1**

Lowest ambient temperatures:

- Operation **-5°C**
- Storage / Transport **-25°C**

**C2**

Lowest ambient temperatures:

- Operation **-25°C**
- Storage / Transport **-25°C**

**C3\***

Lowest ambient temperatures:

- Operation **-50°C**
- Storage / Transport **-50°C**





# Environmental test **E3**

IEC 60076-11 & IEC 60076-16 Standards

## Environment **+++**

**E0**

- Normal indoor installation
- No condensation
- No considerable pollution

**E1**

- Occasional condensation
- Limited pollution

**E2**

- Frequent condensation
- Heavy pollution or combination of both
- Relative humidity up to **93%**

**E3**

- Nearly total condensation or heavy pollution or combination of both
- Abnormal level of humidity up to **95%**
- According to IEC 60076-16 Standard



# Fire withstand **F1**

IEC 60076-11 Standard

## Fire **+++**

**F0**

- No special fire risk to consider
- Except for the characteristics inherent in the design of the transformer, no special measures are taken to limit flammability

**F1**

- Transformers subject to a fire hazard:
- Restricted flammability required
  - Limited formation of fumes
  - Limited contribution with calorific energy to the source of fire
  - Self-extinguishing transformer fire



# Partial Discharges $\leq 5$ pC

## IEC 60076-11 Standard – Special Test

# Partial Discharges + + +

$\leq 10$   
pC at 1.3 Un

•Maximum level of partial discharges measured during **Routine Test**

$\leq 5$   
pC at 1.3 Un

•Maximum level of partial discharges measured during **Special Test** according to IEC60076-11 Standard

The image displays three KEMA test certificates. The top certificate is titled 'TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE' (133-05) and includes a table with columns for 'Test Voltage', 'Test Duration', 'Test Result', 'Standard', and 'Remarks'. The middle certificate is titled 'TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS' (28-05) and contains similar data. The bottom certificate is titled 'TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS' (79705-11-20-05) and also includes a table with columns for 'Test Voltage', 'Test Duration', 'Test Result', 'Standard', and 'Remarks'. Each certificate contains detailed technical specifications and test results.

# Testing – Routine, Type/Special Tests



## **Routine tests** (performed on each unit)

- Voltage ratio
- No-load losses and current
- Impedance voltage, short-circuit impedance and load losses
- Partial discharge (Acceptance criteria  $\leq 10$  pC at 1.3 Un)



## **Type and special tests** (on request / at customers charge)

- Temperature-rise test
- Determination of sound levels
- Lightning impulse test, Short-circuit test (**External**)
- Partial Discharges (**External** - Acceptance criteria  $\leq 10$  pC at 1.3 Un)

# Trihal Special Application

# Power Transformer



Big power transformer (MV-MV) with air duct in HV coil & MV coil

10MVA 35/10.5kV YNd11

Modern city is becoming bigger and bigger. Load centre is far away from the power plant. Indoor power transformers are needed more and more.





# Power Transformer

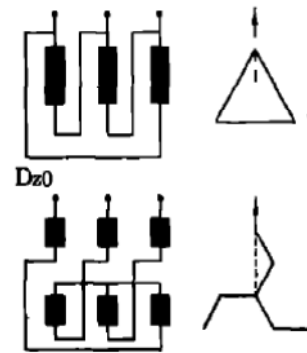


Big transformer (MV-MV) with air duct  
in HV coil 8MVA 22/6.6kV Dzn0

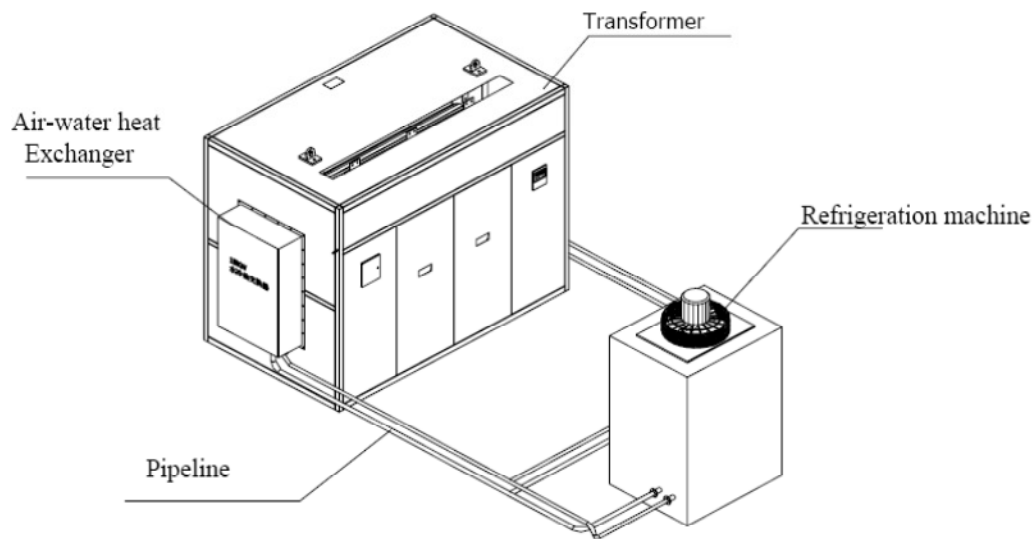
It is used in a data center.

It can be used for:

- Asymmetric load
- The secondary side contains DC current



# Air & Water Cooled Trihal



## Air-water cooling transformer

It can be used in a wind-farm or a dirty environment.

The heat exchange is transferred to another place through the coolant. For example, the heat can be exchanged to the outside of the wind-turbine tower not in the tower to influence the other equipment.

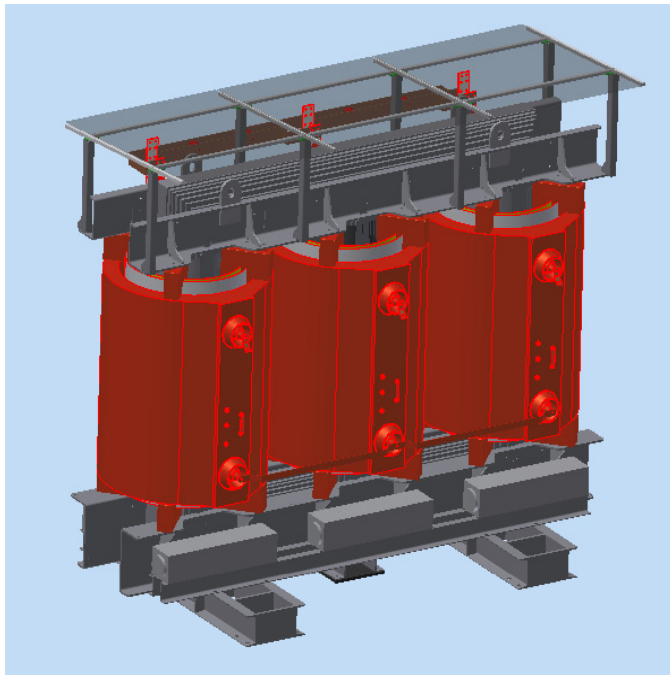


# High current



Big current transformer 4MVA (20/0.4kV) with busduct (very very big current 5773A)

The customer need a big power transformer but the secondary side voltage is LV (e.g. 400V). Normally they can use two units. Due to limited by the space or some other reasons, they want only one transformer.



## Wind-farm transformer 7MVA 35/3.3kV YNd11

Limitations for wind-farm application:

1. High atmosphere temperature, max 65°C;
2. Limited dimension and weight;
3. Withstand ability to vibrations;
4. Transformer and its accessories must be resistant to corrosion (ISO 12944 C4/high);
5. Over voltage of the system;
6. DC current of the system

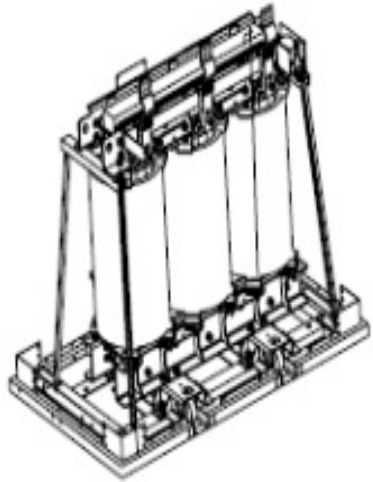
12 pulse rectifier  
transformer  
Dyn5Dd0



With on load  
tap changer



# Trihal transformer special Application



Nuclear transformer



Three-winding transformer



LV/LV transformer



Dual HV transformer

# Customers Benefits / Applications



## Benefits

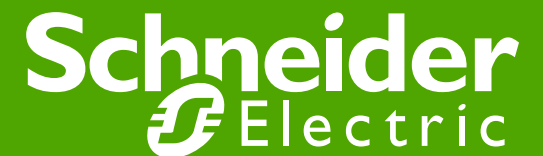
- Safety for People and Property
- No Fire Hazard
- Environmental Friendly
- No Pollution - Product fully recyclable
- Almost Zero Maintenance
- Reduced Civil Works



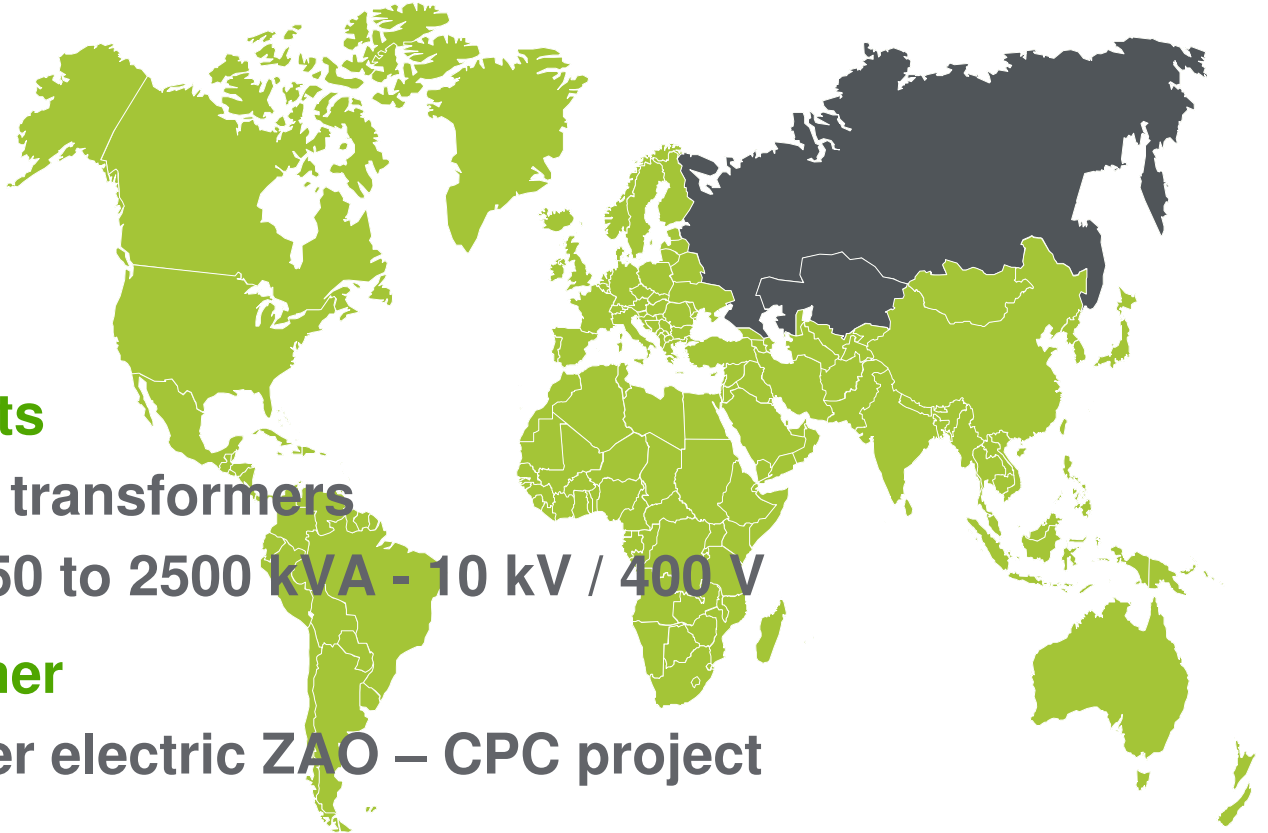
## Applications

- Fits for most demanding applications
- Infrastructure
  - Public and commercial Buildings
  - Airports, Hospitals, etc...
  - Pharmaceuticals, Food, etc...
- Energy / Infrastructures
- Small Industries
  - Textile, Automotive,

# Trihal – References list



# Focus on...



- **Products**

32 Trihal transformers

From 1250 to 2500 kVA - 10 kV / 400 V

- **Customer**

Schneider electric ZAO – CPC project

- **Country**

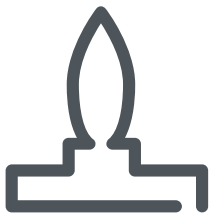
Russia and Kazakhstan

- **Date**

2010 / 2011

- **Market segment**

Oil & Gas



# Focus on...



- **Products**

13 Trihal transformers  
1600 kVA - 11 kV / 433 V



- **Customer**

Ministry of Interior

- **Country**

Qatar



- **Date**

2011

- **Market segment**

Building



# Focus on...



- **Products**

13 Trihal transformers  
1600 kVA - 11 kV / 433 V

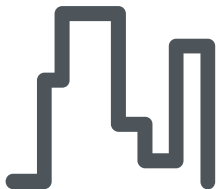


- **Customer**

Ministry of Interior

- **Country**

Qatar



- **Date**

2011

- **Market segment**

Building



# Focus on...



- **Products**

23 Trihal transformers

1600 kVA – 20 kV / 620 V

- **Customer**

Schneider Electric GMBH

- **Country**

Germany

- **Date**

2011

- **Market segment**

Wind farmer



# Focus on...



- **Products**

21 Trihal transformers

2500 kVA – 20 kV / 410 V

- **Customer**

Equirix

- **Country**

France

- **Date**

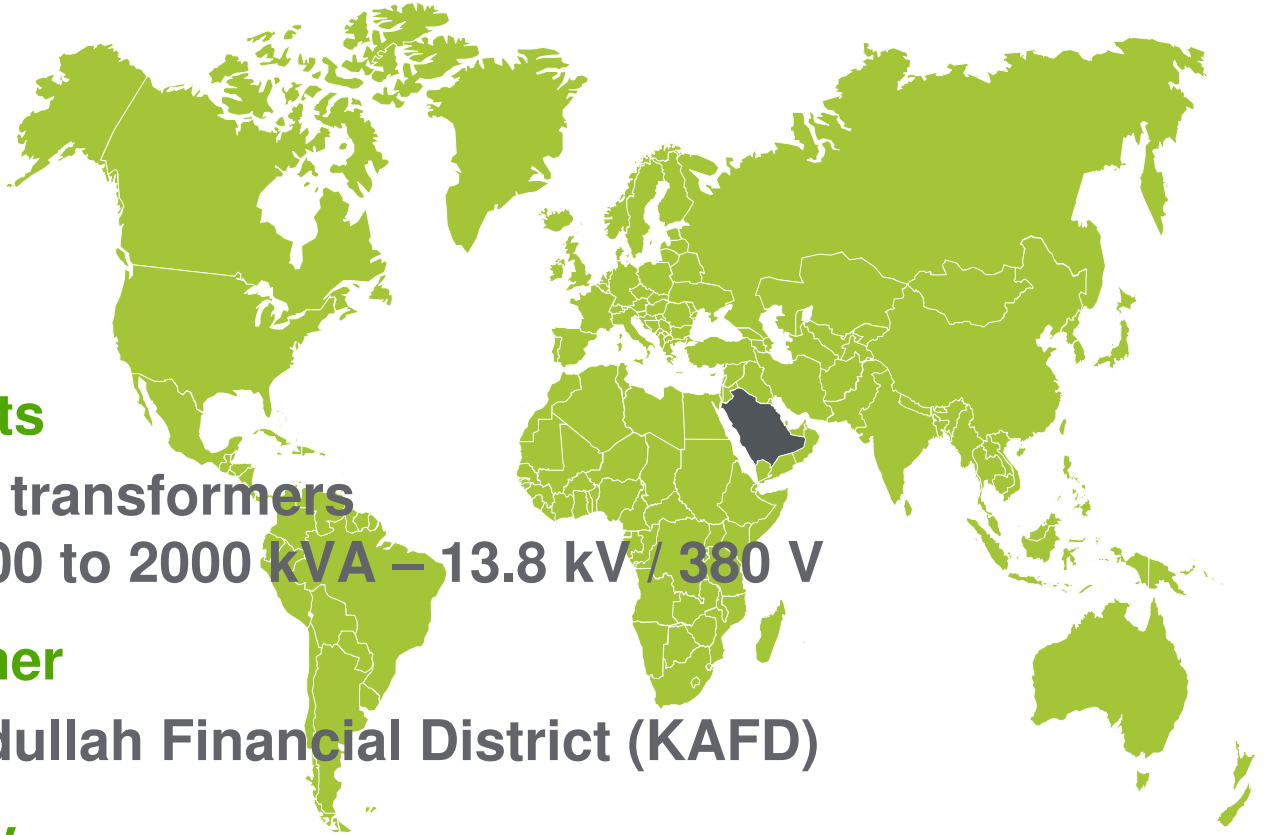
2011

- **Market segment**

Data Center



# Focus on...



- **Products**

68 Trihal transformers  
From 1000 to 2000 kVA – 13.8 kV / 380 V



- **Customer**

Kind Abdullah Financial District (KAFD)

- **Country**

Saudi Arabia



- **Date**

2011

- **Market segment**

Infrastructure

Make the most of your energy™

