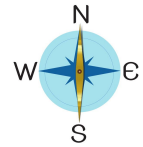


แผนที่บริษัท ไดเฮ็น อิเล็กทริก จำกัด

NEW MAP OF DAIHEN ELECTRIC CO.,LTD



DAIHEN ELECTRIC CO.,LTD
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Chachoengsao 24130



Reliability and Creativity

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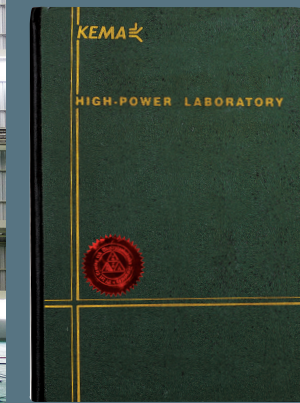


DAIHEN

DAIHEN ELECTRIC CO., LTD.

is the first power transformer manufacturer in Thailand and has supplied more than 1180 units (end of 2016) to domestic power authorities, industries and overseas countries including JAPAN.

DAIHEN ELECTRIC transformers are manufactured under technical collaboration with **DAIHEN CORPORATION**, which is one of the leading transformer manufacturers in JAPAN and has experience of more than 90 years (established in 1919) in this field. Employing the most up-to-date technical know-how transferred from **DAIHEN CORPORATION** and latest manufacturing facilities, **DAIHEN ELECTRIC** can offer highly reliable products to the customers not only domestic but also international market in compliance with their requirements.



KEMA TEST REPORT

Superior Quality

A reputation for quality has been built by supplying products of high reliability. DAIHEN ELECTRIC CO., LTD. intends to provide reliable products and services with high quality in a cost-competitive manner to achieve customer satisfaction. Resulting from our severe quality control of products, we passed short-circuit test for 50 MVA transformer at KEMA high-power laboratory in Netherlands.



History

- 1989

August
The company was established.
- 1991

Delivered first 2 units of 115 kV, 40 MVA to Provincial Electricity Authority (PEA), Thailand
- 1997

Passed short circuit test of 115 kV, 50 MVA at KEMA high-power laboratory, Netherlands
Transformer was delivered to Electricity Generating Authority of Thailand (EGAT)
- 2003

Delivered 2 units of 50/80 MVA 132/33 kV to Sarawak Electricity Supply Corporation, Malaysia
- 2004

Delivered 5 units of 100 MVA 15.75/11.5-11.5 kV to Umm At Nar IWPP, Arabian Power Company, U.A.E
- 2006

Delivered 3 units of 120 MVA 26/11.5-11.5 kV to Tanjung Bin Power Sdn. Bhd., Malaysia
- 2007

Delivered 2 units of 100 MVA 115/33 kV to Thai Oil Public Company Limited, Thailand
Type test of 90 MVA 132 kV transformer for Tenaga Nasional Berhad (TNB), Malaysia was performed under witness of independent laboralory, CESI, Italy.
- 2008

Delivered 1 unit of 50 MVA 230 kV transformer to Pedaeng Industry Public Company Limited, Thailand
Delivered 2 units of 75/100 MVA 69 kV transformer to Sadui Aramco, Saudi Arabia
- 2009

Delivered 3 units of 100 MVA 150 kV generating transformer to Indonesia
- 2012

Completed new factory for manufacturing large power transformer (up to 550 kV 500 MVA)
- 2013

Delivered 1 unit of 50/75/100 MVA 107.5/66 kV to JFE Kurashiki, Japan
- 2014

Delivered 1 unit of 155 MVA 66/230 kV to Myanmar
Delivered 1 unit of 120/160/200 MVA 230/121/22 kV to EGAT, Thailand
- 2015

Delivered 1 unit of 48/62.5 MVA 230/115/13.8 kV to CBK Power Company, Philippines
Delivered 1 unit of 180/240/300 MVA 230/121/22kV to EGAT, Thailand
- 2017

Delivered 6 units of 28/35 MVA 11/230 kV and 2 units of 42/52 MVA 11/230 kV to Tanzania
Delivered 2 units of 162 MVA 16.5/230 kV to Laos Nam Ngiep



3 Phase 50 Hz 230 kV 35/50 MVA ONAN/ONAF Transformer



3 Phase 50 Hz 230 kV 180/240/300 MVA ONAN/ONAF/ONAF Transformer



3 Phase 50 Hz 150 kV 60/80/100 MVA ONAN/ONAF/ODAF Transformer



3 Phase 50 Hz 230 kV 155 MVA ONAN Transformer



GIS direct connection type

Outline of Company

Capital.....	600 million Baht
Founded.....	August, 1989
Technology.....	Licensed by DAIHEN Corporation
Products	Medium and Large Power Transformer (Capacity 3-500 MVA, Voltage 36-550 kV)
Scale of Factory.....	Size : Land 78,300 m ² , Building 16,850 m ² Annual Production Capacity : 10,000 MVA Number of Employees : 350



Fig. 1 Core Cutting Machine



Fig. 2 Core Stacking



Fig. 3 Core Raising Table



Fig. 4 Coil Winding Room

Manufacturing facilities

1. Core production (Fig. 1, 2, 3)

- Automatic silicon steel sheet cutting machine
- Core stacking and core raising table

2. Winding and its insulation production (Fig. 4)

- Winding machine in air-conditioned, humidity control and dust-proof room
- Insulation paper processing machine
- Kraft paper wrapping machine

3. Assembling, drying and oil treatment (Fig. 5, 6)

- Coil stabilizing treatment
- Drying oven
- Vacuum oil purifying equipment
- Vapour phase drying equipment

4. Tank-fabrication and painting (Fig. 7, 8, 9)

- Plate cutting and bending machine
- Automatic and semi-automatic arc cutting machine
- CNC plasma/gas cutting machine
- Shot blasting equipment
- Painting booths

5. Lifting facilities

- Overhead travelling crane 200/20 Tons, 70/20 Tons, 16/5 Tons etc.

6. Radiator production (Fig. 11,12,13)

- Panel press machine
- Automatic panel welder
- Automatic panel processing line



Fig. 5 Coil Stabilizing Treatment

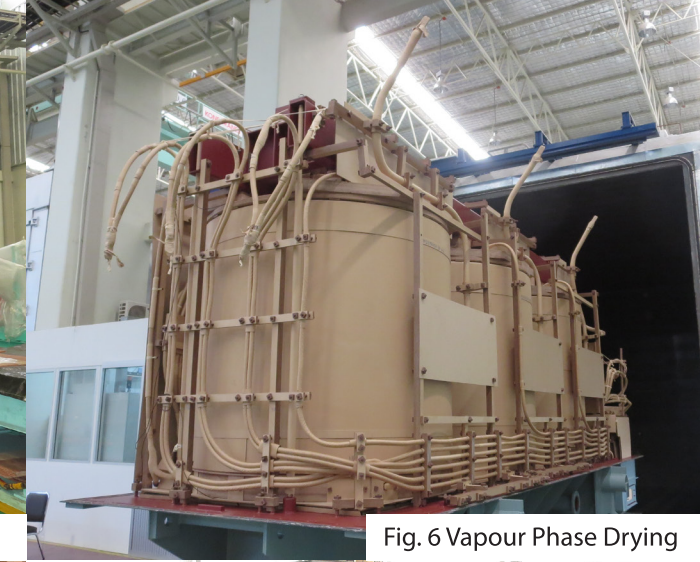


Fig. 6 Vapour Phase Drying



Fig. 7 Tank Fabrication



Fig. 8 CNC plasma/gas cutting machine

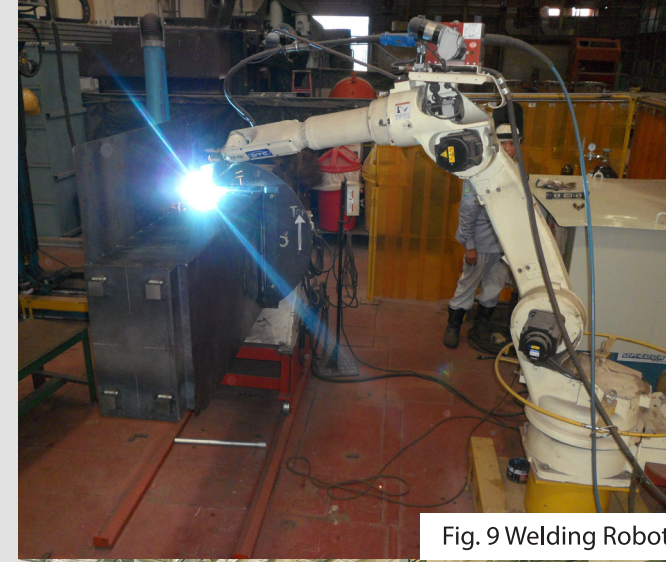


Fig. 9 Welding Robot



Fig. 10 Internal Wiring



Fig. 11 Panel Press Machine



Fig. 12 Automatic Panel Welder

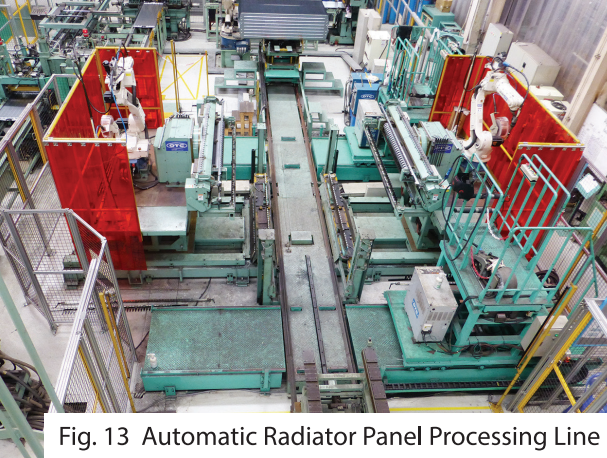


Fig. 13 Automatic Radiator Panel Processing Line



Fig. 14 Shipment

Process flow

1. Coil winding

Coil winding is performed in the dust-proof air-conditioned and humidity-controlled room in order to raise the quality of product. The transformer coils are made of electrolytic copper strip conductors with rectangular cross-section and rounded corners which are wrapped with several layers of kraft paper. Several winding methods are employed to meet the requirement of the customers.

2. Insulation production

Insulations for the transformer are produced and stocked in the air-conditioned room in order to prevent insulation material from absorbing moisture.

3. Coil stabilizing treatment

The coil is pressurized while being heated at the proper temperature for 36-48 hours in the coil stabilizing treatment chamber to acquire enough strength to withstand the electromagnetic force under severe short circuit condition. (Fig. 5)

4. Core assembly

The high quality silicon steel strips are cut by modern automatic cutting machine into sheets. These sheets are stacked horizontally on the core raising table, each corner being carefully miter-jointed to make the best use of properties of the core material. The stacked core is clamped to the table and is gradually raised to the upright position together with the table to avoid undue mechanical stress in the core, so that high quality of the core can be assured. (Fig. 2, 3)

5. Wiring connection

The connection between the coil ends and the bushings as well as between the coil and the tap changer are made of copper cables insulated by wrapping kraft paper. All joints between conductors are tightly well-connected with smooth surface to reduce the electric stress. (Fig. 10)

6. Tank-fabrication

Tank parts are carefully welded for both inside and outside and are thoroughly checked for oil leakage when the tank is completed. These tanks can withstand a full vacuum and also the proper internal pressure test. Both inside and outside surfaces of tank are shot blasted thoroughly before being coated with the rust proof primer and final painting.

7. Radiator Production

High quality panel type radiators are produced by automatic process line consisting of press machine and panel welding machines, then assembling and painting. (fig.11,12,13)

8. Shipment

During transportation, bushings and other accessories are disassembled from the main tank, and the transformer oil is replaced by dry nitrogen gas to reduce weight. (Fig. 14)

Transformer test

DAIHEN ELECTRIC has all facilities to perform all tests normally required by the customers in compliance with existing transformer standards such as IEEE, IEC, BS, JEC and others. Those facilities have capabilities sufficient to test transformers of rated capacity up to 500 MVA and rated voltage up to 550 kV.

Temperature-rise test and impedance test can be carried out under full load conditions, three phase motor-generator 1,000 kVA, capacitor banks 130 MVAR and matching transformers are available for that purpose.

Dielectric tests are carried out with a high frequency generator 1 phase 200 Hz 300 kVA or 3 phase 200 Hz 800 kVA, a high-voltage testing transformer 1 phase 50/60 Hz 460 kV 690 kVA and an impulse voltage generator 2,400 kV 240 kJ in

addition, partial discharge can be observed during the dielectric test or prolonged over voltage test.

Analysis of the various gases dissolved in the transformer oil, performed before and after temperature-rise and dielectric test, is the most reliable means for the diagnosis of the transformer under operation. By this means even a small discharge or locally heated hot spot can be detected before they may develop to a serious failure.

The testing shop is also provided with a wide range of measuring apparatus to facilitate such tests as noise and characteristics of transformer.

Testing equipments

- Motor-generator sets
 - 3 phase 50/60 Hz 6.9 kV 1000 kVA
 - 3 phase 180/200 Hz 6.2/6.9 kV 650/800 kVA
 - 1 phase 200 Hz 6.6 kV 300 kVA
- Impulse voltage test facilities and testing transformers for power frequency test
 - Lightning/switching impulse voltage generation : 2400 kV 240 kJ
 - Testing transformer 50/60/200 Hz 460 kV 690 kVA
 - Potential divider : 2400 kV for lightning impulse test : 2000 kV for switching impulse test : 680 kV for power frequency
- Auxiliary testing transformers
 - 3 phase 50/60 Hz 130 kV 113 MVA
 - 3 phase 50/60 Hz 34.5 kV 20 MVA
 - IVR 3 phase 6.6 kV 3000 kVA
 - IVR 1 phase 6.6 kV 3000 kVA
- Phase modifiers
 - Compensation capacitors : 3 phase 50/60 Hz 38.1kV 108/130 MVAR
 - Reactor : 1 phase 180 Hz 6.6 kV 4000x3 kVAR
- Measuring and investigating equipments
 - Partial discharge measuring equipments : Electrical PD fully digital system
 - Gas chromatograph (gas dissolved in oil analyzer)
 - Moisture meter
 - Oil tester
 - FRA
 - Particle in oil counter

Fig. 15
Testing Control Room



Fig. 16
Gas-Chromatograph Analyzer



Fig. 17
Moisture Meter



Fig. 18
Generator For Characteristic Tests



Fig. 19
Partial Discharge Detector (Fully digital system)





Customer name (Overseas)	Capacity (MVA)	Voltage	Quantity	Customer name (Thailand)	Capacity (MVA)	Voltage	Quantity
Arabian Power Company, Umm Al Nar IWPP U.A.E	100	15.75	5	Amata Power	26 - 58.8	115, 120	48
Batangas Cogeneration Corporation, Philippines	19, 32	115	2	Bayer Polymers Co.,Ltd. & Bayer Thai Co., Ltd.	63	115	2
Chubu Electric Power Co.,Inc., Japan	9, 10	33, 75.25	5	Central Plaza Rama II	25	112(64.7)	2
Compahia Siderurgica Paulista (COSIPA), Brazil	72	88	3	Chow Steel Industries Co., Ltd.	40, 100	115	2
Electricite Du Cambodge, Cambodia	25,50, 75	115	12	Electricity Generating Authority of Thailand	50, 120, 160, 200, 300	115, 230	26
Electricite Du Laos, Laos	16, 20, 30, 50	115	20	Ford Motor Company (Thailand) Limited	18, 24	115	2
Electricity of Vietnam, Vietnam	25, 40, 63	110, 115	4	Glow Energy Public Co., Ltd.	50, 51.5, 63.5	112.5, 118, 123	5
Gadong Power Station 1 / Brunei DES, Brunei	46	66	4	Gulf JP Co., Ltd.	20, 25, 40	115	8
Hokkaido Electric Power Co.,Inc. Japan	10	64.5	2	Honda Automobile (Thailand) Co., Ltd.	25, 50	115	5
Hydrochem(s) Pte. Ltd., Singapore	36	66	2	IRPC Public Co., Ltd.	50	115	1
Jimah Energy Ventures Sdn Bhd, Malaysia	120	26	2	Isuzu Motors Co, (Thailand) Ltd.	15, 20, 30	67, 112, 115	3
Kenya Electricity Generating Company Ltd. , Kenya	23	132	2	Metropolitan Electricity Authority	40, 60	67, 69, 112	72
Kinyerezi Combined Cycle Power Plant, Tanzania	28, 35, 52	230	8	Metropolitan Rapid Transit Authority	75, 80	67, 112	4
Laos Nam Ngiep1 Hydroelectric, Laos	162	230	2	Metropolitan Waterworks Authority	7.5, 15	67, 69, 115	7
Mitsui Elastomer Singapore Pte, Ltd, Singapore	19	22	1	Mitsubishi Motors (Thailand) Co., Ltd.	20, 25	115	2
Myanmar Electric Power Enterprise, Myanmar	20, 44, 60, 100	230, 66, 132/√3	8	Nawanakorn Electric Co., Ltd.	30, 32, 56	115, 120	4
National Power Corporation , Philippines	19	22	2	NMB-Minebea Thai Ltd.	25	115	6
Niger Delta Power Holding Company of Nigeria Plc., Nigeria	60	132	1	Padaeng Industry Public Company Limited	50	230	1
Philippines National Oil Company, Philippines	7.5, 67, 88	13.8, 138	2	Praxair (thailand) Co., Ltd.	30	115	2
PT Asahimas Chemical, Indonesia	80, 120	150	2	Port Authority of Thailand	12.5, 25	67	4
PT Central Java Power , Indonesia	54	22.8	4	Provincial Electricity Authority	25, 40, 50	115	205
Rabigh Refinery & Petrochemical Company, Saudi Arabia	25	34.5	3	PTT Group	35, 40, 45, 55, 80, 85	22, 115	17
Sabah Electricity Sdn. Bhd., Malaysia	20, 30, 45, 60, 90	33, 66, 132	42	Rojana Power Co., Ltd.	40, 50, 60, 94	115	21
Saudi Arabian Oil Company, Saudi Arabia	25, 100	34.5, 69	4	Royal Irrigation Department	16, 20	115	4
Syarikat SESCO Berhad, Malaysia	15, 20, 25, 80	33, 132	62	Sahacogen (Chonburi) Public Co., Ltd.	30, 50	22, 115	4
Tanjung Bin Power Sdn. Bhd., Malaysia	120	26	3	Thai National Power Co.,Ltd.	25, 40, 50, 55, 90	115	8
Tenaga Nasional Berhad, Malaysia	30, 45, 90, 130	132, 289.5	50	Thai Oil Public Co., Ltd.	100	115	2
The Kansai Electricity Power Co.,Inc. , Japan	10, 20, 30	75, 25, 77	62	Thai Yamaha Motor Co., Ltd.	30	112	1
TNB Repair and Maintenance Sdn. Bhd., Kenyir Power Station, Malaysia	130	289.5	1	The Aromatics (Thailand) Public Co., Ltd.	80	115	2
Toyo Thai Power Myanmar Co., Ltd.	155, 57, 34	230, 66	4	Toyota Motor Thailand Co.,Ltd.	12.5, 15, 25, 30	22, 67, 115	6
Western Australia Biomass Pty Ltd., Australia	56.25	132	1	Wind Energy Holding Co., Ltd.	40, 60, 70	115	7

Servicing

The transformer is one of the most important equipments in electrical system that affects the reliability of the power system. When there is outage of electricity, it causes loss of chance, property, and even life. As we realize such importance, so we are committed to be a part of the security system of customers by providing service teams who are qualified to ensure customers for our following servicing.

- Transformer installation, and relocation
- Transformer commissioning and testing
 - * Measurement of insulation resistance (IR)
 - * Measurement of tan delta and capacitance of transformer
 - * Measurement of magnetizing current
 - * Measurement of short circuit impedance
 - * Measurement of voltage ratio
 - * Check of vector group
 - * Measurement of winding resistance
 - * BCT test
- Transformer repairing
- Transformer preventive maintenance
- OLTC Maintenance
- Oil treatment (dehumidifying & degassing)
- Oil test (DGA, breakdown voltage, water content, particle in oil, etc.)
- Training

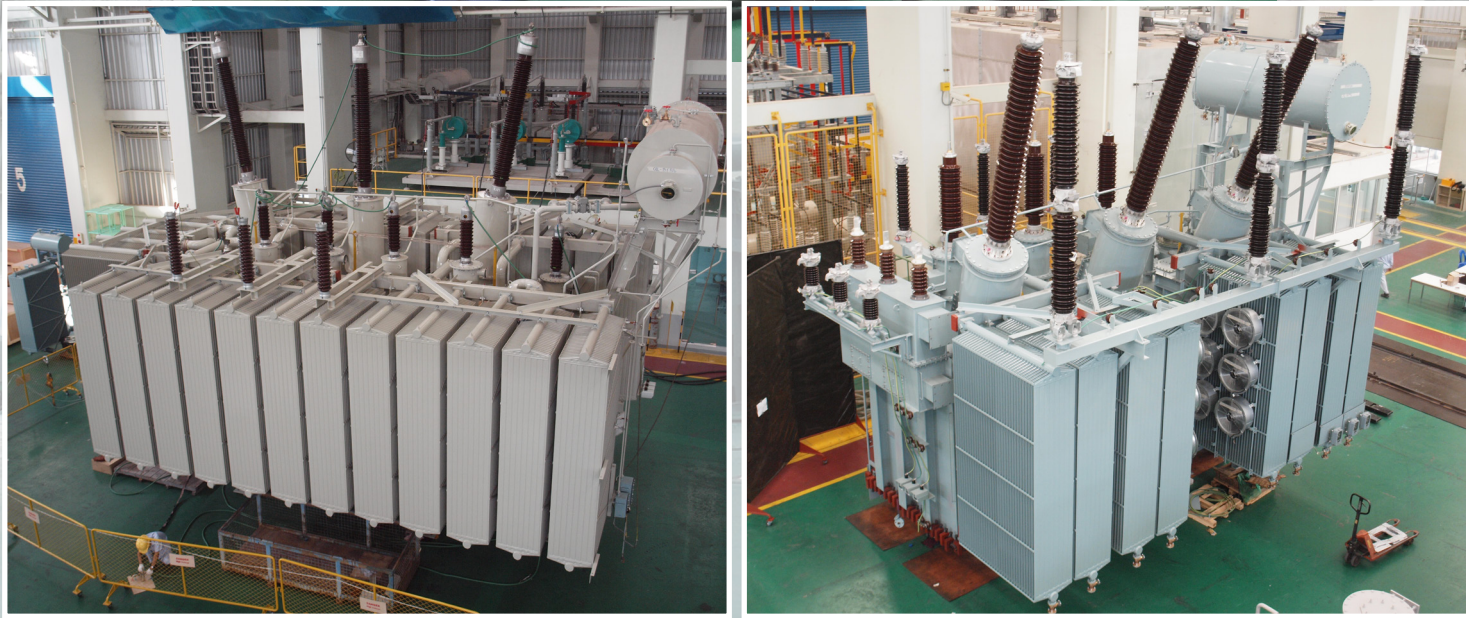


Fig. 20 Transformer testing hall