

Cast resin transformers

**Fuji Electric for reliability and performance.
Contributing to stable power supply by pursuing high functionality.**



Fuji Electric's Energy and Environment Businesses

Clean energy

Stable supply

Power Ele

Power Generation



Geothermal power generation



Solar power generation

Energy



Energy management



Transmission and distribution systems



Power supply and facility systems

System

Engineering



Power conditioning systems



Transformers



Switchgears and controlgears



Power distribution and control

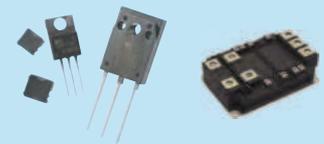


Uninterruptible power system

Semico



Industrial field



Priority SDGs to be Addressed through Our Businesses



Spread of renewable energy use
Improvement of energy efficiency



Reduction of CO₂ emissions from industrial processes
Reinforcement of social and industrial infrastructure

History

Fuji Electric

- 1923 Established Fuji Electric Manufacturing Co.,Ltd.
- 1962 Started operation of Chiba factory (transformer)
- 1968 Started operation of Kobe factory (switchboard)
- 1971 Started manufacturing rectifier transformer units
- 1974 Started manufacturing cast resin transformers
- 1984 Changed company name and logo to Fuji Electric Co.,Ltd.

- 1985 Delivered the first 800kV transformers
- 1990 Delivered the first 1,100MVA transformer
- 1996 Delivered the first 8,300kV Gas Insulated Switchgear
- 2002 Introduced new company symbol mark
- 2009 Delivered the first 1,750V DC, 87.5kA power supply equipment

Fuji Electric is diligently pursuing synergy between its core power semiconductor and power electronics technologies, and is contributing to the realization of a responsible and sustainable society in the fields of industrial and social infrastructure through its four businesses in Power Electronics, Semiconductors, Power Generation, and Food and Beverage Distribution.

ly of energy

Energy saving Automation

ctronics

Industry



Factory automation



Process automation



Social solutions

Food and Beverage Distribution



Vending machines



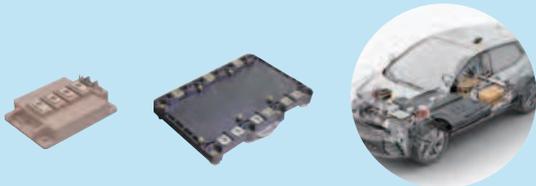
Store equipment

Solutions

Services



nductors



Automotive field



Building safe and secure urban infrastructure services
Development of sustainable transport systems



Efficient use of natural resources
Rigorous management and reduction of emissions of chemical substances and waste



Reducing society's CO₂ emissions through products
Reducing GHG emissions during production

FMT

- 1988 Established as the Overseas Manufacturing Company of NihonDenki-Seiki Cop. [@ Nava NakornIndustrial Estate] (Sep)
- 1989 Started **Mini-UPS** production
- 2007 Started **Medium-capacity UPS** production
- 2010 **Joined Fuji Electric Group** (Company Name : Fuji Electric Power Supply(Thailand)Co., Ltd.) (Jan)
- 2012 Started **Switching power supply, PCS and Low-voltage Inverter** production
- 2013 Started **Large-Voltage UPS** production
- 2013 Started operation at **the New Factory**[@ChumnumsapIndustrial Estate] (Dec)
- 2014 Changed Company name: **Fuji Electric Manufacturing (Thailand) Co., Ltd.** (Jan)
- 2014 Started **Vending Machine** and **GIS** production
- 2016 Started **SWGR** production and **Service** business
- 2019 Started **Engineering business**
- 2020 Started operation at **System production & Engineering Factory(3rdFactory)** (Apr)
- 2022 **LV SWGR(FSMBE)** and **CRT** production

From everyday buildings and factories to social and transportation.

Active wherever electricity is used.

Fuji Electric became Japan's first manufacturer of cast resin transformers in 1974.

Since then, we have sold over 100,000 units in 55 countries.

We offer reliable and industry-proven transformers to meet the needs of our customers.



infrastructures for energy

Applications

Cast resin transformers are suitable for the following places.

- Sites where compact size and light weight are required.
- Sites where easy maintenance is required.
- Sites where there are airborne contaminants and extremely severe environments.
- Sites where fire prevention is the highest priority.

Applicable locations

Buildings

Hotels

Shopping centers

Art galleries

Stadiums

Industrial complexes

Railway substations

Tunnels

Water and sewerage plants

Refuse disposal plants

Hospitals

Laboratories

Schools

Theaters

Petrochemical plants

Underground railways

Cranes

Power supplies for construction sites

Wind power sites



Fuji Electric's Cast resin transformers offer high and compactness, made possible by our unique

Vacuum-Casting

Cast resin transformer is manufactured with vacuum casting method using metal pattern. Therefore, they have the following features.

Void-less

Vacuum-casting method realizes highly reliable, void-less molded winding with excellent partial discharge characteristics.

Fire prevention

Molded insulated parts are fire resistant with self-extinguishing properties.

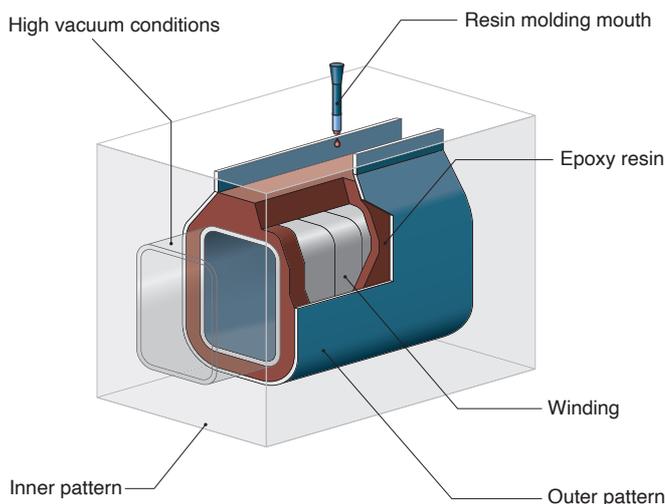
Resistance to humidity and dust

All winding conductors are molded. They have remarkable humidity resistance which prevents insulation materials from deteriorating due to dust and dirt during operation.

Robust construction

Molded winding is highly resistant to secondary short-circuit fault and surface cracking.

Vacuum-casting method using metal pattern

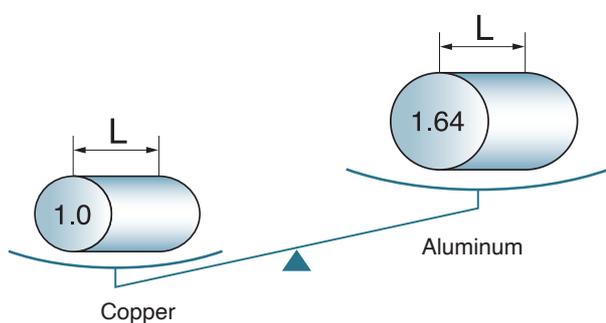


Aluminum winding

(1) Weight reduction

The aluminum winding weights are approximately half of the copper winding, thus realizing weight reduction.

| | Copper: Aluminum |
|------------------------------|------------------|
| Conductivity [%] | 100 : 61 |
| Cross sectional area ratio | 001 : 1.64 |
| Gravity [g/cm ³] | 8.9 : 2.7 |
| Gravity ratio | 3.3 : 1 |
| Mass ratio | 100 : 50 |

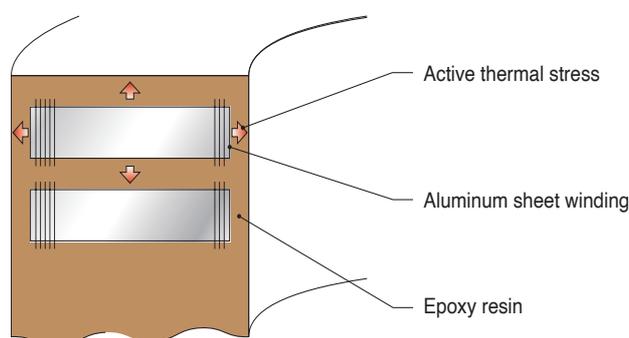


(2) Low thermal stress and excellent crack resistance

Aluminum's thermal expansion coefficient is close to resin, thus reducing thermal stress and improving crack resistance effectively.

| Material | Thermal expansion coefficient [mm/mm.h.°C] |
|-------------|--|
| Aluminum | 2.3×10^{-5} |
| Copper | 1.6×10^{-5} |
| Epoxy resin | 3.3×10^{-5} |

Thermal stress acting on winding

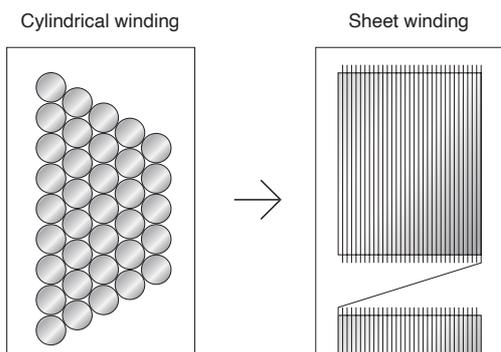


functionality, high reliability, technologies and expertise.

Sheet winding

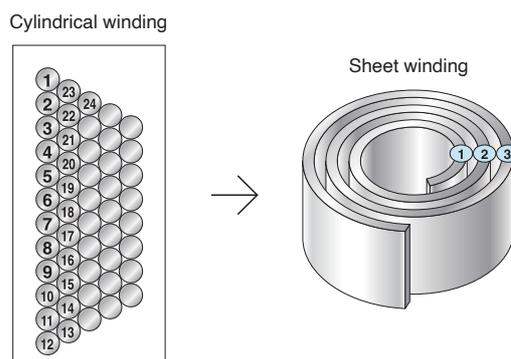
(1) Downsizing

Sheet winding has high lamination factor, thus realizing downsizing of transformers.



(2) High insulation reliability

In sheet winding, the voltage between turns is only for one turn, thus having high insulation reliability.



IEC Certification

Fuji Electric's cast resin transformer have passed all tests of IEC60076-11 including special test and type test in 2006.

- Climatic class: C2 (crack resistance) • Fire behavior class: F1 (fire resistance)
- Environment class: E2 (moisture resistance) • Short-circuit test



Start of fire-test



After test (completely extinguishing)



Design Techniques / Test and Inspections

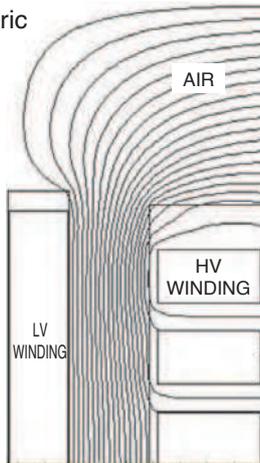
Vacuum-Casting

The insulation of a cast resin transformer is composed of resin-air composite insulation.

The distributed voltages of individual transformer parts depend on their respective dimensions.

Thus, appropriate dimensions for insulation are designed with electric field analysis of the individual parts of the winding including air space.

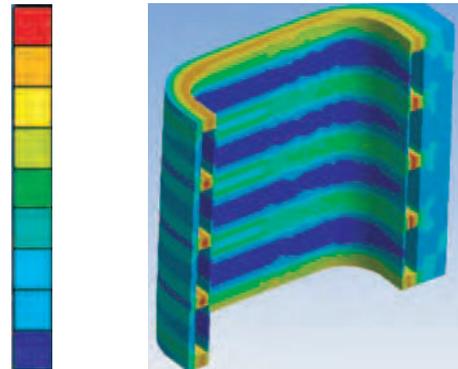
■ Example of electric field analysis



Thermal stress analysis

Molded winding composed of conductor and insulating material is subjected to thermal stress due to the difference in thermal expansion coefficient between conductor and resin, and thermal distribution in the winding block, where winding temperature varies with the load fluctuation of the transformer. The stress value obtained in thermal stress analysis is used to design optimum winding structure for high crack-resistance of winding.

■ Example of thermal stress analysis



Electric field analysis

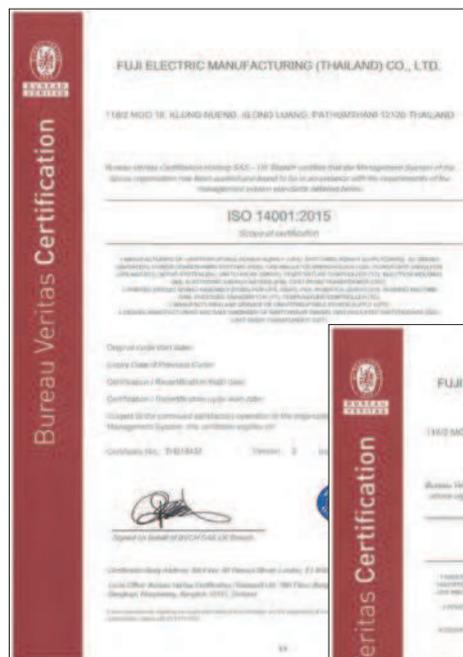
Routine test control

- Measurement of insulation resistance
- Measurement of voltage ratio and check of phase displacement
- Measurement of no-load loss and exciting current
- Measurement of short circuit impedance and load loss
- Separated-source voltage withstand test
- Induced overvoltage withstand test
- Measurement of insulation resistance
- Measurement of partial discharge

Type test

- Lightning impulse voltage withstand test
- Temperature-rise test
- Measurement of sound level

■ ISO 9001-2015



■ ISO 14001-2015



Accessories



Off-circuit tap changer terminals

The tap voltage can be changed by switching the shorting bar connector.



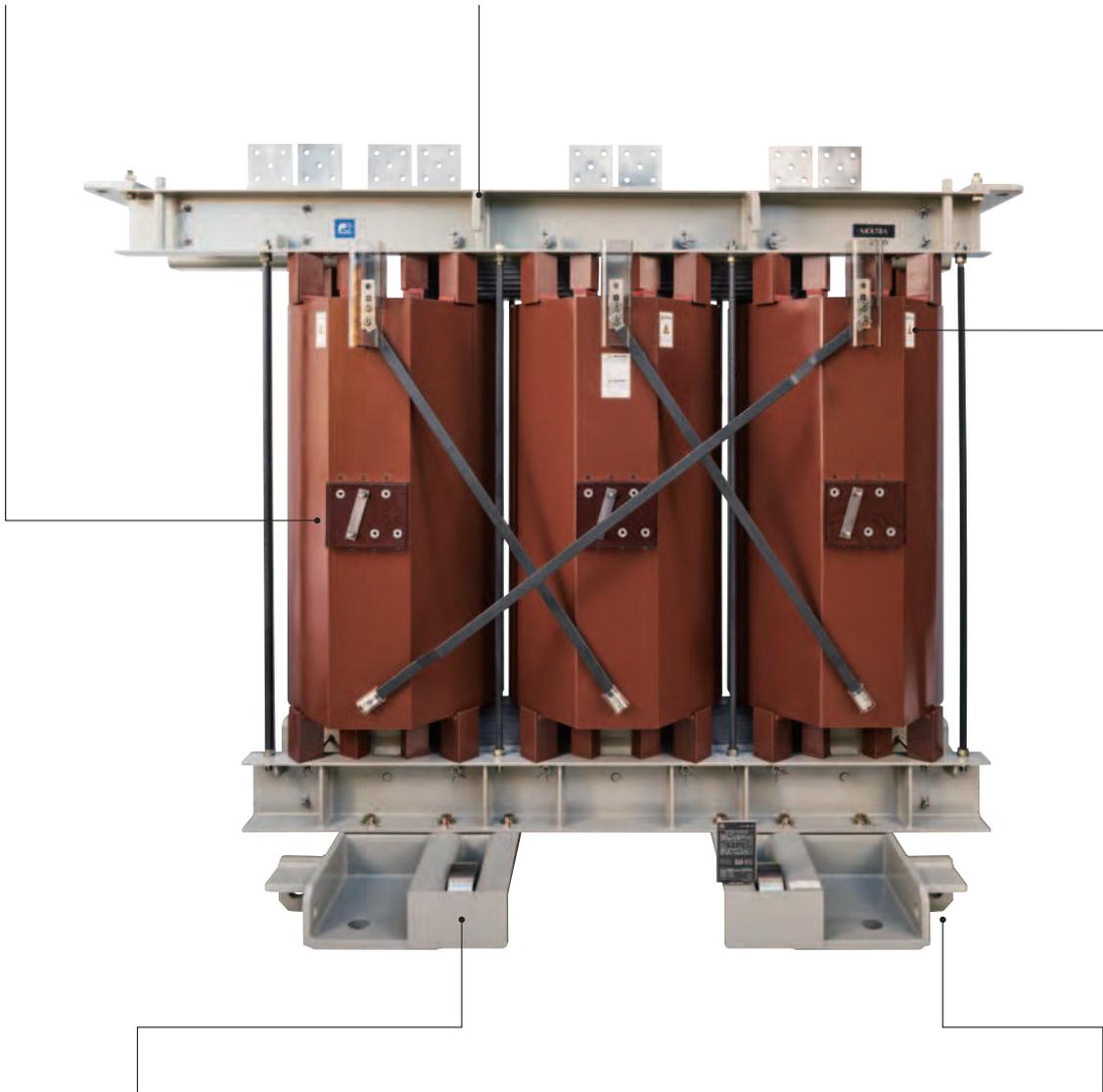
Lifting lugs

Four lifting lugs are provided as standard fixtures on the transformer body.

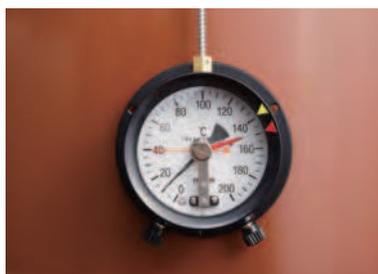


Warning label

A danger label is attached to warn against contacting the surface of the HV windings.



Rubber vibration isolator (Option) Bi-directional wheels (Option)



Dial thermometer (Option)



Earthing terminals with clamping bolts

Two earthing terminals are provided at the lower frame ends : one on the primary side and one on the secondary side.(One of these earthing terminals is in use.)

Technical Inquiry Specification Sheet for Cast Resin Transformer

Your Ref.no :

Date:

| | |
|--|--|
| To: FMT Attn.: _____ Email: _____ Tel.: _____ | Client requesting a route Company name: _____ Person in charge: _____ Email: _____ Tel.: _____ |
|--|--|

Technical specifications

| Item | Item | Item |
|-------------------------------|--|--|
| Number of Units | | |
| Rated capacity (kVA) | | |
| Primary voltage (kV) | <input type="checkbox"/> 11kV <input type="checkbox"/> 22kV <input type="checkbox"/> 24kV | <input type="checkbox"/> Others: |
| Secondary voltage (kV) | <input type="checkbox"/> 400V | <input type="checkbox"/> Others: |
| Tapping range | <input type="checkbox"/> ±2×2.5% | <input type="checkbox"/> Others: |
| Number of phases | <input type="checkbox"/> 3φ | <input type="checkbox"/> Others: |
| Vector group q Dyn11 q Other: | <input type="checkbox"/> Dyn11 | <input type="checkbox"/> Others: |
| Impedance voltage (%) | <input type="checkbox"/> Manufacturer Standard | <input type="checkbox"/> Others: |
| Cooling Method (*) | <input type="checkbox"/> AN | <input type="checkbox"/> AF <input type="checkbox"/> AN/AF |
| Insulation class (thermal) | <input type="checkbox"/> F | <input type="checkbox"/> Others: |
| Frequency (Hz) | <input type="checkbox"/> 50 <input type="checkbox"/> 60 | |
| Standard | <input type="checkbox"/> IEC60076-11 | <input type="checkbox"/> Others: |
| Ambient temperature | <input type="checkbox"/> Standard -5 to 40°C | <input type="checkbox"/> Others: |
| Altitude | <input type="checkbox"/> Standard 0 to 1,000 m | <input type="checkbox"/> Others: |
| Overload | <input type="checkbox"/> Continuous at 100% | <input type="checkbox"/> Others: |
| K-rating (if any) | — | |

<Insulation levels>

| | | | |
|--------------------------------------|---------------|---|---|
| Separate-source AC withstand voltage | Primary(kV) | <input type="checkbox"/> 28kV <input type="checkbox"/> 50kV | <input type="checkbox"/> Others: |
| | Secondary(kV) | <input type="checkbox"/> 3kV | <input type="checkbox"/> Others: |
| Lighting impulse test | Primary(kV) | <input type="checkbox"/> 75kV <input type="checkbox"/> 95kV | <input type="checkbox"/> 125kV <input type="checkbox"/> Others: |
| | Secondary(kV) | — | <input type="checkbox"/> Others: |

<Options: Optional accessories>

| | | |
|---|--------------------------------------|--|
| Dial thermometer | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Wheels | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Resistance thermometer valve (Pt 100Ω) | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Rubber vibration isolator | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Protective enclosure | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| If Yes, Degree of Protection will be selected | — | |
| If Yes, cable entry will be selected | — | <input type="checkbox"/> Bottom <input type="checkbox"/> Top <input type="checkbox"/> Others: |

<Options: Special test and witness test>

| | | |
|----------------------------|--------------------------------------|------------------------------------|
| Temperature rise test | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Lighting impulse test | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Measurement of sound level | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |
| Witness Routine test | <input type="checkbox"/> Unnecessary | <input type="checkbox"/> Necessary |

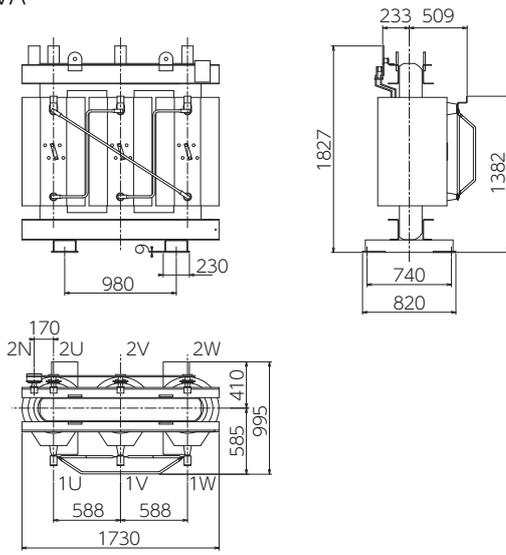
<Options: Other request item>

| | | |
|--------------------|---|--|
| Other request item | — | |
|--------------------|---|--|

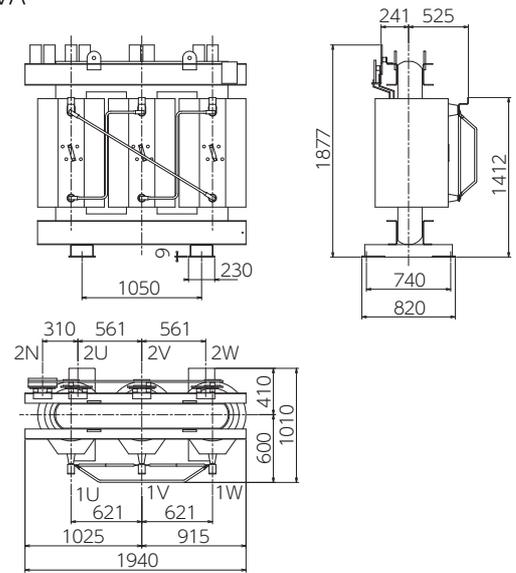
(*) Remarks AN: Naturally-air-cooled type
 AF: Forced-air-cooled type with cooling fan
 AN/AF: Naturally-air-cooled/Forced-air-cooled type with cooling fan

Outline drawing

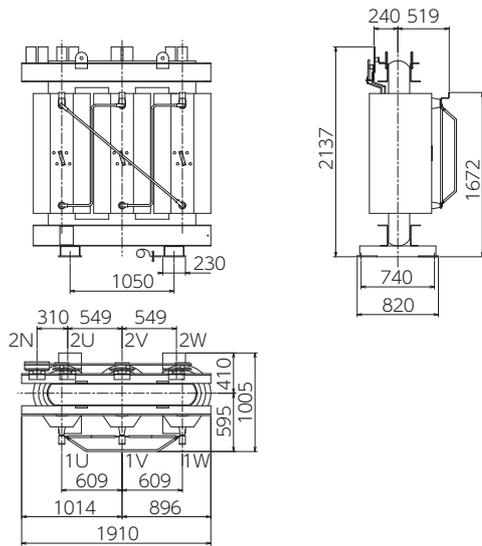
●1,000kVA



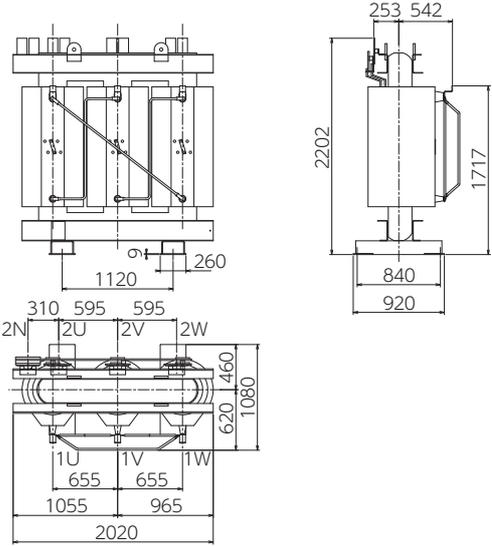
●1,250kVA



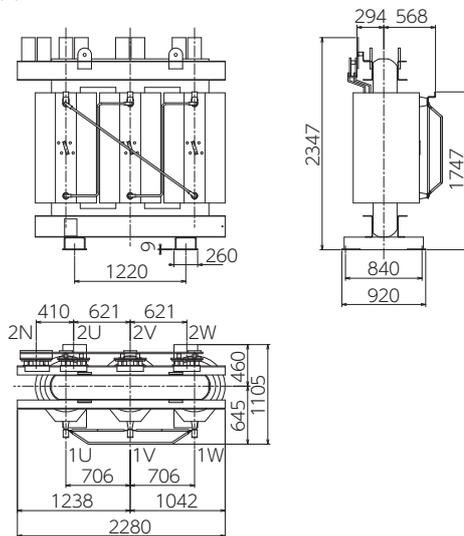
●1,600kVA



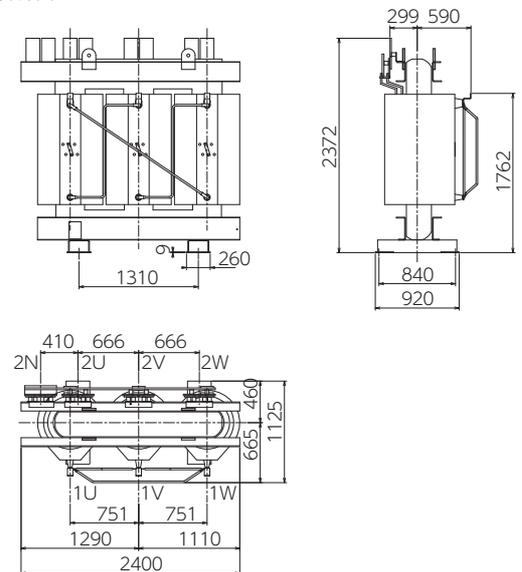
●2,000kVA



●2,500kVA

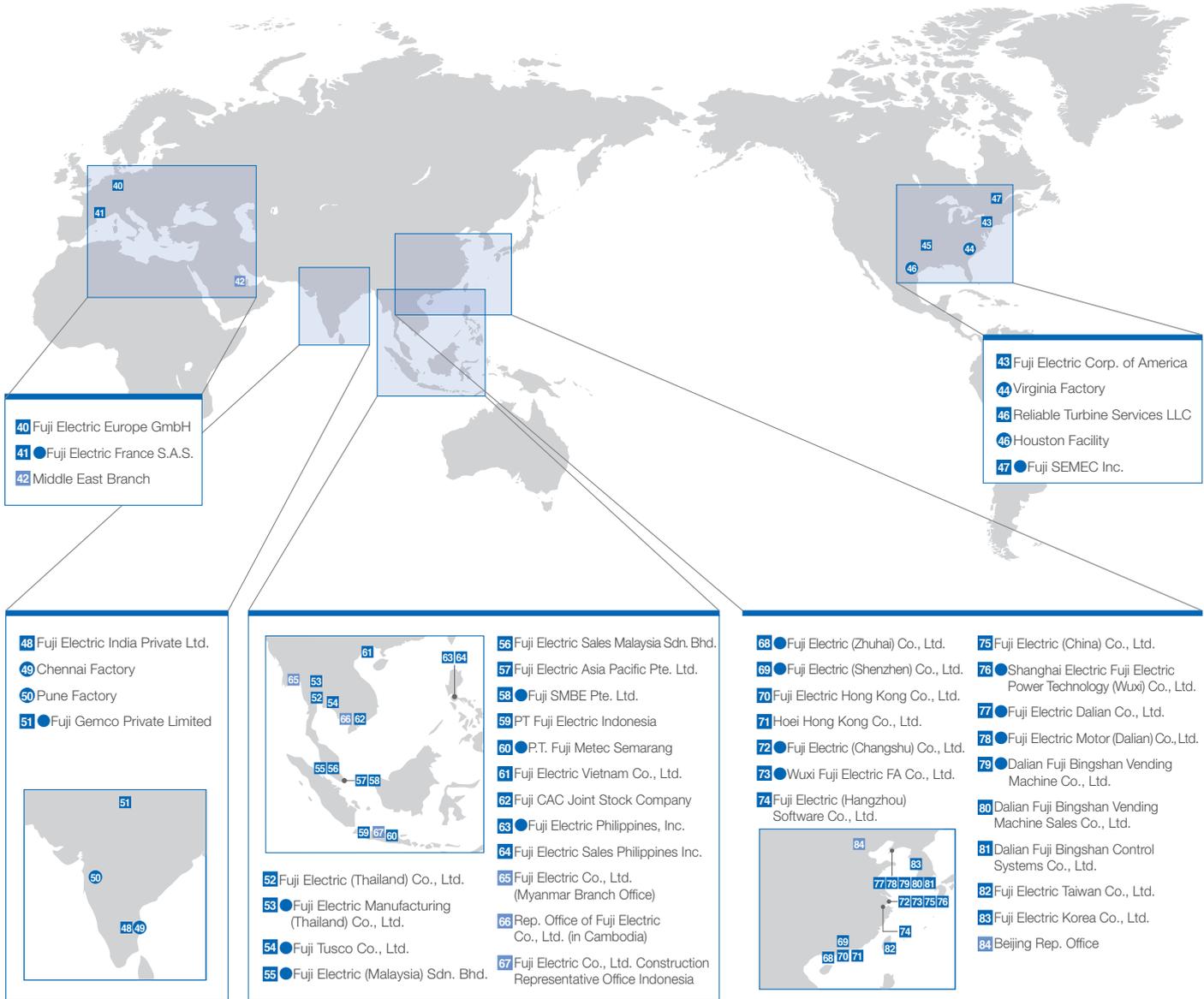


●3,150kVA



Global Network

□ : Head and branch office in Japan ● : Manufacturing bases ■ : Affiliated companies ▣ : Overseas offices



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