Main Product Lineup for Transmission & Distribution Systems

High-voltage Switchgear

- **Gas Insulated Switchgear (GIS)**
  - Rated Voltage: up to 1,100kV
  - Mitsubishi GIS Advantages
    - Outdoor installation
    - Proven supply experiences of outdoor installation since 1968
    - Spring operating mechanism
    - Low failure rate/Torsion bar spring
    - Low failure rate
    - High reliability/Proven experience
    - Low gas leakage rate
    - Less than 0.1%/year
    - Insulator
    - In-house production / Less than 0.1pC partial discharge
    - PDM sensor & system
    - In-house production
    - Synchronous switching GCB
    - Solutions of surge elimination / Longer life

- **Hybrid Gas Insulated Substation (H-GIS)**
  - Rated Voltage: up to 550kV

- **Other Component**
  - Gas Circuit Breaker (up to 800kV), Partial Discharge Monitoring System, Synchronous Switching Controller, etc.

Transformer

- **Oil-immersed Transformer (OIT)**
  - Type: shell & core type
  - Rated Capacity: up to 3,000MVA
  - Rated Voltage: up to 1,050kV
  - Mitsubishi OIT Advantages
    - Shell Type
    - Form Fit Tank Structure / Robust Insulation Structure
    - Flexible coil arrangement
    - Composite/Downsize
    - Various application for Generator Step up Tx & Station Tx
    - Minimized Transportation Weight & Volume
    - Coil Group Packed Assembly / Special divided 3ph Tx
    - Sensor Technology
    - High performance, reliable sensor technology such as oil gas analysis, LTC performance monitoring sensor
    - Manufacturing, Testing Technology
    - Clean room Tx factory
    - Well proven factory from design/manufacturing/testing and quality assurance for key components
    - Ultra HV testing laboratory (AC2000kV, Impulse 6,000kV)

- **Gas Insulated Transformer (GIT)**
  - Type: core type
  - Rated Capacity: up to 65MVA
  - Rated Voltage: up to 275kV
  - Mitsubishi GIT Advantages
    - Non-Flammable, Non-Explosive
    - No fire-fighting system requirement
    - Easy maintenance
    - Less Maintenance Item than OIT
    - Reduction of installation period
    - Installation schedule: approx. 25% reduction against OIT
    - Transportation volume: approx. 25% reduction against OIT
    - Flexible arrangement
    - Much low density (SF6 gas 1/60 of mineral oil)
    - Flexible radiators arrangement

- **Other Component**: Bushing, OLTC, Cooler Control Panel, On-line Gas Monitoring Equipment, etc.

For a greener tomorrow

Mitsubishi ELECTRIC

Changes for the Better
High penetration of renewable energies/resources to bulk power systems and power distribution systems

**Wind Power Plants**
- Independent Power System
  - Load fluctuation, three phase imbalance

**Solar Power Plants**
- Long Distance Transmission Lines
  - Voltage Instability

**Key**
- STATCOM: Static Synchronous Compensator
- SVC: Static Var Compensator
- BTB: Back-to-Back
- FC: Frequency Converter
- VSC: Voltage Source Converter
- HVDC: High Voltage Direct Current

**Bulk Power System**
- System Stability
  - STATCOM/SVC, BTB

**DC Interconnection**
- HVDC, FC, BTB

**Increase of Thermal Power Plants**
- Increase in short-circuit currents

**Underground Cable System**
- Overvoltage

**Retirement of Thermal Power System**
- Power Quality

**Distribution System**
- Increase in distributed power generation
  - Power conditioner for photovoltaic generation

**Offshore Wind farm and Island Microgrids**
- Voltage/Frequency Fluctuation

**VSC HVDC Power Transmission Lines**

**MITSUBISHI ELECTRIC**
Changes for the Better
With a constant growing demand for energy, the integration of renewable energy resources and the need to fight climate change, new and efficient solutions become a requisite for power transmission.

Mitsubishi Electric, a leader in the development, design and production of FACTS technology with over 40 years of experience has developed **SVC-Diamond®** as the solution to cope with power transmission challenges.

With its superior features, **SVC-Diamond®** is an innovative and universal MMC VSC solution for grid enhancement.
Smart Meter Systems

**1:N Portable Communication**

**PLC Communication**

**Wireless Multihop Communication (920MHz)**

**Smart Meter**

**Wireless Metering HT**

**HEMS**

**Wireless or PLC**

**Concentrator (wireless)**

**Wide Area Network**

**Smart Meter System (Conceptual Diagram)**

**Smart Meters and communication units**

**Smart meter communication system**

**Smart meter management system**

**Smart Meter Management System (MDMS*)**

**Backup site**

**Main site**

**Head End System (HES)**

**Backup site**

**Main site**

** Auxiliary System**

**Customer Support, Distribution Automation, Billing System, etc.**

**Existing System**
- Gather data locally by meter readers

**Smart Meter System**
- Gather data remotely and timely by utilizing communication networks
  - Create customer benefit with improving service level for end-user
  - Support customer in proactive measures for excess demand of electricity

*HT: Handy Terminal  MDMS: Master Data Management System

for a greener tomorrow

Changes for the Better
The world’s largest energy-storage system - **252 units with 50 MW output and 300 MWh rated capacity** - will be installed at the Buzen, Japan, substation, to balance supply and demand when renewable sources are used. Our BLEnDer® RE SCADA achieves efficient operation of multiple-generation sources and batteries to optimize overall control.
MELPRO-D Series Relay

MELPRO-D series provide comprehensive protection for power distribution automation with integration of advanced network systems

Multi-function

- The MELPRO-D series relay is suitable for feeder protection, motor protection and transformer protection applications.
- Easily configurable, the relay offers multiple step time grading for over-current protection co-ordination.
- Two settings groups offer flexibility for testing purposes or the ability to accommodate different load conditions.
- Remote communications options include IEC 61850 Ethernet communications or Modbus (RS485)
- IEC 61850 communications can be achieved using 1 electrical port or 2 optional ports.
- If 2 optional ports are used, HSR (High-availability Seamless Redundancy) or PRP (Parallel Redundancy Protocol) can be selected through the user interface.
- Up to 5 disturbance recorder fault records can be stored (24 samples/cycle). These fault records can be analyzed using PC Tool software.
- Circuit breakers can be controlled via the HMI or remotely.

GIS/GCB Portable Partial Discharge Monitoring Device PP-100

Insulation diagnosis of gas insulated switchgears with easy operations.
PP-100 supports both the UHF and AE detection methods.

Portable Handsets
(For primary PD diagnostic)

Base Unit
(to be connected with the portable handsets for detailed PD diagnostics)
### Cubicle Type Gas Insulated Switchgear (C-GIS)

<table>
<thead>
<tr>
<th>Standard</th>
<th>IEC62271-200 or IEC60298</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>Up to 72kV, Up to 2500A, 31.5kA</td>
</tr>
<tr>
<td>Insulation Medium</td>
<td>Dry Air/SF₆-gas</td>
</tr>
</tbody>
</table>
| Features      | • Low maintenance  
                • SF₆-gas free line-up  
                • Condition based maintenance |

### Vacuum Circuit Breakers and Contactors

<table>
<thead>
<tr>
<th>Standard</th>
<th>IEC62271-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>Up to 24kV, 2500A, Up to 12kV, 3150A</td>
</tr>
<tr>
<td>Operating Medium</td>
<td>Spring Mechanism</td>
</tr>
</tbody>
</table>
| Features      | • Low maintenance  
                • Next generation type 6kV VCB will be launched in 2012.  
                • Worldwide experience |

### Medium-voltage Switchgears

<table>
<thead>
<tr>
<th>Standard</th>
<th>IEC62271-200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>Up to 15kV, Up to 3150A, Up to 40kA</td>
</tr>
</tbody>
</table>
| Features      | • Type tested by KEMA.  
                • IAC: AFLR 40kA, 1sec  
                • 2-tier application available |

### Low-voltage Switchgears and Motor Control Center

<table>
<thead>
<tr>
<th>Standard</th>
<th>IEC61439</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>690VAC, 4000A, 85kA</td>
</tr>
</tbody>
</table>
| Features      | • Arc proof type (IEC TR 61641)  
                • Easy maintenance  
                • Mitsubishi multi-motor controller (Type EMC) is available |

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Technical Partner in Indonesia, P.T. UNI MAKMUR ELEKTRIKA (UME) manufactures Medium & Low Voltage Switchgears
Features

- Integrating CB, DS, ES, CT and VT&SA into one common unit
- Lower arrangement (VT&SA Equipment)
- Self-standing design (High-seismic design)
- All housing LCP
- Covering all connecting mechanism

Merits

| Plant Design | • Free design for IPB and VT&SA equipment  
  • Low required capacitance for interrupting capability |
| Erection      | • Reduce Erection and Commissioning period  
  • Easy and Quick access for VT&SA Equipment |
| Maintenance   | • High performance and Low-maintenance operating mechanism (Torsion bar spring type)  
  • Easy and Quick access for VT&SA Equipment |


<table>
<thead>
<tr>
<th>Rated continuous current (kA)</th>
<th>8</th>
<th>11-13</th>
<th>15-18</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-circuit current</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kA)</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 20-SFMG-63A
- 20-SFMG-100/100A
- 20-SFMG-130
- 20/30-SFMG-125

(Short circuit current: 125kA)

- ~44kA with forced-air cooling

In case of applied forced-air cooling, the maximum current capacity will be 20kA, and depends on the cooling system design.

In case applied of self cooling device, the maximum current capacity will be 18kA.
In case applied of forced-air cooling, the maximum current capacity will be 32kA, and depends on the cooling system design.
Retrofit VCB for Replacement of Existing VCB

Features of New 11kV VCB compared with existing VCB

- Improved insulated frame: Outstanding reliability (Used in MELCO’s latest VCB)
- Greaseless of the gears: Maintenance free of the gears
- Single levering and interlock: Simple and safe operation
- Complete interchangeability: Saving replacement work (No need long shutdown)

Retrofit VCB for Replacement of Existing GCB

Features of New 11kV VCB compared with existing GCB

- Simple mechanism: Outstanding reliability
- Low maintenance: Saving running cost
- SF6 gas free: Environmental
- Complete interchangeability: Saving replacement work (No need long shutdown)
Analysis of gases dissolved in transformer oil (DGA) is recognized as the most useful tool for early detection of incipient fault in transformers, thereby the prevention at an incipient stage of critical accidents and reducing the maintenance cost of transformer. MITSUBISHI ELECTRIC offers three types of DGA equipment having the following features.

**Features**

**PORTABLE TYPE EQUIPMENT**
- **Model: PGA-300**
  - 6 components gas analysis
  - Quick measurement
  - Small amount of oil sample
  - Easy operation

**ON-LINE TYPE EQUIPMENTS**
- Automatic operation at the preset interval
- Easy installation because of the small and light weight equipment
- No consumption of transformer oil
- **Model: N-TCG**
  - TCG (Total Combustible Gas) analysis
- **Model: N-TCG-6C**
  - 6 components gas analysis
- **Model: N-TCG-6CM**
  - 6 components gas analysis with moisture in oil

**LABORATORY USE EQUIPMENT**
- **Model: FAF**
  - Capability of 12 oil samples loading
  - Fully automatic unmanned operation
  - High sensitive and accurate analysis
  - 9 components gas analysis
  - 11 components gas analysis (Option)

**Construction of Online Type Equipment**