

GAS INSULATED SWITCHGEAR

MODEL

HS-X (TYPE1)

12kV/24kV



**Advanced environmentally
friendly switchgear**

Environmentally friendly

Designed and manufactured a substantial amount of switchgear. This vast experience was drawn on to produce environmentally friendly switchgear, the "HS-X".

Flexible design - Suitable for many applications

Designed so that several orientations of cable terminations (power and control) entry are available, makes it one of the most flexible switchgear on the market.

Simple installation - Quick and easy

No gas processing is required during site installation and commissioning, which simplifies planning and reduces time required for installation, and maintains the high quality of the switchgear during transportation.

User friendly - Simple operation

A simple layout of the operating mechanisms and mimic diagram at the front of the panel leads to straightforward operation. Additionally this reduces the chance of mal-operation.

Compact size - Space saving

The weight and required space for installation has been reduced^{†1} by the use of solid insulated busbars and the application of a multi-function relay.

^{†1} 46% less space compared to Mitsubishi Electric existing GIS of the same ratings

Energy saving - Reduction of running costs

The use of an electro-magnetic VCB operating mechanism reduces the required operation energy by approximately 80% when compared to conventional motor-spring operating mechanisms.

switchgear

High reliability - Years of trouble free operation

The reliability has been increased even further by the application of an electro-magnetic vacuum circuit breaker (VCB) operating mechanism. With fewer parts¹² the chances of failures occurring have decreased.

¹² 35% less parts than conventional Mitsubishi Electric spring VCB operating mechanism.

Safe Design - Ensures operator's safety

In the event of an internal arc, any arc fault gas will be directed away from the operator (through the top of the panel). With the benefit of GIS design concepts, there are no live parts exposed inside the panel which ensures utmost safety for operators.

Low maintenance - Reduction of maintenance costs

The circuit breaker's advanced electro-magnetic operation does not require maintenance for over 15 years¹³. The circuit breaker and disconnecting / earthing switch are hermetically sealed in a tank and together with the application of original anti-oxidation grease to the moving parts of the disconnecting / earthing switch enable smooth long-term operation for 15 years or more.

¹³ Under normal operation conditions according to IEC standard.



Environmentally friendly - SF₆ Free

Mitsubishi Electric Co. is the world leader in establishing compressed dry air insulation technology based on the design and development technologies of conventional SF₆ switchgear. Under dry, clean and compression, air has good insulation properties, which makes it ideally suitable to be used as insulation for gas insulated switchgear. (Dry air insulation is an option)

CONTENTS

RATINGS	03
FEATURES	04
COMPONENTS	05
SAFE OPERATION & USER FRIENDLY	07
HIGH RELIABILITY AND COMPACT SIZE	09
SWITCHGEAR ARRANGEMENT	11
FOUNDATION DRAWING	13
STANDARD & OPTIONAL SPECIFICATIONS	13
STANDARD ACCESSORIES	14
OPTION	14

IEC 62271-200 ^{†1}	
kV	12 24
Hz	50 / 60
A	630 / 1250
kV (peak)	75 125
kV (rms)	28 50
kA	25
sec	3
SF ₆ / Dry air ^{†2}	
MPa-abs	SF ₆ : 0.13 SF ₆ : 0.13
	Dry air : 0.17 Dry air : 0.17
MPa-abs	SF ₆ : 0.12 SF ₆ : 0.12
	Dry air : 0.15 Dry air : 0.15

The application standard is for 630A rating with dry air only. Others are IEC 60298. Insulation medium of dry air is an option and for 630A rating only.

IEC 622271-100	
	12 24
	Vacuum
	25
	63
	3
	O-1min-CO-3min-CO, O-0.3sec-CO-3min-CO, CO-15sec-CO
	Electro-magnetic

IEC 60129	
	630 / 1250
	25
	Manual ^{†3}
	Manual

^{†3} : Motor operation is an option.

IEC 60044-1	
	2000 / 5 or 600 / 5
	5
	10P20 / Class 1.0

‡ : Transformer ratio can be adjusted in combination with MP multi-function relay.

IEC 60044-2	
	11000 22000
	110
	110, 190
	50 / 50
	1.0 / 3P

^{†5} : Tertiary winding is an option.

IEC 60099-4	
	Zinc oxide
	12 24
	5, 10

FEATURES

Multi-function relay

Mitsubishi "MP" relays are installed as standard. This relay combines protection, measurement and control functions into one compact flush door mounted unit. Current transformer ratios are adjustable in combination with the use of wide range current transformers.

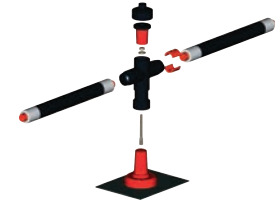


Moduled control circuit

Control devices and equipment and wiring are moduled. Functions are readily interchangeable and the enclosure of live parts provides a high level of reliability.

Solid insulated busbar

The busbar is independently solidly insulated for each phase, which eliminates any chance of phase-to-phase faults. Also no gas processing is required during site installation or maintenance.



Test terminal (Option)

There is no need to disturb the cable terminations in order to carry out high voltage testing of cables. (Maximum applicable voltage : DC20kV / 10min)

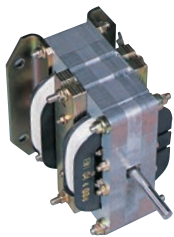
Three position disconnecting switch operating mechanism

The operating mechanism is simple making it user friendly and reduces the chances of mal-operation.



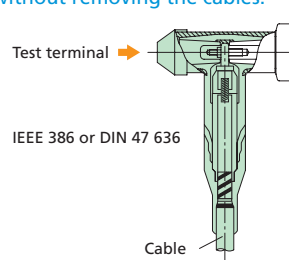
Electro-magnetic VCB operating mechanism

A reduced number of parts increases the reliability of the VCB. Also, a reduction in the required energy to operate the VCB is achieved.



Plug-in termination (Option)

Reduces the time required for cable termination work. Also cable voltage withstand testing can be easily performed by using a test terminal without removing the cables.



Three position switch

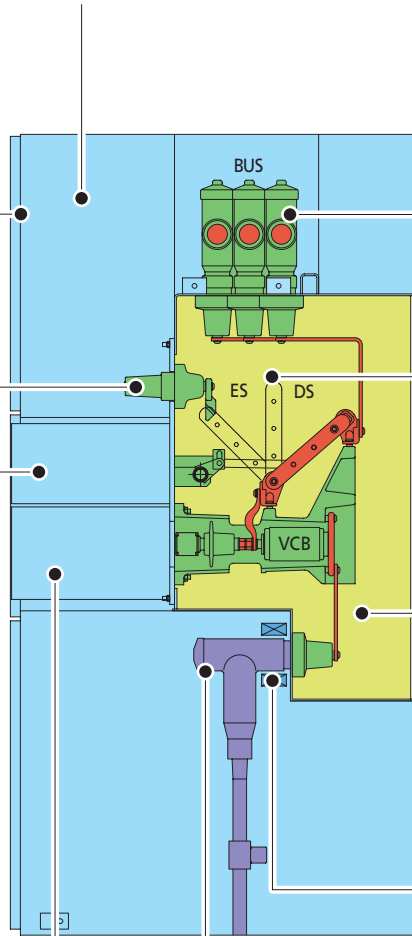
The earthing switch is unified with the disconnecting switch.

Gas vessel

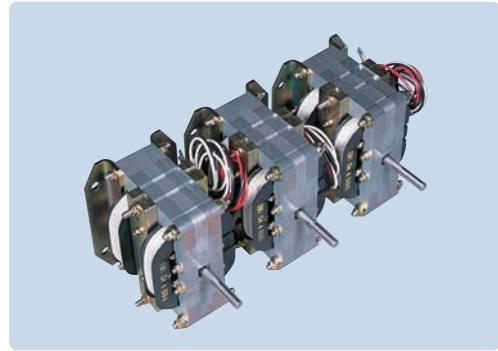
The circuit breaker, disconnecting and earthing switch are hermetically sealed in the maintenance free dry air or SF₆ insulated gas vessel.

Wide range current transformer

The ratios of the current transformers can be changed without physically changing the CTs in combination with multi-function relay (MP), providing great flexibility.



e. As
 en by
 by a

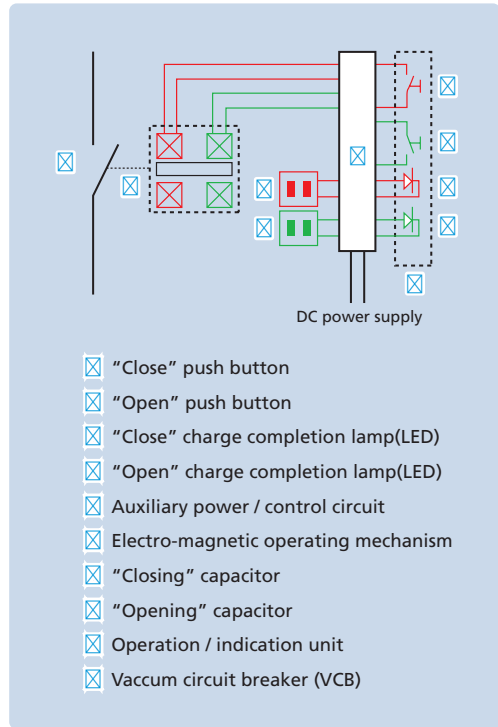


sm is
 nism,
 ; the

nism,
 r1
 itions.

ed to
 izing
 ation

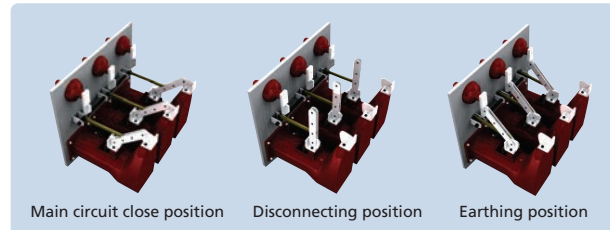
eight



Capacity	Remarks
<p>DC 110V (Open) I=5A, T=0.02 Sec (Close) I=0.4A, T=3.5 Sec</p>	
0.5A	Other voltages are available as an option.
<p>DC 110V : I1=5A I2=1.5A</p>	Option

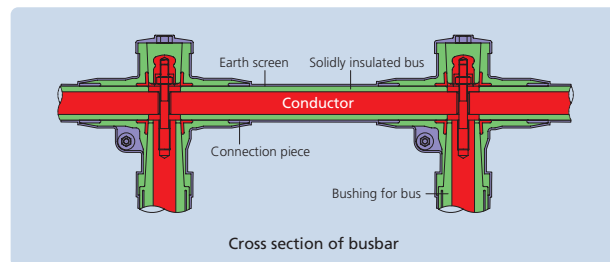
Three position switch

An earthing switch is unified with the disconnecting switch. The earthing switch is manually operated however the disconnecting switch is manually operated with motor operation as an option.



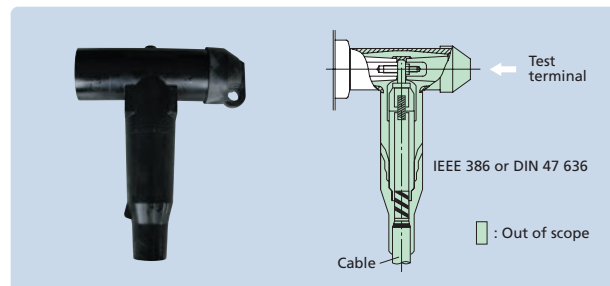
Main busbar

The main busbar is independently and solidly insulated for each phase. During main busbar connection no gas processing is required. Since the surface of the insulation is earth screened, there is no chance of phase-to-phase short circuits.



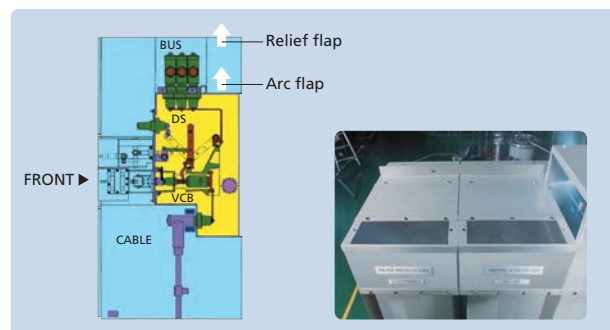
Plug in cable termination (Option)

Plug in type cable terminations make cable connection work simple and efficient. IEEE or DIN standard plug in type terminations are applicable.



Arc pressure relief device

Pressure relief devices are applicable for safety operation to prevent human injury in case of internal arc accidents.



Multi-function relay and wide range current transformer

Flush mounted type multi-function relay "MP" covers protection, control, measurement and communication functions. In combination with the wide range CT, the CT ratios can be readily changed without the replacement of CTs.

Protection

- Overcurrent (50/51),
- Directional ground fault (67G),
- Ground fault (51G),
- Undervoltage (27),
- Overvoltage (59),
- Ground fault overvoltage (64)

Control

- CB control / Lock out / Remote operation.

Measurement

- A, V, W, Wh, Var, Varh, Hz, PF

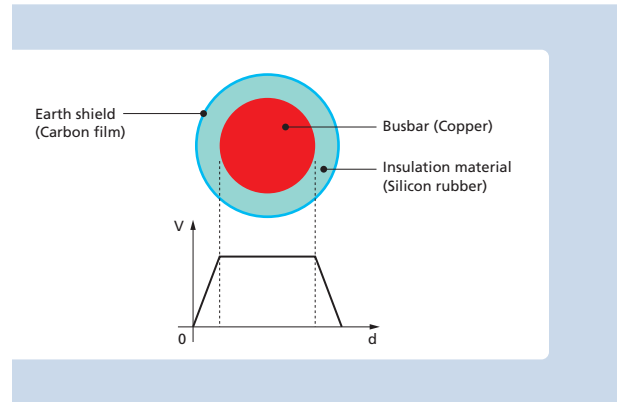
Communication

- Modbus®RTU^{†1}, CC-link, CDL protocols are available.

^{†1} : Modbus® is a registered trademark of Schneider Electric SA.



age transformer, cable termination and gas vessel which is earthed, while the panel is energized.



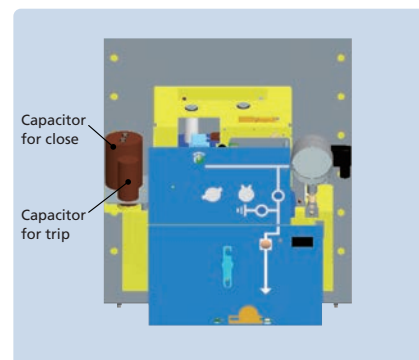
and DS / ES conditions. Mitsubishi HS-X provides easy operation and conveniently located (around eye level) operating mechanisms.

- DS/ES shutter operation selector
- ES operation mechanism with shutter
- DS operation mechanism with shutter
- ES condition indicator
- VCB manual tripping mechanism with cover
- Manual closing button with cover
- Capacitor charged lamp
- Gas densimeter
- DS condition indicator
- VCB operation counter
- VCB condition indicator
- Manual tripping button
- Capacitor discharging button

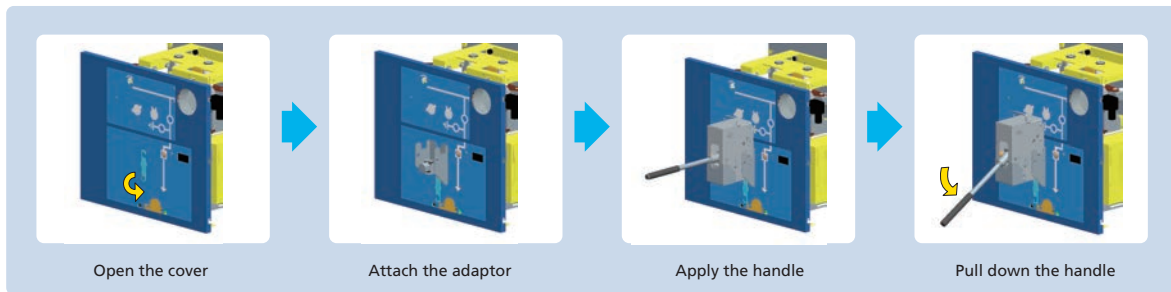
mechanism and

imply two steps

mechanism until

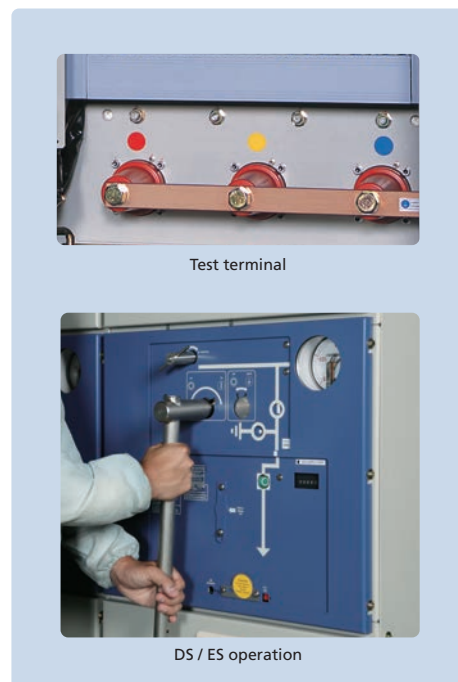


A-2 The VCB mechanism provides simple operation from closed to opened condition by the use of a manual trip handle as described below.



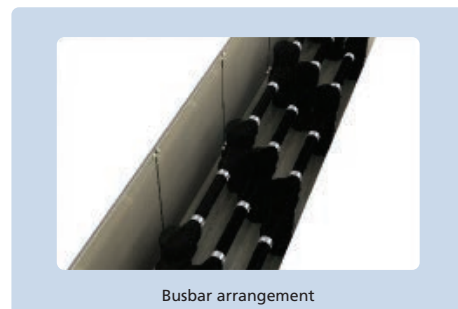
B. Disconnecting / earthing switch

- A three position switch ensures the DS and ES are not operated at the same time.
- By adopting a testing terminal on the ES provides the capability of performing cable withstand testing without removing the main power cables. (Maximum applicable voltage: DC 20V 10min (SF₆))
- The shutter operation key ensures that the DS / ES are operated separately and also provides a locking function.
- The DS / ES can easily operate by using the operation handle

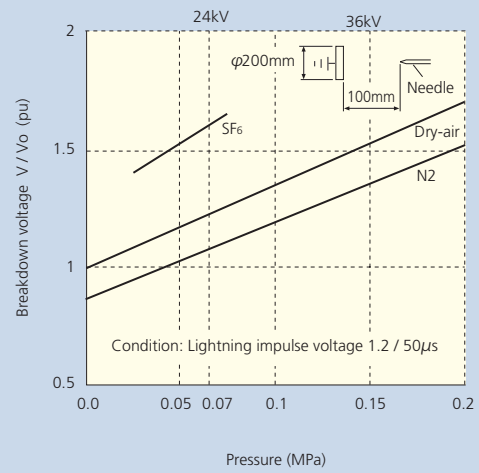


C. Installation of busbar & cable termination

- HS-X switchgear busbar are designed in a individual phase arrangement that prevents faults between phases.
- Since solid insulation busbars are used, no gas processing is required during installation and commissioning.
- Since the cable terminations are standard IEEE / DIN size, installation is very easy.

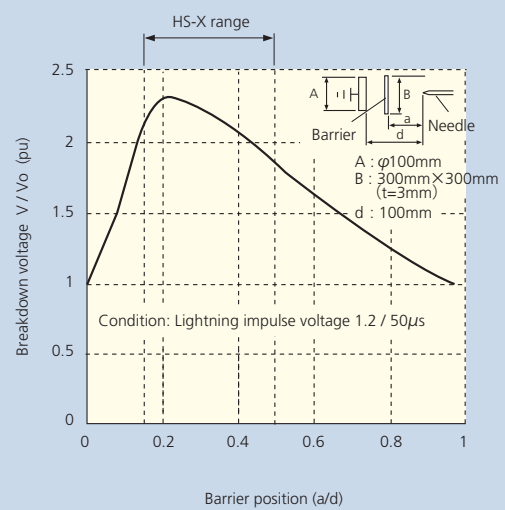


SIZE



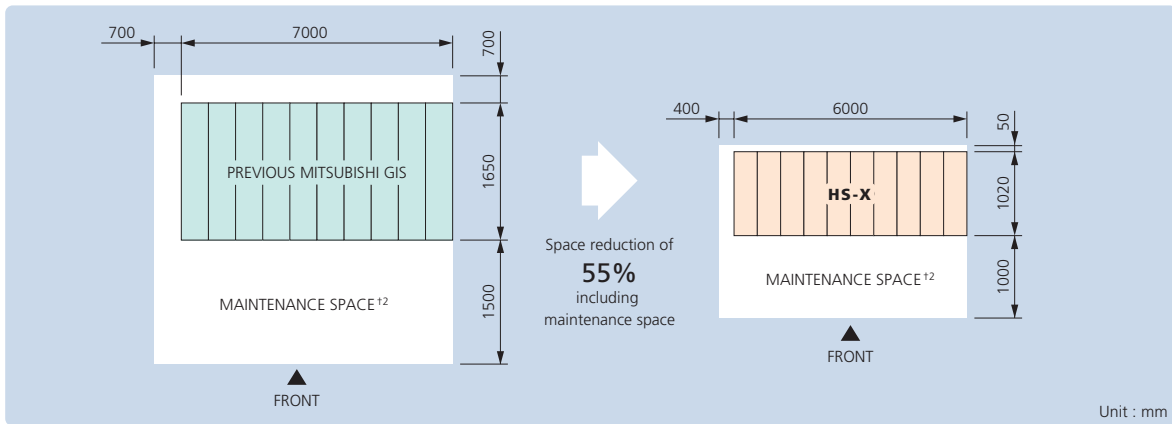
Insulation characteristics of compressed air

(Vo : Breakdown voltage of air at 0.0Mpa)



Insulation characteristics of air with insulating barrier

(Vo : Breakdown voltage without barrier)



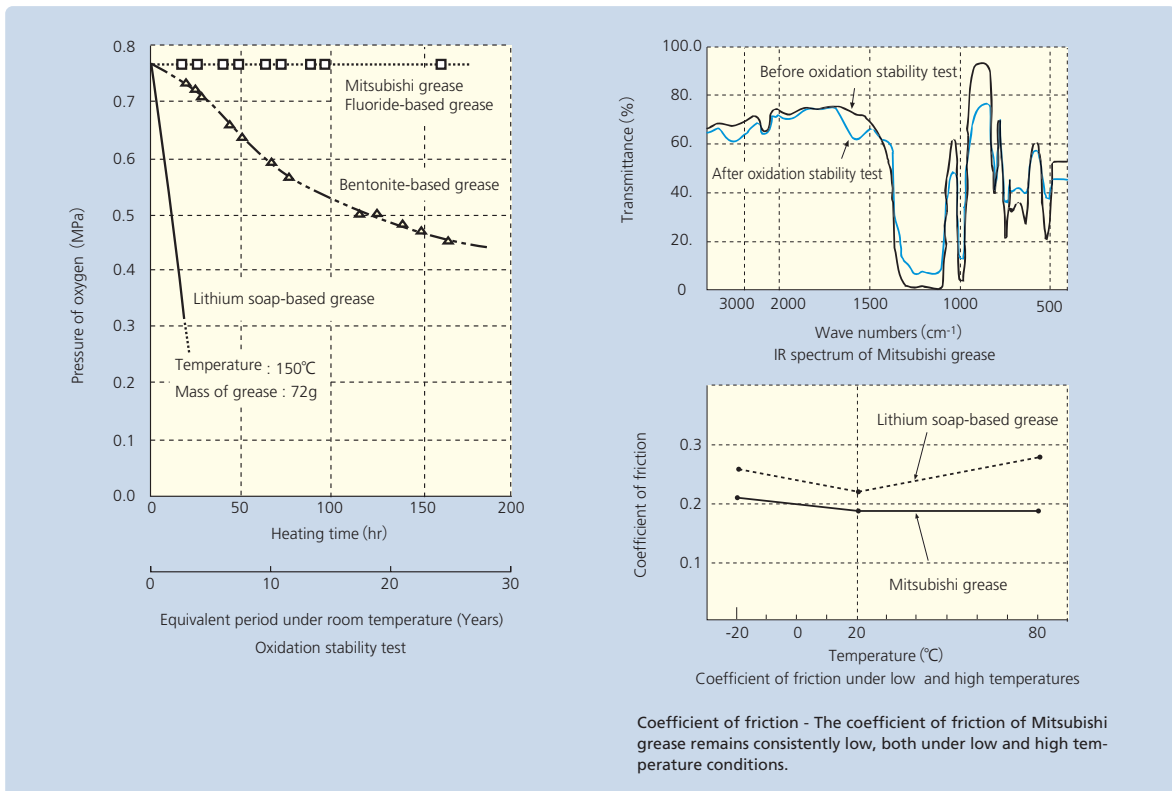
†2 : Maintenance space required is recommendation only.

Mitsubishi long life grease

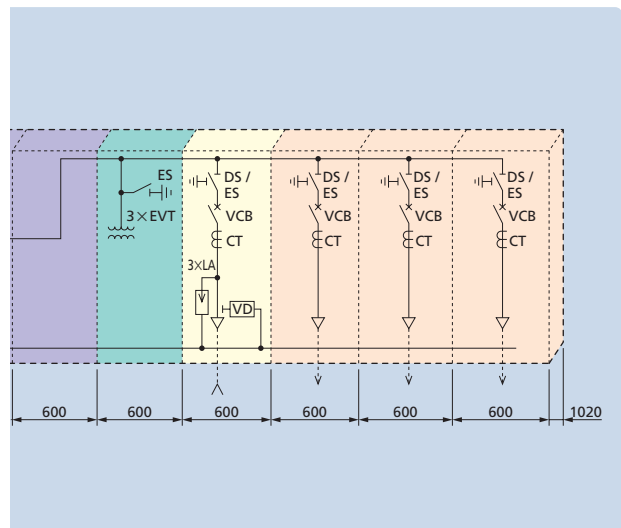
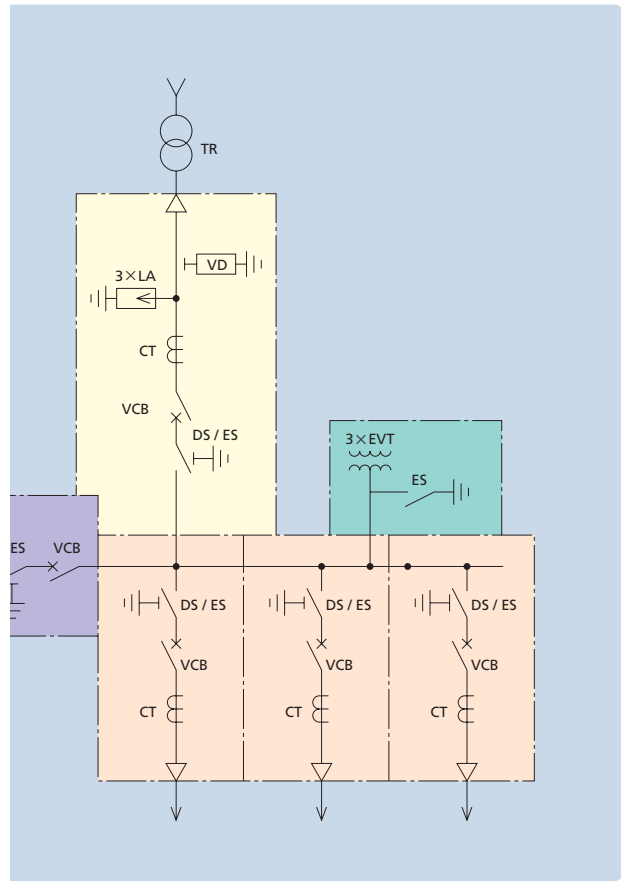
A specially developed long life grease is applied to the moving parts of the operating mechanism of the Disconnecting / Earthing switch. This "Mitsubishi" grease has been thoroughly tested to guarantee smooth lubrication for over 15 years without the need for reapplication, as demonstrated by the test data results graphed below. The required maintenance time required is reduced dramatically.

Oxidation stability test - Oxidation of grease is the main deterioration factor. As the graph above demonstrates Mitsubishi grease show very little oxidation (the pressure of oxygen remains unchanged throughout the test).

IR spectrum of Mitsubishi grease - The IR spectrums of Mitsubishi grease before and after the oxidation stability test are nearly identical, proving the grease characteristics remain the same even after many years after it has been put into use.



Coefficient of friction - The coefficient of friction of Mitsubishi grease remains consistently low, both under low and high temperature conditions.



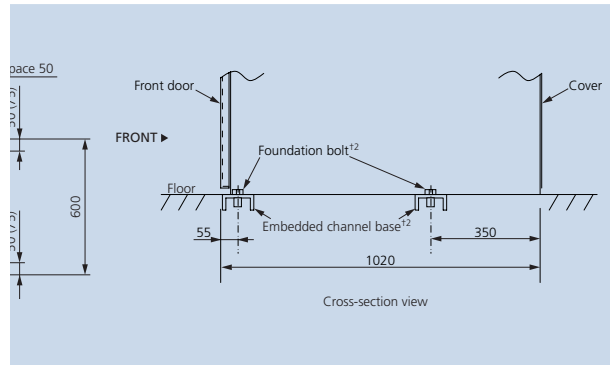
Typical key single line & section view

		Incoming panel	Outgoing panel	Bus section panel		Bus EVT / LA panel
Typical key single line						
Section view						
12 / 24kV	Width (mm)	600	600	600×2		600
	Depth (mm)	1020	1020	1020		1300
	Height (mm)	2000	2000	2000		2000
	Weight (kg)	500	500	800		500
	Heat value (J/S)	85	85	85		25
Note		<ul style="list-style-type: none"> ■ ◀ : Insulator (gas barrier) ■ Heat values indicated are for 630A. ■ For outdoor panels the depth and height are increased by 250mm and 350mm respectively. 				

Other section view (flexible design)

		Cable entry from top (Indoor type only)	Incoming panel with EVT / LA	Incoming panel with bus EVT (Indoor type only)	Incoming panel from bus duct	Bus EVT / LA panel with ES
Typical key single line						
Section view						
12 / 24kV	Width (mm)	600	600	600	†1	600
	Depth (mm)	1300	1300	1020	†1	1300
	Height (mm)	2000	2000	2260	2000	2000
	Weight (kg)	500	550	550	†1	550
	Heat value (J/S)	85	85	85	†1	25
Note		<ul style="list-style-type: none"> ■ ◀ : Insulator (gas barrier) ■ Heat values indicated are for 630A. ■ For outdoor panels the depth and height are increased by 250mm and 350mm respectively. ■ Other type configuration please contact MITSUBISHI ELECTRIC CO. 				

†1 : For these specification please contact MITSUBISHI ELECTRIC CO.



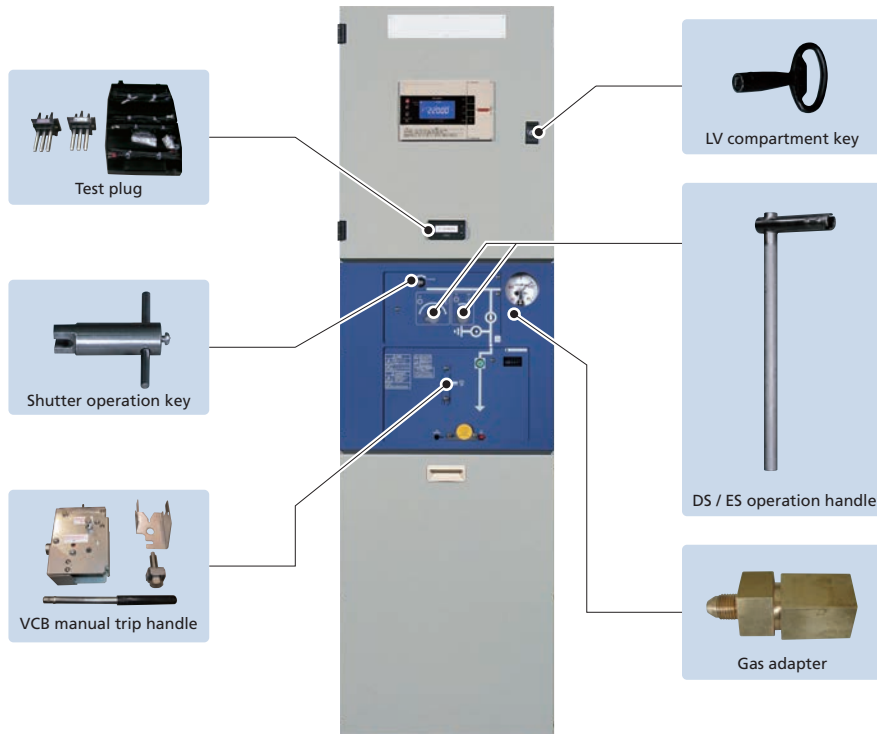
†1 : In case of top or rear cable entry, panel depth is required 1300mm.
 () means size of outdoor use.
 †2 : Embedded channel base and foundation bolt are not supplied.

ATIONS

Standard specification	Optional specification
oor	Outdoor
ore than 2.0 mm	-
s than 0.5% weight per year	-
	Dry air †1
X	IP51
X	IP51
5	-
X	IP51
X	IP51
X	IP4X
insell 5Y7/1	Specified color
insell 5PB3.5/5	Specified color
IV PVC insulated	Specified type
5 mm ² or more	Specified size
mm ²	Specified size
low	Specified color
low	Specified color
een	Specified color
nt bottom	Rear top or bottom
t supplied	Specified type, size & specification
t supplied	Specified type, size & specification
nt bottom	Front top
t supplied	Specified type & specification
ew type	Specified type
ylic plate	Laminated plates or stainless steel
+ Wide range CT	Specified type
nual	Motor
t supplied	Supplied

†1 : Insulation medium of dry air is for 630A rating only.

STANDARD ACCESSORIES

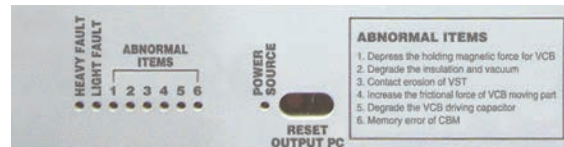


OPTION

CBM (Condition Based Maintenance) System

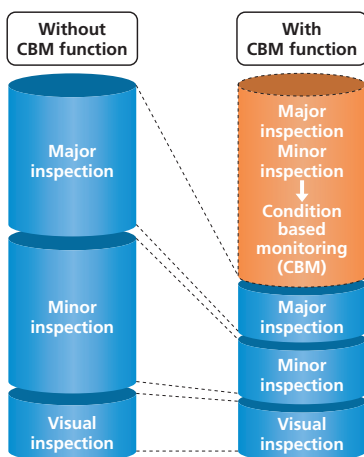
CBM system is the maintenance system based on the equipment condition. It has two advanced points compared to Time Based Maintenance system requires periodical maintenance.

1. Prevention of accidents by early detection of malfunction
2. Reduction of life cycle cost



CBM function unit

Example of maintenance Item



Main periodical inspection item		Items automatically monitored by CBM
Class	Part	
Switchgear	Insulation, gas pressure ^{t2}	• Partial discharge monitoring ^{t1}
	Vacuum interrupter (contact erosion, degree of vacuum)	• Analysis of driving current • Partial discharge monitoring ^{t1}
VCB	Electro-magnetic operating mechanism	• Analysis of driving current
	Controller	• Charge voltage of capacitor
	Control circuit for drive	• Analysis of driving current
	Control P.C.B.	• CPU fault self-monitoring
	Driving capacitor	• Time properties of discharging

^{t1}: There are cases when partial discharge monitoring cannot be applied, in some cases of noise level from outside system of panel.
^{t2}: Gas pressure is monitored with gas densimeter.

Regarding periodical maintenance

For conditions not monitored by the CBM function, periodical inspections equivalent to those conducted conventionally, including field, minor and major inspections, are required.

JP Pat No. 4682046

Others, two patents in Japan and thirteen patents in seven different countries (CN, HK, TW, KR, US, TH, DE).



for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
www.MitsubishiElectric.com



Safety Precautions

Please read the instruction manual
before using the device.