

**INSTRUCTION MANUAL**

**FOR**

**“PRECISE”**

**SF<sub>6</sub> GAS LOAD BREAK SWITCH**

**33 kV 400 A, 12.5 kA**

**TYPE: ORAP21-396-20MT**

**MANUFACTURED BY  
PRECISE ELECTRO-MECHANICAL WORKS CO., LTD.**

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## 1. Introduction

### 1.1 General

This SF<sub>6</sub> high speed sectionalizing load break switch is designed, manufactured, and tested to applicable sections of current IEC and NEMA standards. These switches are completely assembled, adjusted, sealed, filled, and tested at the factory. The application of gas filled equipment requires some knowledge of the correct procedures for handling of SF<sub>6</sub>. The information and instructions included herein are an aid to qualified personnel in the proper installation, operation and maintenance of the units.

### 1.2 Shipment Inspection

Uncrate and remove packing as soon as possible after receiving the switch. Examine the equipment carefully for any damage that may have occurred in transit. If any damage is found a claim should be filed at once with the transportation company. In addition, the tank pressure should correspond to the values given in 4.2 of this instruction. If the tank pressure is below the recommended level, consult the factory before placing in service.

### 1.3 Storage

Switches that will not be immediately installed should be suitably stored by replacing the crating material and storing the unit in a clean, dry location.

## 2. Installation Procedure

### 2.1 Handling

The switch is equipped with lifting eyes or other provisions. Use proper equipment to obtain a vertical lift without damaging the unit. See nameplate on the switch for approximate weight.

### 2.2 Mounting

Provisions should be made to provide ample room for the cable training to the switch. Switches are provisions for mounting. Check that the switch, in its installed position, is secured and that the cross arm is adequate to maintain this position. See "Mounting Arrangement".

### 2.3 Ground Attachments

A ground terminal is provided on the switch tank. The switch tank MUST be attached to a suitable ground as required by local practice.

## **2.4 Cable Connections**

2 hole NEMA pad have been provided on the bushings to connect to the overhead conductor. Proper strain relief must be provided for the overhead conductor before connecting to the switch to avoid under stress on the bushing. No force should be applied on the bushing by the overhead conductor.

## **2.5 Operation Check**

Actuate each operating handle several times to make sure operation is proper without binding or Interference. Consult the representative if any problems are encountered. Operating instructions are provided in Section 5.

## **2.6 Final Inspection**

Check that the unit is pressurized to the proper level by observing that the low pressure indicator does not show a red flag. High potential tests on the cable termination may be performed before the switch is energized. Test levels may vary depending upon system requirements but should not exceed rated withstand levels.

## **3. Standard**

This specification cover the basic requirements of three-phase SF<sub>6</sub> gas load break switch (“the switch” hereinafter) which could be operated by manual and/or local/remote electrical means for the controlling of overhead distribution lines. The offered switch has been tested in accordance with IEC 265-1

## **4. Technical requirement**

### **4.1 Service conditions**

The switch is suitable for operation under the following conditions:

Ambient air temperature	: up to 40 <sup>0</sup> C
Relative humidity	: up to 100%
Altitude	: up to 1,000 m above mean sea level
Climatic condition	: tropical climate

#### 4.2 Design/performance data

Descriptions	22kV	33kV
Manufacturer	PRECISE ELECTRO – MECHANICAL WORKS CO.,LTD	
Model / Type or Catalogue No.	ORAP21–396–20MT	
Rated voltage (kV)	24kV	33kV
Rated frequency (Hz)	50	
Rated normal Current (A) (max.)	630	400
Rated symmetrical interrupting current (A)	630	
Rated short-time withstand current, 1 sec (kA r.m.s.)	12.5	
Rated short-time making current (kA peak)	31.5	
Rated impulse withstand voltage (kV peak)	125	170
Rated mainly active load breaking capacity (A)	630	
Rated transformer off-load breaking capacity (A)	21	
Rated cable charging breaking capacity (A)	10	
Maximum temperature of (K)		
- Contacts	30	
- current carrying parts	30	
- mechanical parts	5	
Number of operations at rated normal current Interruption	400	
<b>Mechanical endurance, in number of operations</b>	2,000	
Rated pressure range of SF <sub>6</sub> gas (kgf/cm <sup>2</sup> )	1.2	
Pressure of SF <sub>6</sub> when locking device operates (kgf/cm <sup>2</sup> )	0.7	
Protection degree of assembled enclosure	IP 67 (SF <sub>6</sub> tank)	

Descriptions	22kV	33kV
Operation force of handle (kgf)	35 max	
Conductor material of main circuit lead	Copper	
Cross section of main circuit lead	200 mm <sup>2</sup>	120 mm <sup>2</sup>
Creepage distance of porcelain bushing (mm)	600	900
Net weight (kg)	240	230

#### **4.3 Switch Construction**

Each switch is equipped with an internally mounted operating mechanism capable of providing quick-make and quick-break operation in either switching direction. The mechanism is capable of delivering sufficient torque and is provided with latches for each position to assure load interrupting, fault closing and momentary ratings. The mechanism uses compression type spring to assure long life and reliability.

The switch has closed-position mechanical-latch to prevent the switch contacts from opening through loss of line voltage. The switch could be operated manually without power supply by using a NEMA-head hook stick. The switch employs a puffer interrupting mechanism.

The enclosures of the switch are made of stainless steel and shall be dust-tight and waterproof. All switch are subject to the gas leakage test at 10<sup>-5</sup> cc/second. Any formation of condensation water is prevented by absorber. The enclosure has a standard protection against corrosion. The finishing coat is light gray.

#### **4.4 Standard Feature**

1. Manual operation handle, with operating hook(s) having inner diameter of not less than 26 mm, suitable for use with NEMA head hook stick from ground level.
2. Mechanical indicator, FREE/LOCK and ON/OFF.
3. Lifting lugs.
4. Ground terminal.
5. Pressure releasing device operating in case pressure builds up higher than permissible design pressure.

6. Safety locking device to prohibit switching in case SF<sub>6</sub> gas pressure drops below permissible minimum pressure, with red indicator easily to be seen from ground level.
7. Six (6) porcelain bushings.
8. Six (6) lead wires, 2.5 meter long, with insulated copper conductor.
9. Nameplate
10. Hanger assembly, made of galvanized steel.
11. Tank coating light gray paint with primer, three millimeters thick.
12. Absorber to absorb moisture and de-composed SF<sub>6</sub> gas.
13. Mechanical operation counter.
14. Provision for field gas filling.
15. Mounting kit for cross arm mounting.

#### **4.5 Safety Devices**

##### *4.5.1 Low Pressure Safety Locking Device & Mechanical Indicator*

The switch shall be equipped with a safety locking device to disable the operating circuit and the manual operation in the event of loss of SF<sub>6</sub> gas below its permissible level. Such lock—out status shall be indicated outside of the switch with an indicator. The operating handle shall be also locked to prevent a possible manual operation in the field while line is still energized.

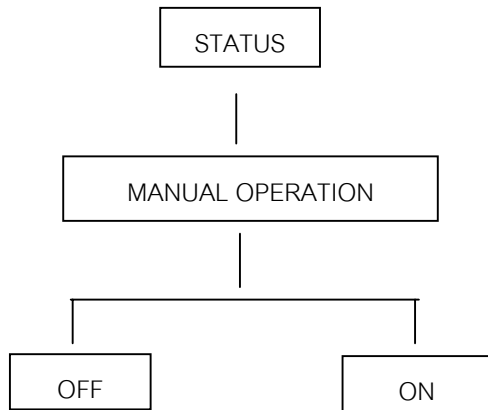
##### *4.5.2 Over-pressure Releasing Device*

The switch shall be equipped with a rupture disc, externally mounted on the switch, to release the pressure inside of the switch in a controlled manner in the event of an over pressured condition.

## 5. Switch Operation

### 5.1 Operating Sequence

Mode: Mechanical FREE



Pull downward the left side of manual operating handle the

Pull downward the right side of manual operating handle

### 5.2 Free / Lock operation

Free / Lock selection mode intended for, when “FREE” position, operation can operated the load break switch at normal function, but when select “LOCK” position the load break switch will not change any status and can not be command by anyway. The “FREE/LOCK” lever is installed at the load break switch tank.

### 5.3 Mechanical operation

This operation can be operated “ON” or “OFF” load break switch by hook stick to operate the handle at load break switch.

## 6. Maintenance Recommendations

### 6.1 General

At least once per year and before each operation, check the SF<sub>6</sub> gas pressure in accordance with the pressure listed in 4.2 above, re-pressurize if required. A fitting is provided on the tank for the addition of SF<sub>6</sub> if required. If leak detection becomes necessary, detectors which are sensitive to SF<sub>6</sub> are readily available.

## 6.2 Internal Maintenance

There is no internal maintenance required. However, if the switch must be opened, personnel should be instructed to take certain precautions. First, during any internal maintenance, the switch must be de-energized. The gas should be vented to the outdoor atmosphere or pumped through filters into a storage tank for re-use.

**Caution:** Gas venting on a switch should be channeled to an open area and allowed to freely disperse. Make sure adequate ventilation is provided for low-lying or enclosed environments to prevent oxygen displacement and possible asphyxiation.

## 6.3 Filling procedure

If the switch has lost some gas but has maintained a positive pressure, it need not be de-energized or vacuumed before re-pressurizing with SF<sub>6</sub>.

**Warning:** If the switch has not maintained a positive pressure, de-energized immediately and follow the entire filling procedure outlined below.

- a) The switch tank should be purged. Remove the pipe cap covering the valve, connect the vacuum pump, open the tank valve and evacuate the switch to less than -29 inches of mercury. Close valve vacuum pump. Fill switch to 10 psig with dry nitrogen or SF<sub>6</sub> having a dew point of less than -45 °C(-49 °F). After completing the fill vent and re-vacuum to less than -29 inches of mercury, close the valve and disconnect the vacuum pump. The switch is now purged.
- b) To refill the switch, purge air from the SF<sub>6</sub> gas supply line by allowing a small volume to flow before connecting to the switch. After making connection, set the gas regulator to 20 psig and pressurize the tank to the appropriate value as listed in 4.2. Close the tank valve, disconnect and recap the valve outlet. The switch is now filled.

**Note :** DO NOT attempt to exceed the specified pressure.

## 7. Minimum nameplate Information

- 7.1 Manufacture's name/country.
- 7.2 Type.
- 7.3 Manufacturer's serial number.
- 7.4 Year of manufacture.
- 7.5 Rated maximum voltage.
- 7.6 Rated frequency
- 7.7 Rated normal current.
- 7.8 Rated symmetrical interrupting current.
- 7.9 Rated short time withstand current, 1-second
- 7.10 Rated short circuit making current.
- 7.11 Rated power frequency withstand voltage, 1 min
- 7.12 Rated impulse withstand voltage.
- 7.13 Rated auxiliary voltage.
- 7.14 Total weight.

## 8. Test

### 8.1 Routine

The switches shall pass the routine tests in accordance with the latest IEC 265—1 and also gas leakage test has to be performed.

### 8.2 Type Tests

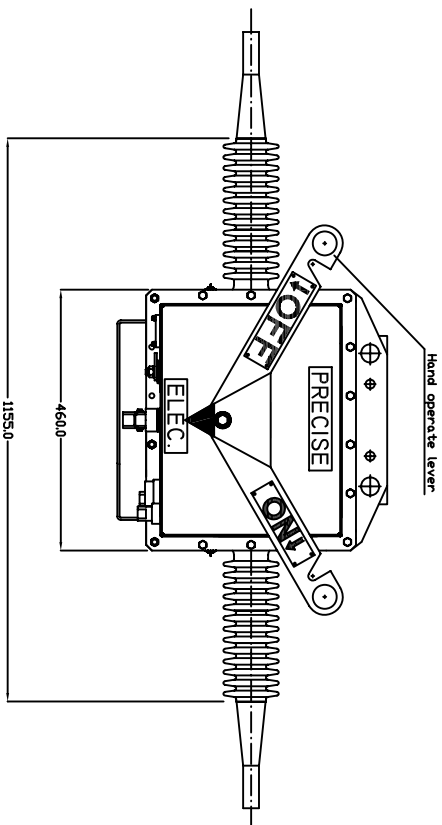
The switches shall have passed type tests in accordance with IEC 265—1 to demonstrate the switches comply with the ratings stated in IEC 694.

In addition to the above, 400 full load operations at 630 amp have been performed at the independent test facilities. (CESI in Italy)

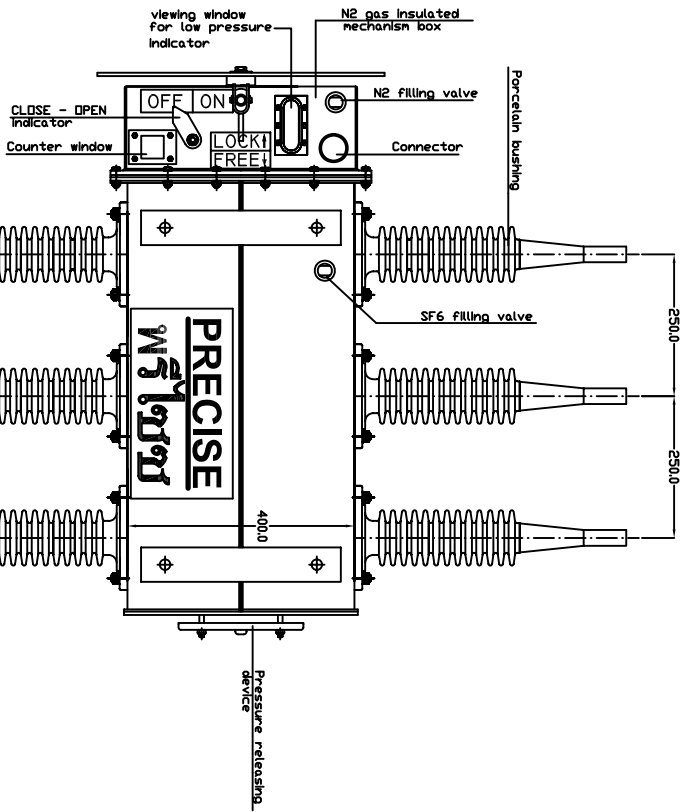
## 9. Packing

Each unit of the Switch with installation instruction and its accessories with parts list shall be seaworthy packed in an export crate or wooden case; but each set of accessories with parts list may be separately seaworthy packed in another wooden case to avoid damage during transportation.

**SIDE VIEW**



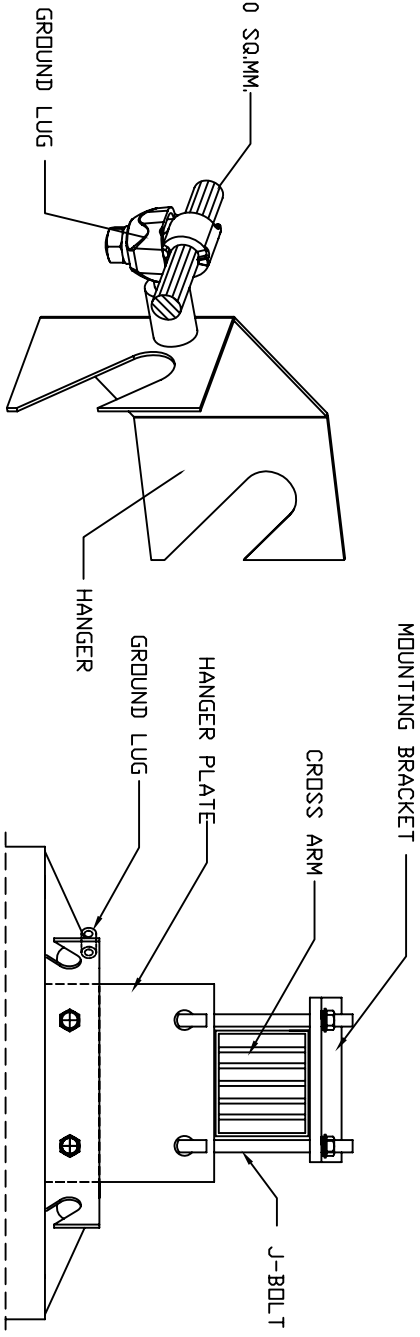
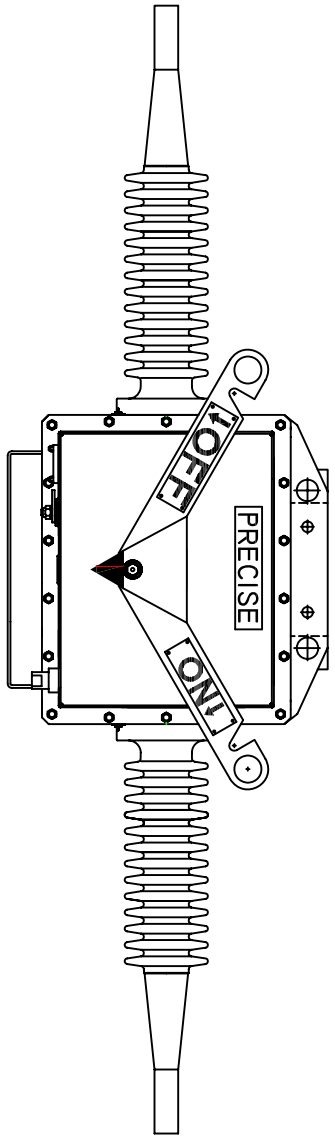
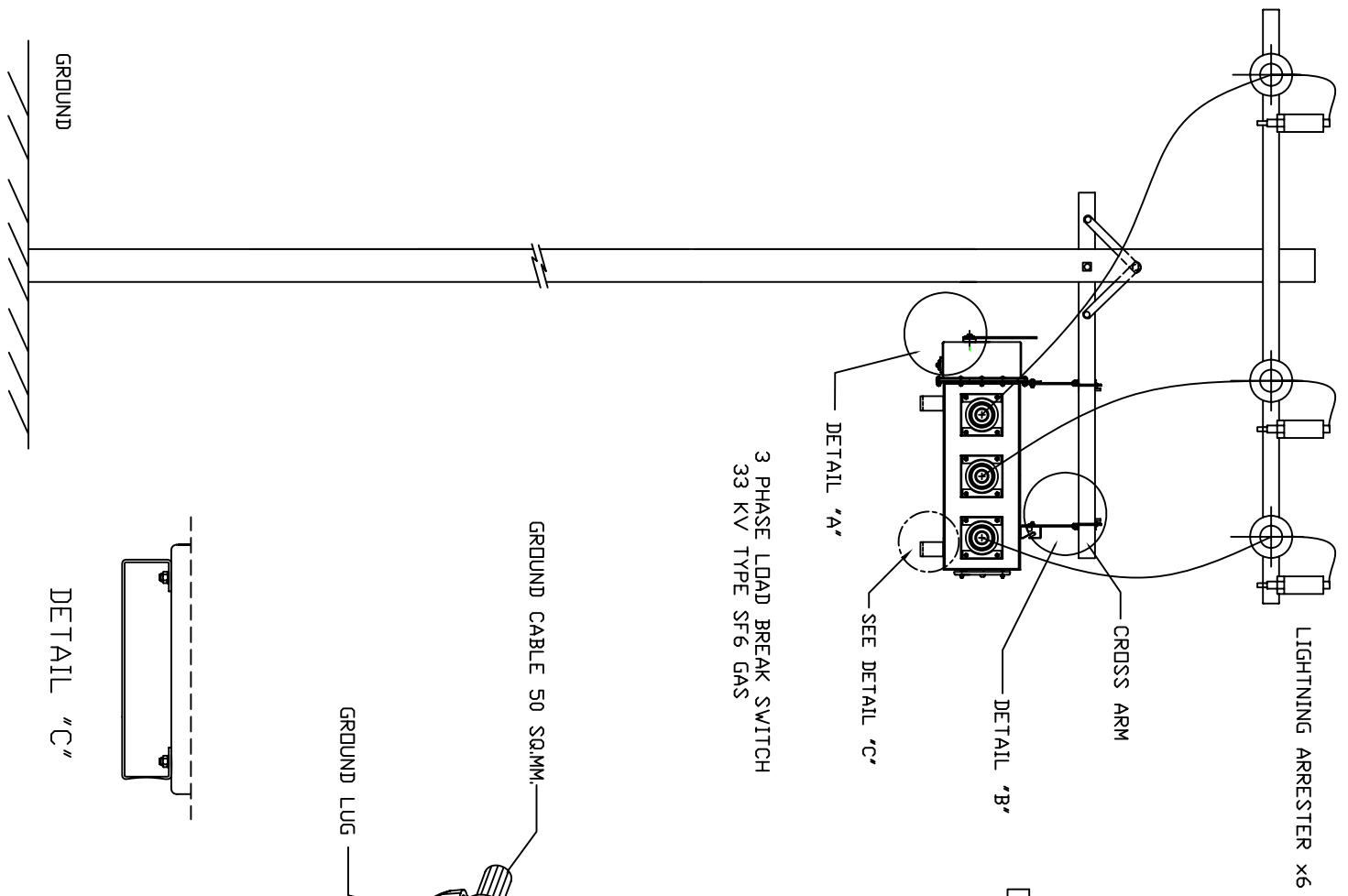
**FRONT VIEW**



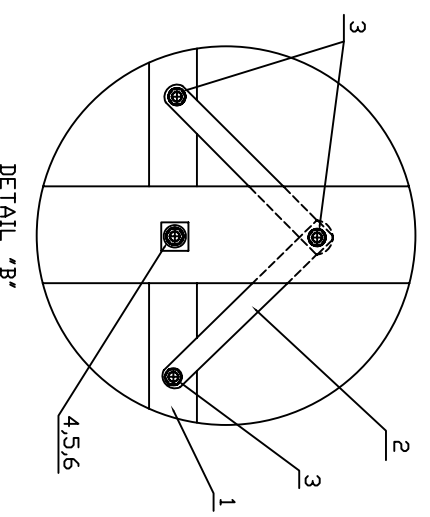
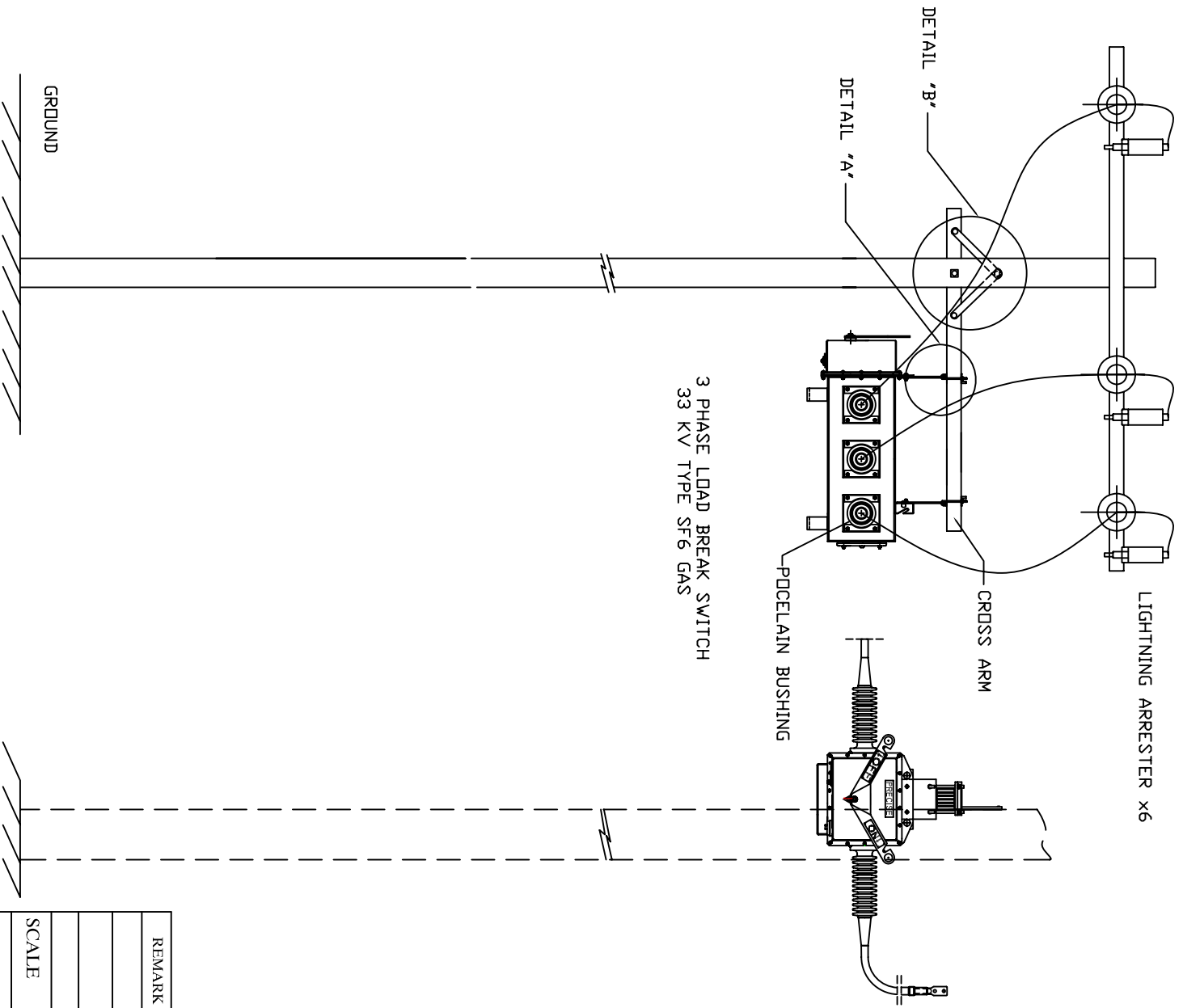
**BOTTOM VIEW**

NOTE : ALL DIMENSIONS ARE IN MILLIMETERS .  
DIMENSIONS IN TOLERANCE ±10%

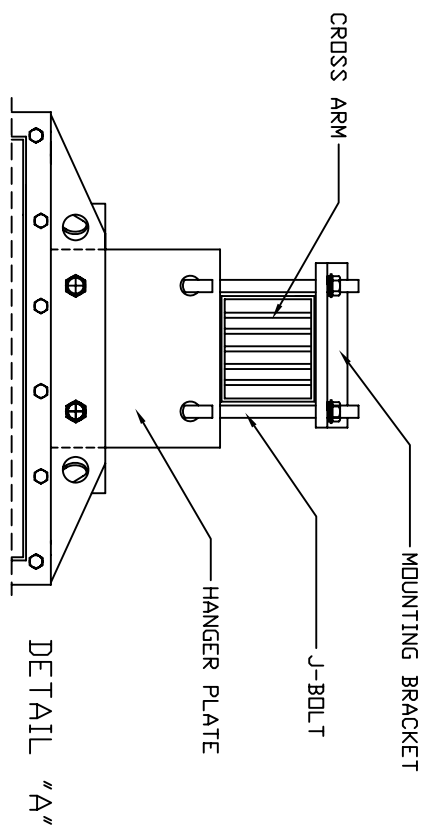
REMARK	REVISION	DRAWN BY	TITLE
	0	W. PRABHAKARIN	33 kV 400 A SF6 GAS LOAD BREAK SWITCH (TOGGLE OPERATION)
SCALE	NO SCALE	CHECKED BY	DWG NO.
		APPROVED BY	07-G-033-0001
		ISSUED DATE	SH NO.
MATERIAL		PRECISE ELECTRO - MECHANICAL WORKS	1/1



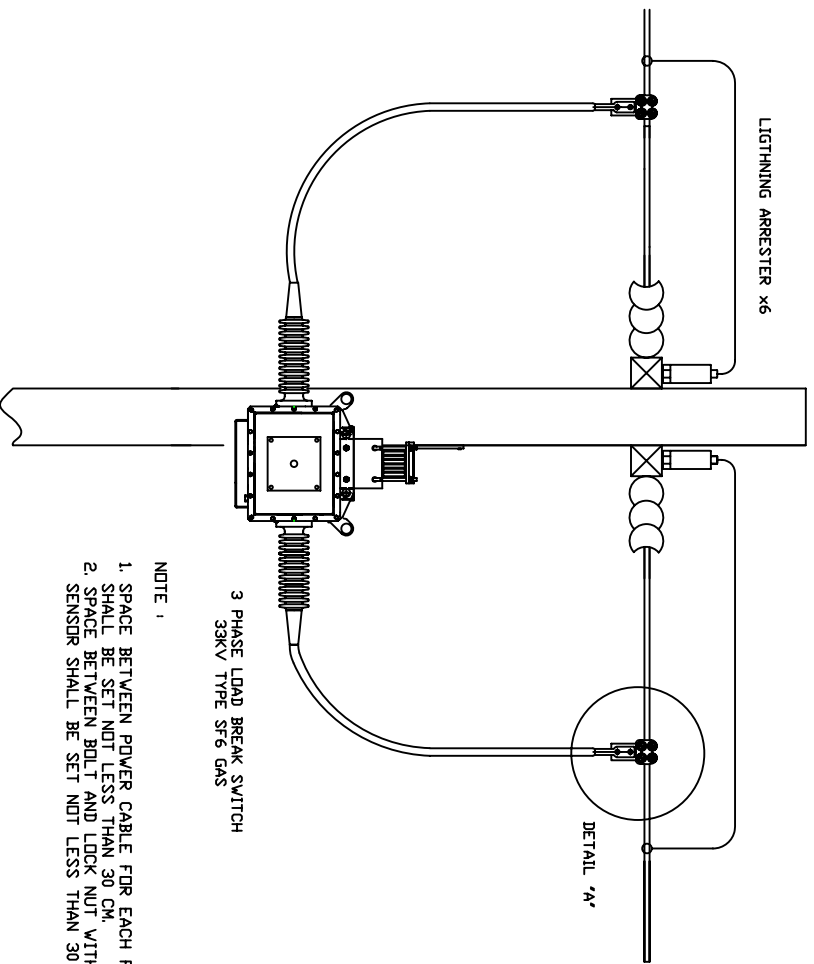
REMARK	REVISION	DRAWN BY	W. PRABHAKRIN	TITLE	POLE MOUNTING DETAILS FOR 33KV LOAD BREAK SWITCH (TOGGLE OPERATION) BY HOOK STICK
	0	CHECKED BY			
		APPROVED BY			
		ISSUED DATE			
SCALE	NO SCALE	PRECISE ELECTRO - MECHANICAL WORKS		DWG NO.	07-G-133-0002
MATERIAL				SH NO.	1/3



1. CROSS ARM SIZE 100X100X3.2 MM , LENGTH 2000 MM. (HOT DIP) 1 PC.
2. BRACE FLAT FOR CROSS ARM 30X6 MM , LENGTH 760 MM. (HOT DIP) 2 PCS.
3. BOLT MACHINE M16X130 MM. (HOT DIP) 3 PCS.
4. WASHER LOCK SPRING SIZE 16 MM. (HOT DIP) 1 PC.
5. BOLT MACHINE M16X350 MM. (HOT DIP) 1 PC.
6. SQUARE WASHER FLAT 52X52X4.5 MM. HOLE Ø18 MM. (HOT DIP) 2 PCS.

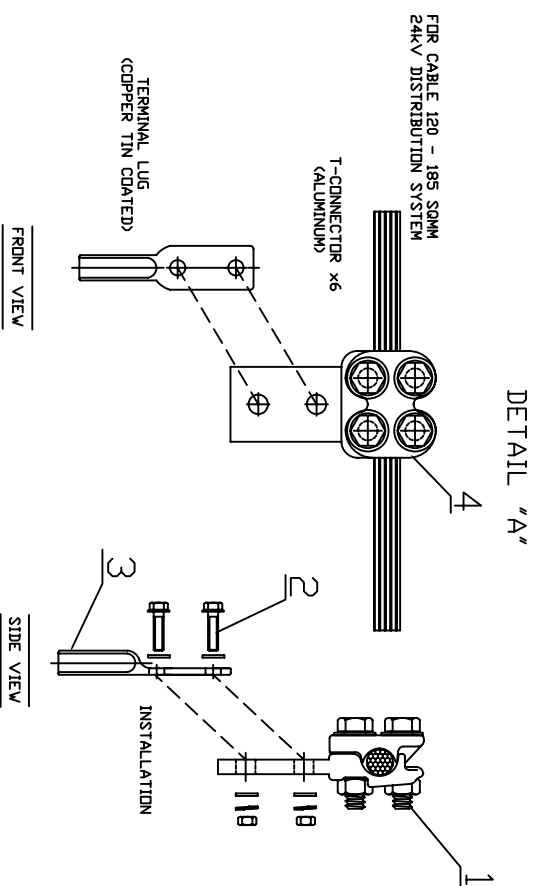


REMARK	REVISION	DRAWN BY	W. PRABHAKRIN	TITLE	POLE MOUNTING DETAILS FOR 33KV LOAD BREAK SWITCH (TOGGLE OPERATION) BY HOOK STICK	
	0	CHECKED BY		DWG NO.	07G-133-0002	SH NO.
		APPROVED BY		PRECISE ELECTRO - MECHANICAL WORKS		
		ISSUED DATE	APRIL 07, 2006	SCALE	NO SCALE	
MATERIAL						2/3



- NOTE :  
 1. SPACE BETWEEN POWER CABLE FOR EACH PHASE SHALL BE SET NOT LESS THAN 30 CM.  
 2. SPACE BETWEEN BOLT AND LOCK NUT WITH VOLTAGE SENSOR SHALL BE SET NOT LESS THAN 30 CM.

- NOTE :  
 1. LIGHTNING ARRESTER 21KV, 5KA, OR 24KV, 5KA, (NGR) OR DEPENP ON DISTRIBUTION SYSTEM.



- DETAIL "A" FOR CONNECTION
1. BOLT M12X40 SUS COMPLETE WITH ROUND WASHER , SPRING WASHER AND NUT M12 QTY. 4 SETS FOR CLAMP.
  2. BOLT M12X55 SUS COMPLETE WITH ROUND WASHER , SPRING WASHER AND NUT M12 QTY. 2 SETS FOR PAD.
  3. TERMINAL LUG 500 MCM , COPPER TIN COATED.
  4. TEE-CONNECTOR CAST ALUMINIUM FOR CONDUCTOR 120-185 SQ.MM.

REMARK	REVISION	DRAWN BY	W. PRABHAKRIN	TITLE	
	0	CHECKED BY		POLE MOUNTING DETAILS FOR 33KV LOAD BREAK SWITCH (TOGGLE OPERATION) BY HOOK STICK	
		APPROVED BY			
		ISSUED DATE	APRIL 07, 2006		
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MATERIAL				SH NO.	3/3