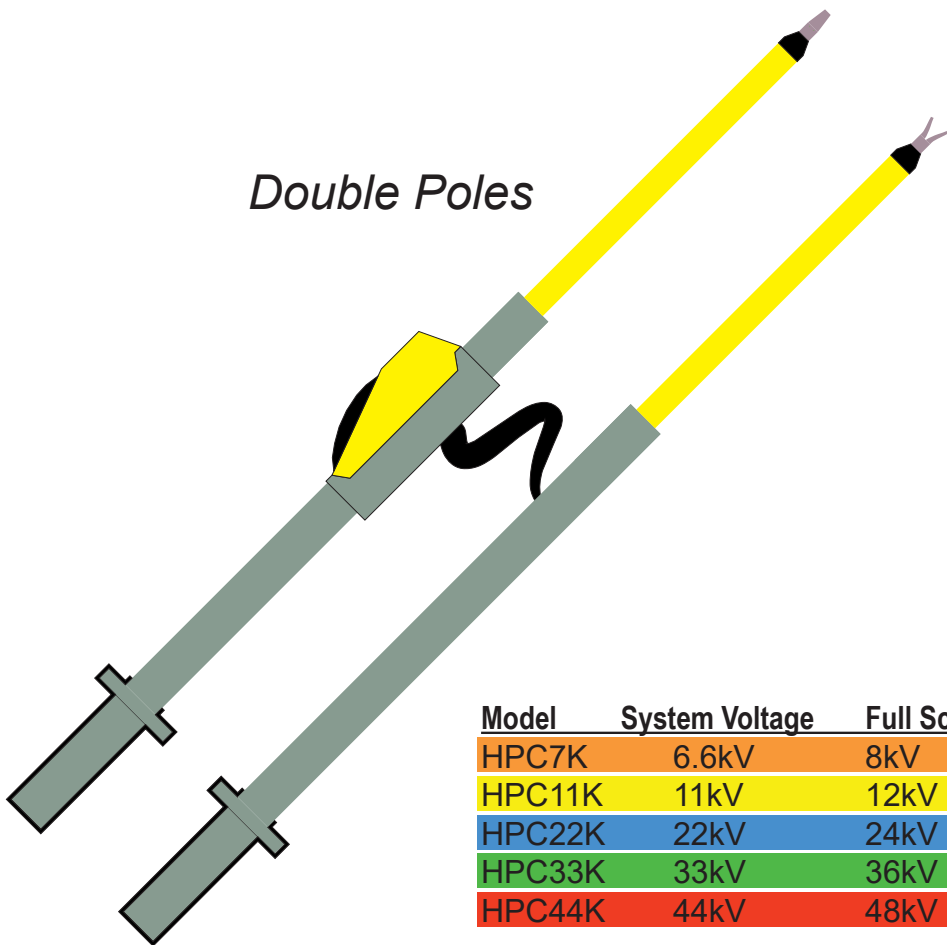


HIGH VOLTAGE PHASE COMPARATORS

Double Poles



USER'S MANUAL

INDEX PAGE

SAFETY RULES..... 1

GENERAL DESCRIPTION..... 2

PRINCIPLE OF OPERATION..... 2

PROVING THE PHASE COMPARATORS..... 3

LIMIT MARK..... 3

LABELS AND MARKING..... 4

RANGE OF MODELS..... 5

INSTRUCTION FOR USE..... 5

OPERATION..... 6

SPECIFICATIONS..... 7

SCALES..... 8

DIRECTIONS FOR USE..... 9

TESTING FOR PHASING PRESENCE..... 10

CARE AND MAINTENANCE..... 11

SAFETY RULES

- Only Personnel who are **fully trained** in the use of High Voltage Phase Comparators should use this equipment.
- Be aware that the system that it will be used on are powered from high voltages which are **lethal**.
- Before use, ensure that the Phase Comparators and any accessories are clean, free from cracks or deep scores, and are properly secured together.
- Only the proper rated Phase Comparators must be used. Ensure that the Phase Comparator is **properly rated for the voltage** of the system under test.
- Test the operation of the Phase Comparator **before and after each test**.
- Do not allow any part of the Phase Comparator except the contact electrodes to come in contact with energized or earthed items.
- **Safe Working distance** must always be observed.
- Safety insulated Gloves and protective clothing and glasses **must be wear** when using the Phase comparator.
- The Phase Comparator must only be handled by **one person only**.
- **Do not insert** the Phase Comparator beyond its limit mark into the apparatus under test. The Limit mark is the red band.
- The Phase Comparator should not be used as a synchronising Device or a voltage detector.
- The Interconnecting lead/cord must not be allowed to come within 4" (10cm) of the hand guard and must not be touched while testing.
- Before using the Phase Comparator in the testing of factory assembled switchgear, the manufacturer of the switchgear must be consulted as the suitability of the Phase Comparator in such testing.
- **Always check for Phase Presence before testing between Phases. Ensure that voltage is present on both phases before testing between phases.**
- The Phase Comparators are not to be subjected to a constant voltage for a period longer than 1 minute in every five minutes.

GENERAL DESCRIPTION

- The range of high Voltage Phase Comparators have been designed to comply and exceeds the requirements of VDE0681 Part 5.
- The Phase Comparators are double poles devices which are used to determine the correct Phase Relationship between two energized conductors of the same nominal Voltage and Frequency.
- Models are available to cover systems voltages from 1kV to 44kV 50/60Hz.
- For other systems voltage, please contact the factory.
- All models may be used indoor and outdoors in dry weather only.

PRINCIPLE OF OPERATION

- The range of Phase Comparators is a resistive device which comprise mainly of resistors, a neon and a panel meter. The Phase Comparator draw current from the circuit or source under test.
- The Phase Comparator consist of two inter-connected poles (the master pole with the panel meter and the slave pole).
- The Master pole carries the panel meter with the color coded scale and the integral neon light indicator.
- The color coded scale indicates "in-phase/out-of-phase" band on the scale. (Green = in-phase; Red=out-of-phase).
- The Neon light lit up when the voltage between the poles is greater than $\pm 1.2\text{kV} \pm 1.5\text{kV}$.
- If two energized conductors are out-of-phase and a contact electrode is touched onto each pole, current will flow between the conductors through the resistors (resistors are inside the fiberglass front end in each pole) in the poles and the interconnecting lead/cord. This will cause the neon to lit and the panel meter's indicator to move into the out-of-phase area (Red).
- If two energized conductors are in-phase and a contact electrode is touched onto each pole, current will not flow between the conductors through the resistors in the poles and the interconnecting lead/cord. This should not cause the neon to lit and the panel meter's indicator to move. The indicator will stay into the in-phase area (Green).
- **Ensure that voltage is present on both phases before testing between phases.**

PROVING THE PHASE COMPARATORS

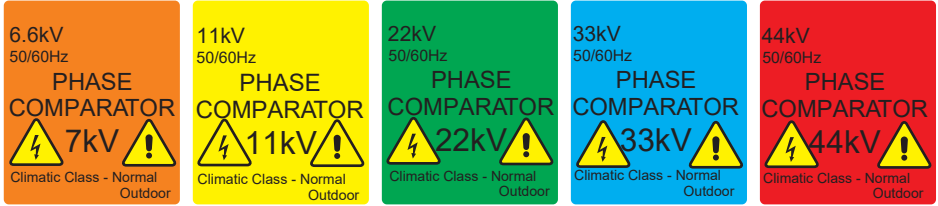
- **Before and after** using a Phase Comparator and accessories, a functional test should be performed on the Phase Comparator as It is to be used on the source or circuit to test.
- **A High Voltage Insulation tester can be used for this purpose.**
- When using a High Voltage Insulation tester, the Phase Comparator will indicate the voltage generated by that H.V. Insulation tester.
- Please note that H.V. Insulation testers are generating DC voltage and have polarity.
- The range of Phase Comparators are using a ½ bridge rectifier and current only pass one way into the panel meter. However, the neon must lit both ways.
- When proving with a DC source as with a H.V. Insulation tester, the poles must be tested for both polarity to confirm that the panel meter only show voltage in one way, but confirm that the neon indicates both polarity.
- The reading on the High Voltage Insulation tester also indicate the total value of the resistor chain and is also a good indication that the circuit is still correct and in good condition (See specifications).
- A Proving Unit can also be used if a High Voltage Insulation Meter is not available. The Proving unit does not indicate how many mega ohms are in the front end or if the circuit is still in good condition or not. The Proving unit only output a DC voltage of 5kVdc.

LIMIT MARK

- Each Phase Comparator has two poles.
- Each pole has a front end which is in Fiberglass tubing.
- Each pole has aKandle section.
- At the junction between the handle section and the front end section, there is a RED BAND which is the limit mark.
- By definition, this mark, or the Red Band, indicates the physical limit to which the poles of the Phase Comparators may be inserted between live components or may touch them.

LABELS AND MARKING

The following labels must be present on the Master Pole.



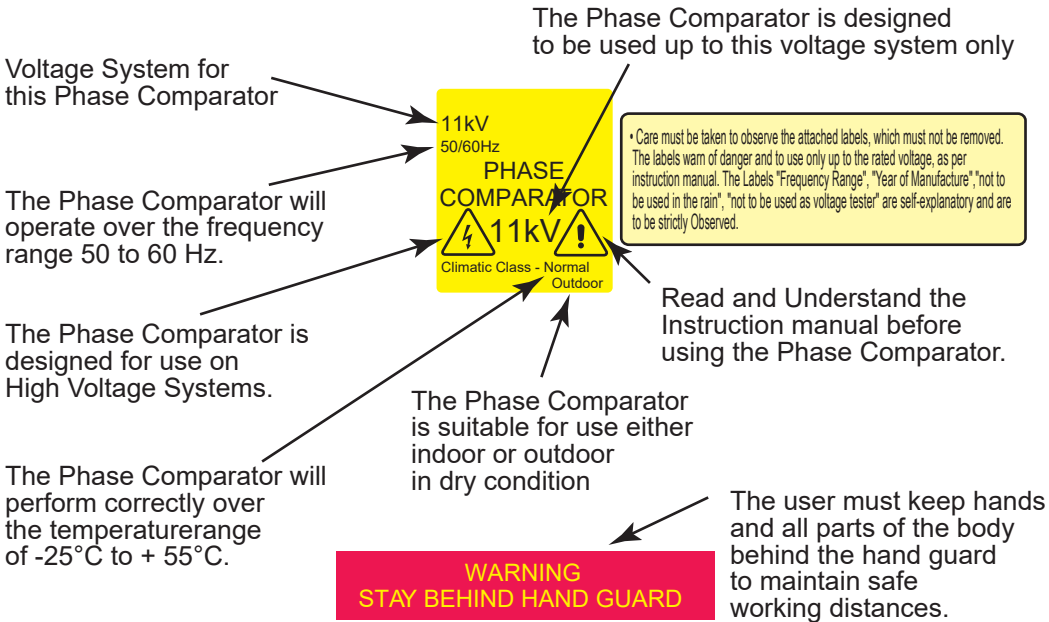
CONFORMS TO DIN VDE 0681/5

The following labels must be present on BOTH Poles.

NOT FOR USE IN RAIN

CAN BE USED AS A VOLTAGE TESTER

6.6kV DANGER: USE ON SYSTEMS UP TO 6.6kV ONLY AS PER INSTRUCTION MANUAL	11kV DANGER: USE ON SYSTEMS UP TO 11kV ONLY AS PER INSTRUCTION MANUAL	22kV DANGER: USE ON SYSTEMS UP TO 22kV ONLY AS PER INSTRUCTION MANUAL	33kV DANGER: USE ON SYSTEMS UP TO 33kV ONLY AS PER INSTRUCTION MANUAL	44kV DANGER: USE ON SYSTEMS UP TO 44kV ONLY AS PER INSTRUCTION MANUAL
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RANGE OF MODELS

- Models are available to cover system voltages from 1kV to 44kV @50 or 60Hz.
- Contact the factory for information on models suitable for other voltages.
- The following models are available as standard instruments:

Model N°	System Voltage	Full Scale Voltage	Maximum Voltage	Display Type
HPC7K	6.6kV	8kV	9kV	Neon Panel Meter
HPC11K	11kV	12kV	15kV	Neon Panel Meter
HPC22K	22kV	24kV	30kV	Neon Panel Meter
HPC33K	33kV	36kV	40kV	Neon Panel Meterr
HPC44K	44kV	48kV	55kV	Neon Panel Meter

INSTRUCTION FOR USE

- Before using the Phase Comparator, clean the Front End (FiberGlass) with a polymer polish.
- All models do not require batteries and are being signal driven (current taken from the source or circuit under test) and do not require arming. However, it is recommended that a functional test be carried out using an High Voltage Insulation tester or a proving unit.
- To prove the Phase Comparator, set the voltage on the Proving unit or on the High Voltage Insulation tester, to suit the model of Phase Comparator. Turn the test "ON" or the proving unit "ON". The Neon should lit (if the voltage if high enough) and the indicator should move nearest the voltage measured.
- Reverse the poles of the Phase Comparator and check that an out-of-phase indication is given.
- They are no user serviceable parts on our range of Phase Comparators. Should the Phase Comparator become damaged, please consult with your nearest distributor to return it to the factory.
- There must be galvanic contact between the test electrodes and the part of the installation under test and no other part of the phase Comparator, except the electrodes, should be in contact with energized or earthed parts, in order to ensure accuracy of the display.

OPERATION

To determine the correct phase relationship between two energized conductors, the following procedure should be followed:

- **First, Check that each Phase to be compared is individually energized.**

1. With one handle held in each hand, touch one bare conductor (first phase which will be compared later) with one contact electrode and touch the earth with the other contact electrode.

2. The Neon will operate and the meter pointer will indicate the Red out-of-phase band indication which indicate that this phase is energized. The voltage scale will indicate the voltage phase-to-Earth or/and the percentage of the full scale.

3. Repeat the operation 1 and 2 with the other bare conductor (the other phase to be compared later) so that it is known that both Conductors are energized.

- Now, you should know if both conductors are energized because you will have read the voltage Phase-to-Earth of both conductors.

- If both phases are not energized, then, the remedial action will have to be carried out before proceeding to the next stage of the Test.

- **Compare the Phases.**

- If both Phases are energized (after checking between Phase and Earth that they are energized) proceed to compare between the phases.

- Now touch each bare conductor (each phase to compare) with a contact Electrode.

- If the conductors (Phases) are in-phase, the neon will not lit and the meter pointer will not operate or the meter pointer will stay in the Green band.

- If the conductors (Phases) are out-of-phase, the neon will lit and the meter pointer will operate or the meter pointer will go in the Red band.

SPECIFICATIONS

Safety Standard: IEC 61481

	A	B	C	D	E
Total Resistance	4.48M ohm	6.78M ohm	10.82M ohm	19.68M ohm	26.8M ohm
Response time	<1Sec	<1Sec	<1Sec	<1Sec	<1Sec
Neon Threshold	1.2kV	1.2kV	1.2kV	1.2kV	1.2kV
Neon Lit Fully @	1.5kV	1.5kV	1.5kV	1.5kV	1.5kV

Mechanical

	A	B	C	D	E
Length of Handle	30"	30"	30"	30"	30"
Length of Front					
End (Fiberglass)	15.75"	15.75"	19.7"	26.2"	32.3"
Total Length	46.25"	46.25"	50.2"	56.7"	62.8"
Total Weight	4.6lbs	4.6lbs	4.9lbs	5.3lbs	5.5lbs
Handle Material	Composite Material with Polyurethane				
Front End	Fiber Glass Wound Tubing				

Vibration Resistance: tested in accordance with IEC 68-2-6

Drop Resistance: tested in accordance with IEC 68-2-32

Bump: tested in accordance with IEC 68-2-2

Impact: tested in accordance with IEC 1010 Clause 8.2

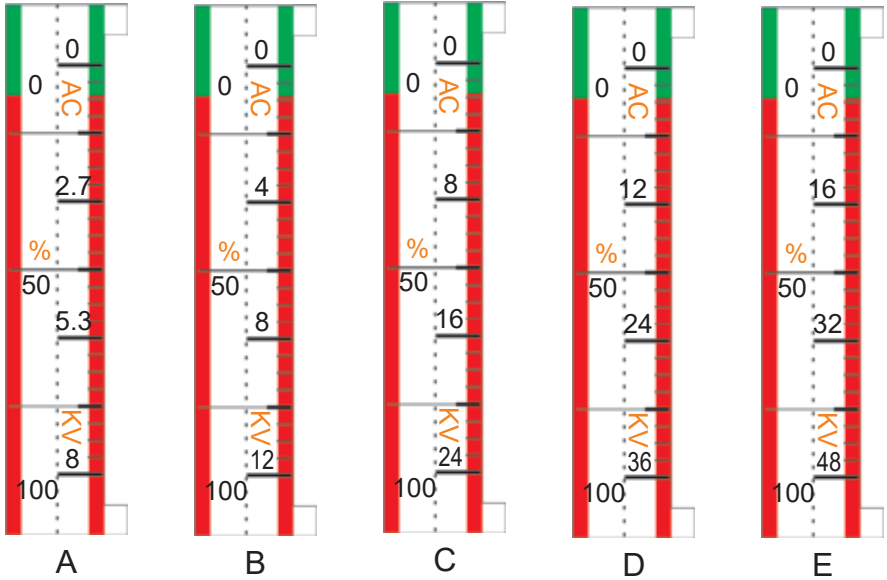
Environmental

Operating temperature: -25°C to +55°C

Operating Humidity: 20 to 96% RH.

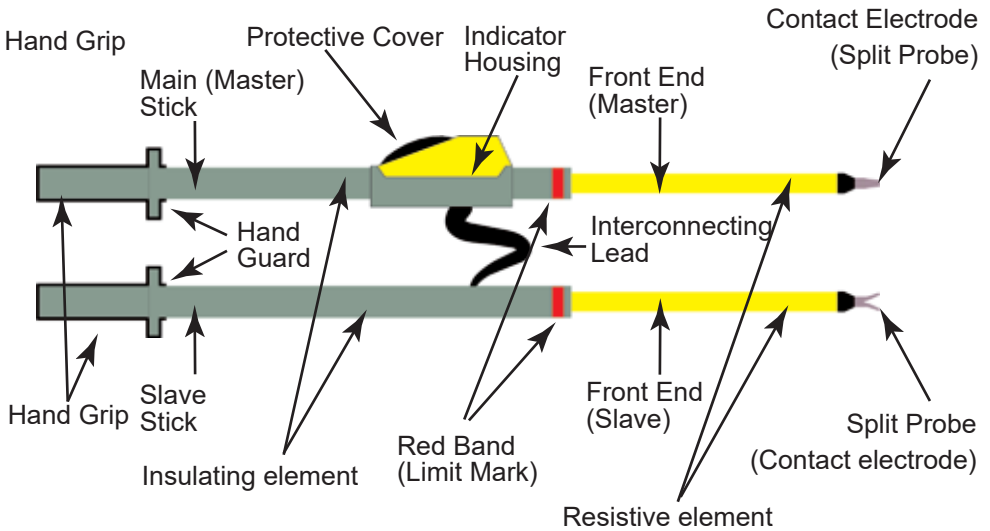
SCALES

Special Scales and configuration can be manufactured on a case by case basis. Contact the factory with your requirements.

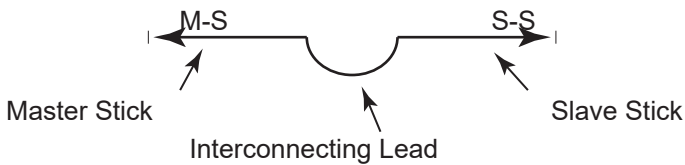


DIRECTIONS FOR USE

It is the user's responsibility to ensure that only competent personnel with the necessary knowledge and training use and handle this equipment. Before using the Phase Comparators, it is recommended to check them with an High Voltage Insulation tester. For Phasing, it must be ensured that both feeders are in a live condition of the same voltage and in a stable state before commencing the phasing tests. The Phase Comparators consist of two interconnected parts; these are the Master Stick, containing the indicator housing. The second stick is referred to as the slave.

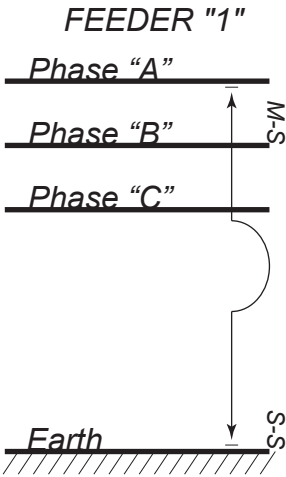


REPRESENTATION FOR EXPLANATION PURPOSE



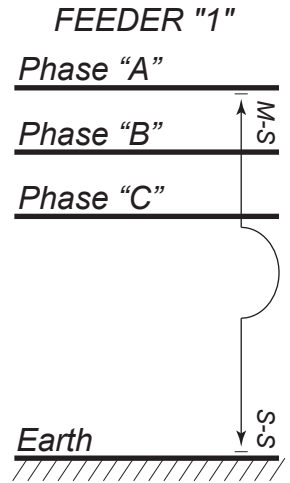
TESTING FOR PHASE PRESENCE

Before doing the Phase Comparison test, you must ensure that the feeders to be compared are live.



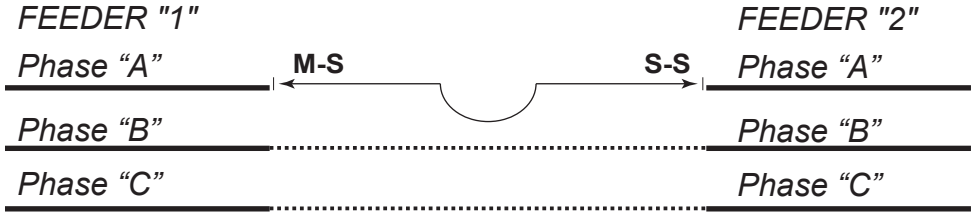
Example: Preparing to Compare two Phases From different feeders Check that both phases to be compared are Live and have the Same amplitude.

To Check Phase Presence, measure the Voltage between Phase and Earth. The result will confirm that voltage is present and that the amplitude are the same.

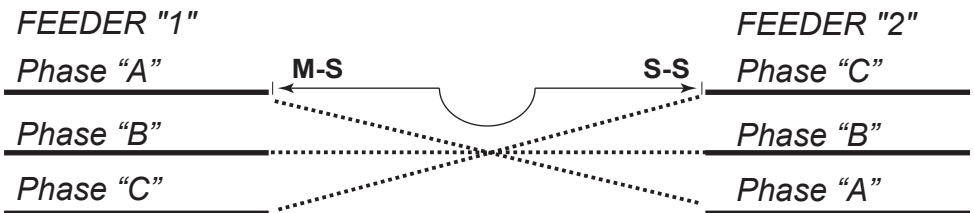


TESTING FOR PHASING

No Indication - Neon OFF (does not lit) = IN PHASE



Indication - Neon ON (does lit) = OUT OF PHASE



Note that the links must be arranged so that the phases are Connected in Phase, as indicated by the dotted lines.
Do Not Use Phasing Sticks unless you have been fully trained In High Voltage work and understand the system.

CARE AND MAINTENANCE

- **Storage:** The Phase Comparator and it's accessories should be stored in the carrying case/bag when not in use.
- **Transporting:** When the equipment is in transit it should be stored in its carrying case/bag. While the equipment has been designed for field use it should not be subjected to excessive bumps and shocks.
- **Cleanliness:** Dirt can cause surface tracking and it's therefore necessary to keep the Phase Comparator and its accessories clean by washing them in mild detergent solution. All parts should be cleaned with the appropriate liquid.
- **Mechanical Damage:** If surface scratches or dents can easily be seen by the naked eye, then the equipment should be returned to the factory of your nearest distributor for repairs since these blemishes act as traps for dirt and moisture. Mechanical damage would also necessitate the return of the equipment to the manufacturer.
- **Reccalibration and Proof Testing:** Every twelve months the Phase Comparator and it's accessories should be rechecked. This would include checking the threshold level of the neon, voltage proof testing in factory or accredited laboratory and pressure testing of the panel meter housing.

Please note that there are no internal user replaceable parts.

**The Phase comparator must always be clean and dry
before use and during use.**