

## **OPERATION**

**KEEP HANDLE PORTION OF TOOL CLEAN AND DRY. MAINTAIN WORKING CLEARANCE BETWEEN HANDS AND SPLICES AND CABLE.**

The Phasing Tool is equipped with a cable reel on which the cable between the two resistor sections is stored. When in use, only the length of cable necessary to permit the contacts to reach between the points of measurement should be used. Any remaining cable length should be kept wound on the reel.

Safety: Cables are in better control and less likely to swing too close to personnel, structures or other conductors if they are not permitted excess sag.

The handle sections are foam core Epoxiglas 8 feet long to provide adequate clearance from the resistor sticks and ease of handling the tool. **MAINTAIN WORKING CLEARANCE BELOW SPLICE AS REQUIRED BY UTILITY RULES.**

**RESISTOR ENCLOSURE PORTION WILL PUNCTURE ABOVE 40kV. KEEP THIS PORTION CLEAR OF CONDUCTORS, STRUCTURES AND GROUNDS.**

This tool is not intended for continuous contact application. Tests at full voltage for 30 minutes produced no damage although heating of resistors did occur. Contact should be limited to the time required to note the meter indication.

To measure line-to-ground voltage, the section on which the meter is mounted should preferably be used at the ground potential contact to minimize stray capacitance influence on the meter. On line-to-line measurements, contact is made to each phase conductor keeping connecting cable as far as possible from other conductors, grounded or metal structures and away from contact with platforms or personnel. This is to avoid puncturing and/or damage to this tool and to guard against shock.

In tying two energized 3-phase feeders together where it is necessary to match phases, voltage measurements must be made between a conductor of one circuit and each of the conductors of the second circuit. This procedure is followed for each phase to avoid connecting phases in reversed rotation. Re-check the third phase just before making the final connection to assure proper phase relationship. With matched phases, one may expect the voltage indication to be near zero. More often a voltage will be indicated due to phase shift at the point junction in remotely energized circuits and/or unequal voltage drop. Proper connections can readily be determined by the meter indications. Preliminary phase to phase measurements of each circuit are recommended to determine proper voltages are being joined.

In substations, bus and switchgear cubicles or other crowded areas where electrical fields are of greater intensity, extra precaution is recommended to avoid disturbing influences affecting meter indications and to avoid contact of the tool enclosures and cable with personnel and/or station grounds, other busses or apparatus. **WATCH CABLE CLEARANCE.**

Under some circumstances, such as wind or close clearances, a hot line hand tool may be used to help control cable position particularly for the longer reaches.

## **CARE**

This is both a hot line tool and a delicate electrical instrument. If you take care of it, this instrument should provide years of safe, trouble-free service. Abuse or misuse may damage the resistors or the sensitive meter. Store in a dry location, protect from rough jostling when carrying or using instrument.

The instrument cable insulation is for mechanical protection since its insulation value is only 15kV. Therefore cable **MUST BE POSITIONED AWAY FROM CONDUCTORS, GROUNDS AND PERSONNEL. OBSERVE WORKING CLEARANCE FOR VOLTAGE BEING MEASURED FOR CLEARANCE OF CABLE.**

# Care and Operation of



## Phasing Testers

Catalog No. H1876, H1876-1, H1876-7

T403-2261, T403-2311 & T403-2557

## Phase Rotation Tester

Catalog No. H1879

## Extension Resistors

**for 48kV & 80kV**

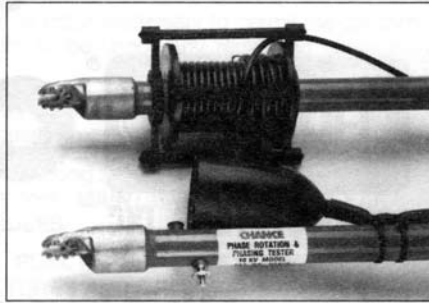
Catalog No. H1876-4 & H1876-2  
use with 16kV models

C403-0457, C403-0458

NOTE: Because Hubbell has a policy of continuous product improvement, we reserve the right to change design and specifications without notice.

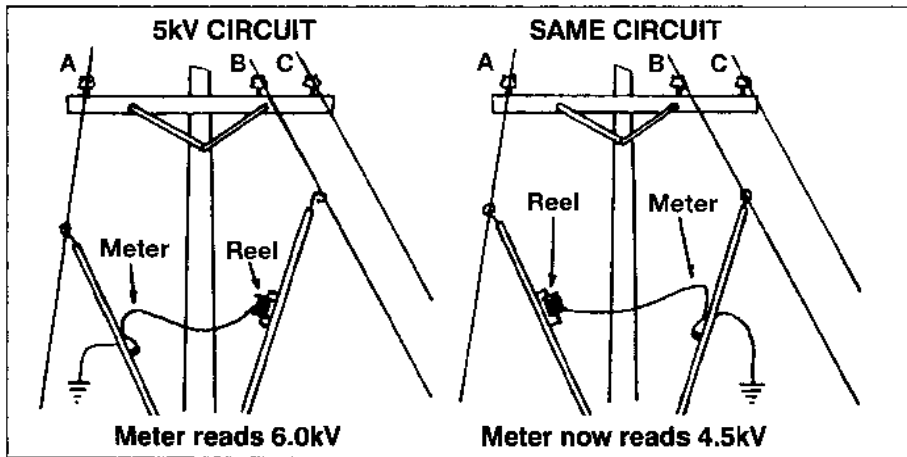
## H1879 PHASE ROTATION TESTER INSTRUCTIONS FOR USE

The H1879 testers are used to determine phase rotation relationship on circuits of 4160 V to 16kV. By the use of our extension resistors, H1876-2 and H1876-4, installed per details on page 2, paragraphs 4 and 6, the unit can be used on circuits through 69kV.



1. On delta systems, first check each phase to ground. If one phase is grounded, use the other two. If not, or on Y systems, use any two phases.
2. Connect a grounded lead to the terminal below the meter before determining phase rotation.
3. Touch the hook of the meter stick to one phase and the hook of the reel stick to the other phase and read the meter. Reverse the meter and reel sticks on the same two conductors and read the meter. Can be used as a standard phasing tool by omitting the ground connection to the stud. **CAUTION: DO NOT ALLOW ANY PART OF THE TESTER OTHER THAN THE HOOKS TO TOUCH LINES OR GROUNDS.** See additional caution information in operation manual for Phasing Tool 1876.

### EXAMPLE:



4. Note which of the two conductors produces the lowest reading when contacting at the meter stick . . . conductor B in example above.
5. Using this conductor (B) as the starting point, rotation in the example above is to the untouched conductor (C), and from that to the remaining conductor (A).

Points to remember:

1. Does not identify specific phases.
2. Selects phases in "Positive Sequence."
3. Can be used as a standard Phasing Tool

## CHANCE PHASING TOOL

CAUTION: Do not drop tool as accuracy may be impaired.

### DESIGN

The Chance Phasing Testers are portable devices which permit the checking of AC voltages on distribution and transmission circuits from 1.0kV to 161kV for the purpose of determining phase relationships and the approximate voltage line-to-line or line-to-ground of the circuits. When used above 15kV, extra caution is required to maintain working clearance for the higher voltage.

The basic instrument, Cat. No. H1876-1, is designed for voltages up to 16kV read directly on the black scale of the meter. This unit consists of two high impedance units of approximately 6.12 megohms each housed in the contact ends of the two "Epoxyglas" housings. These resistance units are encapsulated in a suitable compound epoxy to protect them from mechanical damage and to prevent moisture penetration or accumulation around the resistors. The remainder of the handle is foam filled to prevent moisture accumulation.

Between the two resistor units there is a milliammeter and a connecting cable with 15kV insulation. The resistors limit current values to less than  $1\frac{1}{4}$  milliamperes at maximum voltage rating across the probes. Capacitance current to ground through the cable insulation depends upon area of ground contact. A 4-inch contact pad provided a capacitance current of less than 40 micro-amperes (0.04 milliamperes) at full voltage. This is below perception levels. Current to ground resulting from cable insulation failure or damage is limited to less than  $1\frac{1}{2}$  milliamperes by the resistors.

For use on lines up to 48kV, two extension sticks, Cat. No. H1876-4, are available, increasing the voltage range to 48kV. With these extensions installed with one on the meter stick and one on the reel stick, the scale on the meter is multiplied by 3. These sticks each house resistor units of approximately 12.24 megohms.

**WHEN USED ON HIGHER VOLTAGES OBSERVE ADDITIONAL WORKING CLEARANCE FOR THE INCREASED VOLTAGE FROM HANDS TO LINE PARTS. (EPOXYGLAS RESISTOR HOUSINGS, UNIVERSAL FITTINGS METER, AND CABLE).**

For voltages to 80kV, add a second pair of H1876-4 extensions, installed with two on the meter stick and two on the reel stick and multiply scale by 5, or remove the first pair of H1876-4 extensions and replace with a pair of H1876-2 extensions (installed with one on the meter stick and one on the reel stick).

The space surrounding these resistors is also filled with epoxy compound for mechanical and moisture protection. Current through the connecting cable is limited to  $1\frac{1}{2}$  milliamperes maximum at full voltage across contacts or through damaged cable insulation to ground at the cable with full voltage across the contacts. Capacitance currents to a 4" contact outside the cable insulation was less than 350 micro-amperes (0.35 ma.). This value of current is harmless but is well above the perception point. For this reason, particular care should be taken to avoid contact with the connecting cable.

### OPERATION OVERHEAD

**KEEP RESISTOR PORTION OF TOOL CLEAN AND DRY, MAINTAIN WORKING CLEARANCE BETWEEN HANDS AND METER AND CABLE BY USING PROPER LENGTH UNIVERSAL POLES.**

The Phasing Tool is equipped with a cable reel on which the cable between the two housings are stored. **In use only the length of cable necessary to permit the contacts to reach between the points of measurement should be used. Any remaining cable length should be kept wound on the reel.** There are two reasons for this:

1. Cable insulation is limited to 15kV for light weight and ease of handling. This is adequate for momentary contact with ground of 15kV conductors but damaged insulation may result

in an uncomfortable shock if personal contact is made at a damaged area. At higher voltages, insulation puncture may result.

#### **KEEP CABLES FROM CONTACT WITH OTHER MATERIAL OR PERSONNEL**

2. Meter indications will be affected and error introduced by the capacitance to ground between the cable and grounded structure, moist concrete or the earth. Other conductors will also influence meter indications if the cable is allowed to touch or come in close proximity to these conductors.

#### **RESISTOR ENCLOSURE PORTION WILL PUNCTURE ABOVE 40kV. KEEP THIS PORTION CLEAR OF CONDUCTORS, STRUCTURES AND GROUNDS.**

This tool is not intended for continuous contact application. Tests at full voltage for 30 minutes produced no damage although heating of resistors did occur. Contact should be limited to the time required to note the meter indication.

To measure line-to-ground voltage, the section on which the meter is mounted should preferably be used at the ground potential contact to minimize stray capacitance influence on the meter. On line-to-line measurements, contact is made to each phase conductor keeping connecting cable as far as possible from other conductors, grounded or metal structures and away from contact with platforms or each contact (Fig. 1). As before noted, this is to avoid influence which may distort meter indications.

In tying two energized 3-phase feeders together where it is necessary to match phases, voltage measurements must be made between a conductor of one circuit and each of the conductors of the second circuit. This procedure is followed for each phase to avoid connecting phases in reversed rotation. Re-check the third phase just before making the final connection to assure proper phase relationship. With matched phases one may expect the voltage indication to be near zero. More often a voltage will be indicated due to phase shift at the point junction in remotely energized circuits and/or unequal voltage drop. Proper connections can readily be determined by the meter indications. Preliminary phase-to-phase measurements of each circuit are recommended to determine proper voltages are being joined (Fig. 2).

In substations, bus and switchgear cubicles or other crowded areas where electrical fields are of greater intensity, extra precaution is recommended to avoid disturbing influences affecting meter indications.

#### **OPERATION-UNDERGROUND**

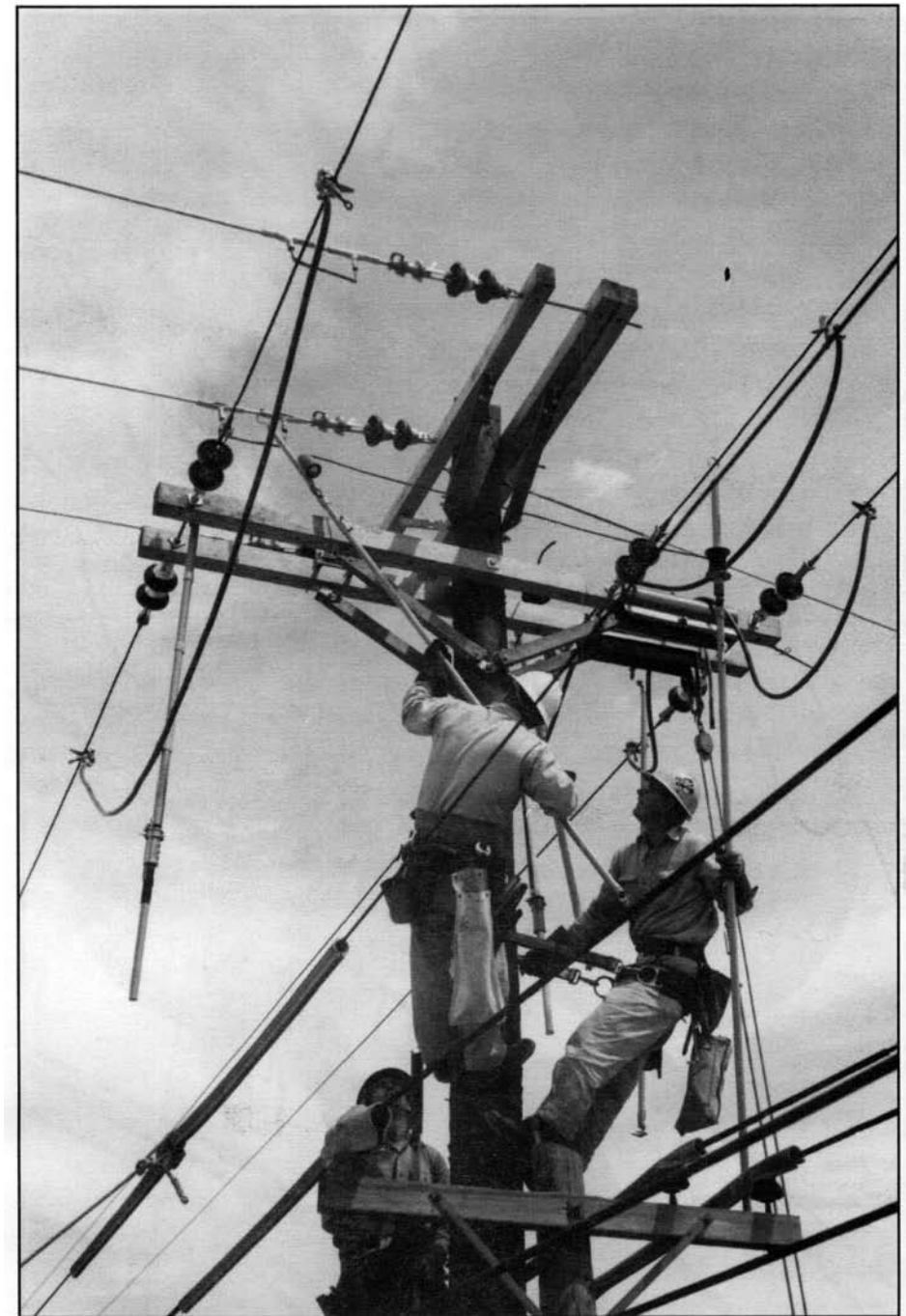
When using the phasing tester on underground systems, the same basic rules and procedures apply as with overhead, for example, maintaining proper working clearances to all parts of the tool, keeping tool clean and dry, keeping clear from contacting energized or grounded surfaces, etc. However, there are some additional considerations when using the tool on underground equipment.

#### **DO NOT USE ANY PROBES ON THE PHASING TESTER WHEN TESTING LIVE-FRONT URD EQUIPMENT.**

Due to the close proximity of energized parts and grounded surfaces, no probes should be used when using the phasing tester on live-front URD equipment. Should any probes be used, they could either bridge from phase-to-phase or phase-to-ground or sufficiently reduce clearance to cause flashover. Therefore, the probes must be removed from the tool. NOTE: A small hex head machine screw (1/4-20-3/8 long) could be inserted to protect the female thread.

#### **USE PROPER ELBOW ADAPTERS AND/OR BUSHING ADAPTER WHEN TESTING DEAD-FRONT URD EQUIPMENT.**

Before the tool is used to test elbows or bushings on dead-front URD equipment, the overhead probes must be removed and the proper adapters substituted.



**FIGURE 1 - Phasing to determine B to B phase.**

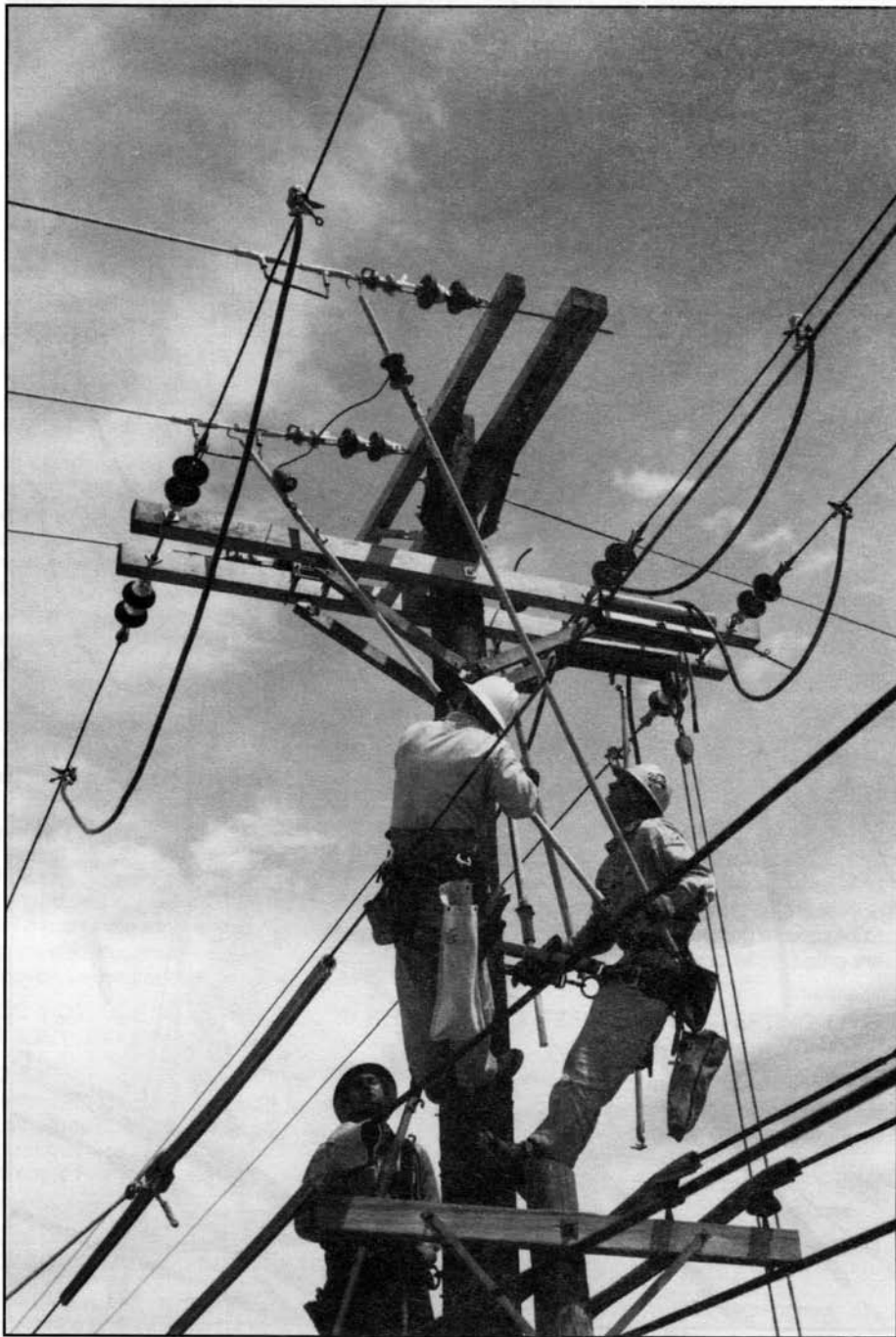
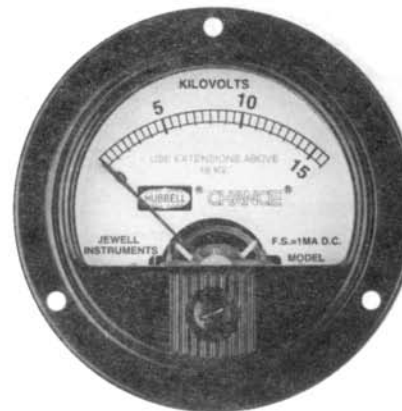
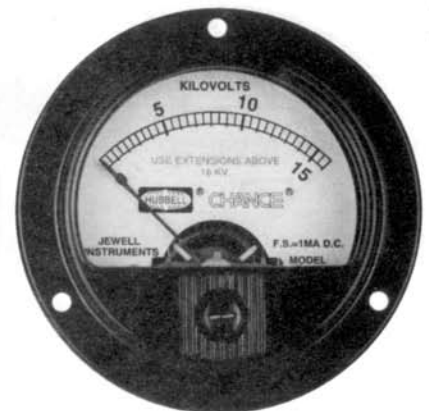


FIGURE 2 - Checking Tester and reading line voltage.



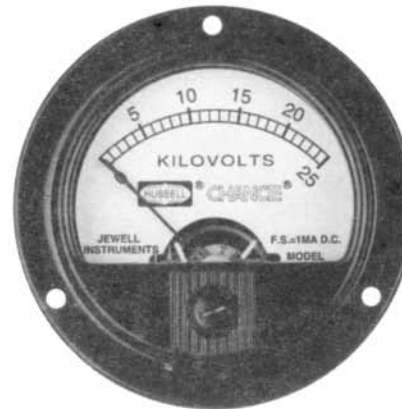
H1876-1  
16kV



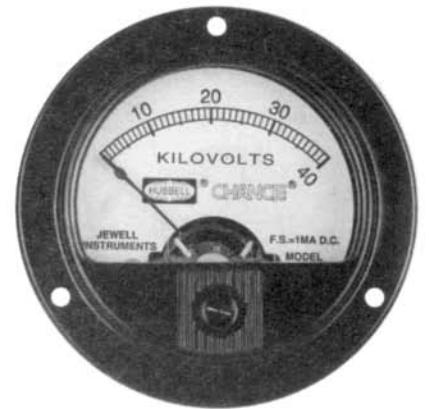
H1879  
16kV

**NOTE:**

With no extensions, scale is direct reading.  
 With one PAIR of H1876-4 extension multiply by 3.  
 With two PAIRS of H1876-4 extension multiply by 5.

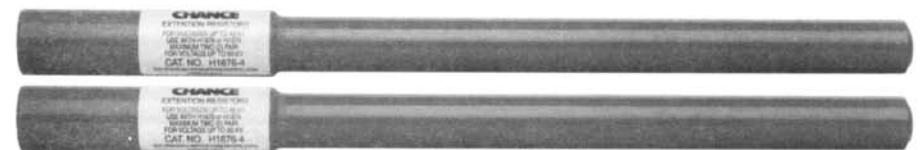


T403-2261  
25kV

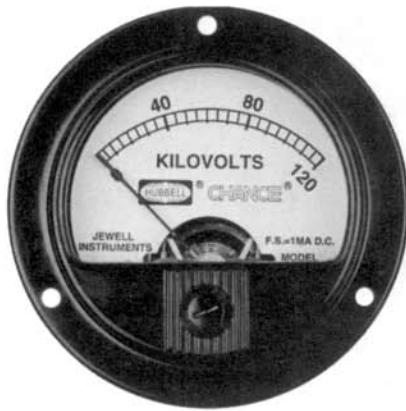


H1876-7  
40kV

**EXTENSIONS**



H1876-4  
48kV EXTENSION  
\*Use with 16kV models only\*

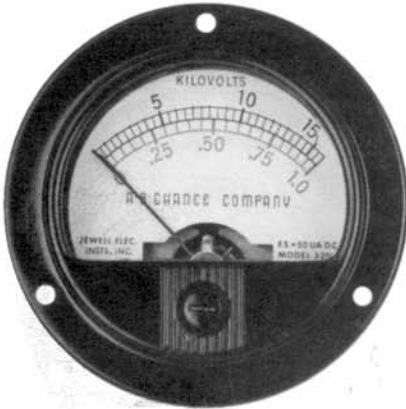


**E403-0498**  
120kV

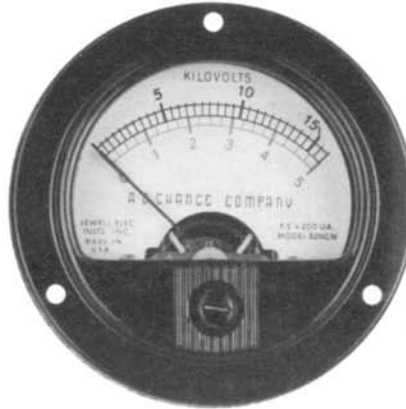


**E403-0499**  
161kV

**NOTE:**  
Multiply by 10

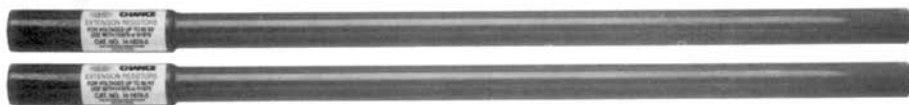


**T403-0786**  
1 & 16kV



**T403-2311**  
5 & 16kV

### EXTENSIONS



**H1876-2**  
80kV EXTENSION  
\*Use with 16kV models only\*

### DC HI-POT ADAPTERS



**C403-1762**  
up to 16kV  
DC HI-POT ADAPTER

**C403-1763**  
up to 35kV  
DC HI-POT ADAPTER

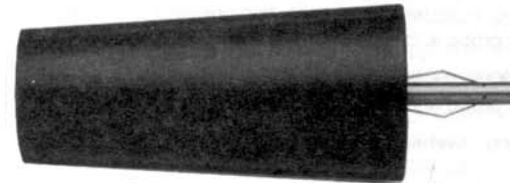


### BUSHING and ELBOW ADAPTERS



**T403-0856**  
up to 35kV  
ELBOW ADAPTER

**T403-0602**  
up to 15kV  
ELBOW ADAPTER



**T403-0857**  
up to 35kV  
BUSHING ADAPTER



**T403-0428**  
up to 15kV  
BUSHING ADAPTER



**C403-0838**  
PHASING VOLTMETER TESTER  
FOR ALL MODELS

## CARE

This is both a hot line tool and a delicate electrical instrument. If you take care of it, this instrument should provide years of trouble-free service. Abuse or misuse may damage the resistors or the sensitive meter. Store in a dry location, protect from rough jostling when carrying or using.

The insulated cable must not touch any grounded or energized object because accuracy of readings will be affected and cable insulation may be impaired or damaged.

**REPAIRS – Contact: M.W. Bevins Co., 9903 E. 54 St., Tulsa, OK 74146 USA**

**Phone: (918) 627-1273 • Fax: (918) 627-1294 • www.mwbevinsco.com**

Catalog No.	Description	Weight
H1876	16kV Phasing Tester Kit includes plastic case, two universal poles with bag, two hook probes and instruction manual	14 lbs.
H1876-1	16kV Phasing Tester includes plastic case, two hook probes and instruction manual	11 lbs.
H1876-7	40kV Phasing Tester includes plastic case, two hook probes and instruction manual	13 lbs.
H1876-3	Case only, for Phasing Tester	
	Metal	16 lbs.
	Plastic	6 lbs.
H1876-5	Straight Probes (pair)	2 oz.
H1876-6P	Pigtail Hook	2 oz.
H1876-6S	Shepherd Hook	2 oz.
H1760-1	Universal Pole, 1/4" x 6" (two needed)	1.75 lbs.
P643-6	Bag for two universal poles	1 lb.
T403-0786	1 & 16kV Phasing Tester Kit includes plastic case, two universal poles with bag, two hook probes and instruction manual	14 lbs.
T403-2311	5 & 16kV Phasing Tester Kit includes plastic case, two universal poles with bag, two hook probes and instruction manual	14 lbs.
T403-2557	5 & 16kV Underground and Overhead Phasing Tester Kit includes plastic case, two universal poles with bag, hook probes, 16kV dc hi-pot adapter, two 15 - 34.5kV bushing adapters, phasing voltmeter tester and instruction manual	18 lbs.
T403-2261	25kV Phasing Tester with case	12 lbs.
T403-0428	15kV Bushing Adapter	1 lb.
T403-0602	15kV Elbow Adapter	1 lb.
T403-0857	15 - 34.5kV Bushing Adapter	1 lb.
T403-0856	15 - 34.5kV Elbow Adapter	1 lb.
H1879	Phase Rotation Tester with case	11 lbs.
H1876-2	80kV Extension Resistors (two) 32" long	4 lbs.
P624-4	Bag for 80kV Extension Resistors H1876-2	1.25 lbs.
H1876-4	48kV Extension Resistors (two) 21" long	3 lbs.
P624-2	Bag for 48kV Extension Resistors H1876-4	1 lb.
C403-0838	Phasing Voltmeter Tester	1 lb.
C403-1762	DC Hi-Pot Adapter up to 16kV	1 lb.
C403-1763	DC Hi-Pot Adapter up to 35kV	1 lb.

Catalog No.	Description	Length	Weight
C403-0457	Phasing Tester for voltages up to 120kV 50/60 Hertz, including resistor sections, handle sections and storage bags, and instruction booklet	63"	33 lbs.
C403-0458	Same as C403-0457 except for voltage up to 161kV 50/60 Hertz	76"	38 lbs.
E403-0498	Phasing Tester less handles, storage bag and instruction booklet - for 120kV, 50/60 Hertz Equipped with male section of H3365-3 splice	63"	16 lbs.
E403-0499	Same as E403-0498 except for 161kV 50/60 Hertz	76"	19 lbs.
C403-0459	One 8' x 1 1/4" Epoxiglas handle with female section of H3365-3 splice (two needed)		5 lbs.
P621-8	Storage bag, weatherproof duck, for 2 handles	108"	3.5 lbs.
C403-0460	Carrying bag, weatherproof duck, for 120kV Phasing Tester less handles	84"	3 lbs.
C403-0464	Carrying bag, weatherproof duck, for 161kV Phasing Tester less handles	102"	3 lbs.
C403-0838A	Phasing Voltmeter Tester for Transmission Phasing Tester	-	1 lb.

## CHANCE HIGH VOLTAGE PHASING TESTER C403-0457 & C403-0458

CAUTION: Do not drop tool as accuracy may be impaired.

### DESIGN

These Chance Phasing Testers are portable devices which permit the checking of AC voltages on sub-transmission and transmission circuits from 50kV to 161kV for the purpose of determining phase relationships and the approximate voltage line-to-line or line-to-ground of the circuits. Caution is required to maintain working clearances for the voltage being measured.

Catalog number C403-0457 is designed for voltages up to 120kV read directly on the scale of the meter. This unit consists of two high impedance units of approximately 49 megohms each housed in the contact ends of the two resistor sections. These resistance units are encapsulated in a suitable epoxy to protect them from mechanical damage and to prevent moisture penetration or accumulation around the resistors. The detachable handle sections have a foam core to combat moisture accumulation and resultant loss of insulation.

Between the two resistor units there is a milliammeter and a connection cable with 15kV insulation. The resistors limit current values to less than 1/4 milliamperes at maximum voltage rating across the probes. To reduce the effects of stray capacitance or influence of the electric field surrounding the tool, the cable is of twin conductor construction, one conductor joining the resistors and meter, the other serving as a field balancing element.

For use on lines up to 161kV, Catalog number C403-0458 is offered. These sticks each house resistor units of approximately 61 megohms, limiting maximum current to 1/4 milliamperes at full rating phase-to-phase.

The space surrounding these resistors is also filled with epoxy for mechanical and moisture protection. Current through the connecting cable is limited to 1/2 milliamperes maximum at full voltage across contacts or through damaged insulation to ground at the cable with full voltage across the contacts. However, damaged resistors may allow excessive current to flow creating a hazardous condition. For this reason, particular care should be taken to avoid contact with the connecting cable. The cable covering is primarily for mechanical protection to cable conductors.