



# AC Dielectric Test Sets



**HIPOTRONICS**<sup>®</sup>  
THE MEASURE OF A LEADER

# The Most Powerful Control,

*For more than 30 years, Hipotronics has been the industry leader in the design and manufacture of AC Dielectric Test Sets. When combined with the most advanced control and measurement systems, we continue to set the industry standards for High Voltage Test and Measurement Systems.*

*Hipotronics' AC Dielectric Test Sets are available in a wide range of voltage and power ratings with exceptional reliability, durability and superior functionality. Thousands of our units are being used every day in production and lab environments and have withstood the test of time. Not only are they designed and manufactured in-house, but we utilize a unique manufacturing process to obtain the best performance possible.*

*The control systems range from standard manual control to a Microprocessor-based Control with Computer Interface. The Microprocessor-based Controller features programmability of test setups and other advanced features. The computer interface with our supplied Windows™-based software program allows complete control of the test set. The software also allows advanced programmability, data acquisition, and test result display, print out and storage. When used with the DDX™ Digital Partial Discharge Detector, it provides a complete solution to Partial Discharge Testing that is both user-friendly and yet highly powerful.*

*In short, you can have the power and control from a Hipotronics solution.*

## Simply the Best

Hipotronics works with you to find the perfect solution for your testing needs. With more than 30 years of industry leadership, a highly knowledgeable staff, and an exceptional product offering, we have what it takes to be *simply the best*.

**Experience** We offer experienced teams to work with you to assess your testing needs and to design an integrated solution that gives you the test capability you want at an affordable price. Our AC Dielectric Test Sets can be configured as an integrated solution (such as for Partial Discharge Testing) or as a Mobile System for use in the factory or field.

**System Design** Systems designed for Partial Discharge Testing can include components such as double-shielded isolation transformers, input and HV filtering, test chambers, and advanced digital PD detectors (such as our DDX Series). Systems designed for mobility can include integrated skid mounting and (for some units) casters or wheels for easy transportation around a factory. In addition, custom units for highly specialized test requirements are available. Consult Hipotronics for more information.

# The Most Affordable Solution



**Powerful Controls** You want a powerful control at an affordable price, and Hipotronics has it. Our 970 Microprocessor-based Control is the best, most powerful digital control solution available. Our standard system is provided in a modern rack-mountable control package and performs many of the unique functions that are only available from others at a premium price. This advanced control gives the operator the ability to manage the complete test environment through features such as a local bus, Windows™-based control and acquisition software, an optically isolated RS232 port, and digital sampling for highly accurate voltage breakdown readings.

**Complete Range of Solutions** Hipotronics offers a complete range of solutions and the willingness to work together to satisfy your unique test requirements. No matter what your requirement, Hipotronics has an affordably priced, highly reliable test solution to meet your needs.

## Applications

- Rotating Machines
- Switchgear
- Insulating Materials
- Instrument Transformers
- Connectors
- Transformers
- Capacitors
- Bushings
- Sample Cable Lengths
- Transmission Line Hardware
- Arrestors
- HV Components

## Types of Tests

- Dry Withstand
- Wet
- Breakdown
- Pollution
- PD/RIV
- Tan-Delta/Power Factor
- Life/Aging

# Affordable Solutions to Your Testing Needs



## Mobile Systems

Hipotronics understands that sometimes you need to take the test equipment to your test object. That's why we offer a complete line of mobility options, including portable systems, casters, and skid-mounted systems. Consult Hipotronics with your exact packaging needs—there is a good chance that we have the perfect solution for you. Shown at left is a 10kV/5kVA mobile system used for testing of stator bars.



## Complete PD Test Systems

Hipotronics can effectively and economically integrate an AC Dielectric Test Set, Shielded Test Enclosure, and Partial Discharge Test Equipment into one complete, ready-to-test package. Alternately, you may select a mobile test system if your test device is very large. When the DDX™ Series of Digital Partial Discharge Detectors and 970AC Control Systems are chosen, all control and data acquisition is provided through one software program on the DDX Series PD Detector. Shown at left is a 50kV/10kVA complete test system for a rubber components manufacturer.



## Dielectric Breakdown Testers

Voltage breakdown testing of materials or samples presents unique challenges. The voltage breakdown can cause oscillations and perturbations that interfere with voltage measurements when conventional measurement circuits are used. Hipotronics 700-D149 Series of Dielectric Breakdown Testers combine the flexibility and programmability of the 970AC Control System with digital sampling techniques to ensure voltage measurement accuracy. In addition, the test sample is housed in an inter-locked safety enclosure for a complete test solution.



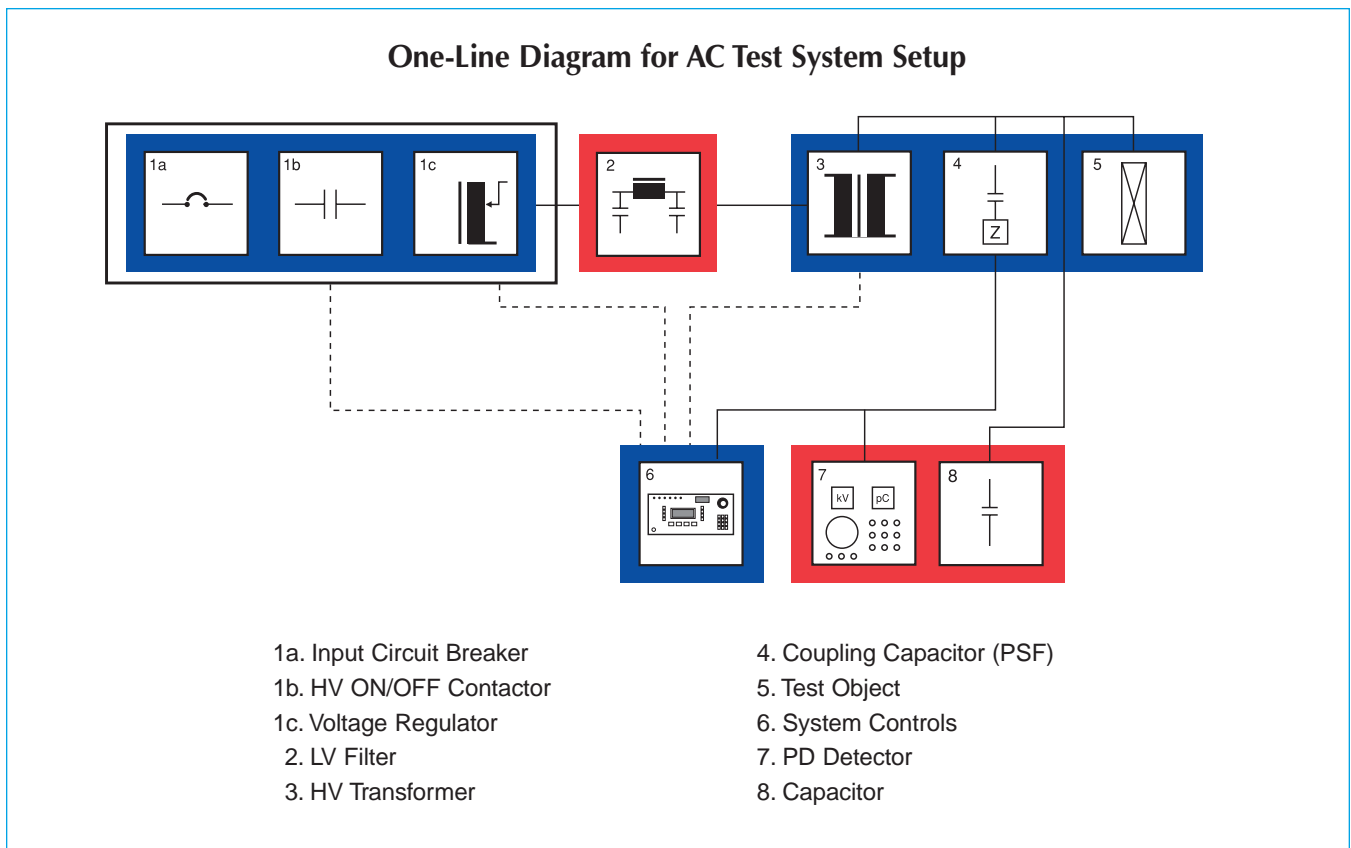
## Resonant Test Systems

Sometimes the test load is too large to economically test with a standard HV step-up transformer. That's why Hipotronics pioneered the use of Resonant Test Systems over 30 years ago. They require much less input power, are smaller and lighter, deliver less follow-through current to the test load in the event of test sample failure, and they usually are more cost-effective. Shown at left is a skid-mounted 60kV/10A system commonly used for generator testing.

# Typical Test System Components

Hipotronics' standard line of AC Test Systems are designed to perform high voltage AC tests on electrical apparatus in accordance with IEC60, IEEE 4 and IEC 270 test standards. A variety of mechanical configurations are available to suit different installation conditions. Some models can be supplied in mobile versions for instances where it is difficult to move the test object.

The one-line diagram shown depicts a typical test set up for AC Hipot testing (shown in blue). The items shown in red are typically added when performing Partial Discharge Tests. Hipotronics' AC Systems may also be supplied as complete Partial Discharge test and measurement systems to provide integrated high voltage test and partial discharge recording capabilities. They can be customized by adding test chambers for production testing of components.



# 970AC Controls

## Manual/Auto Operation

The system can be operated automatically in a pre-programmed mode, or manually through use of front panel pushbuttons.

## Local/Remote

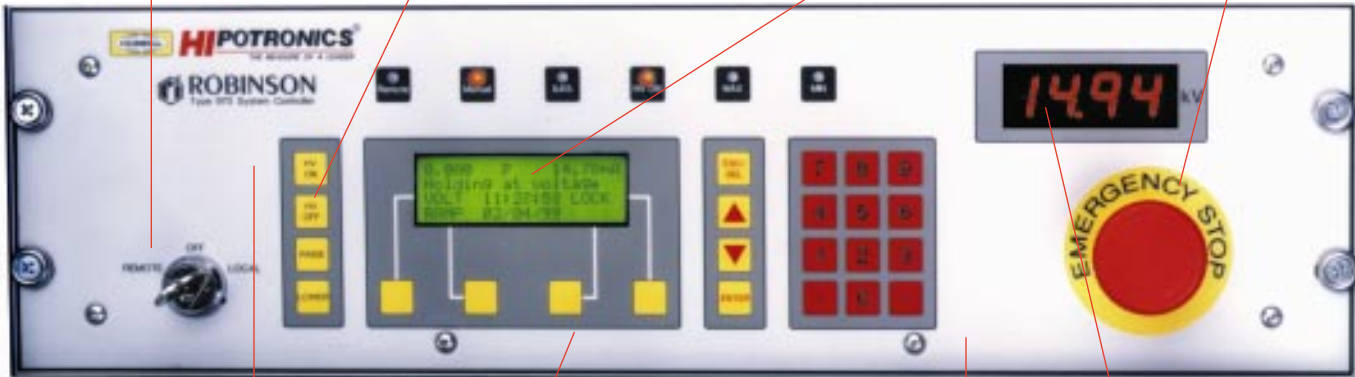
Operation is allowed either from the front panel (LOCAL) or from a separate computer (REMOTE).

## Emergency Stop

A large emergency stop pushbutton provides for quick, fail-safe disconnection of source power (even in the event of a fused contactor).

## LCD Display

A 4 x 20 character LCD screen provides operator prompts and test menu selection information.



## Simple Use

Standard hardware package for multiple test systems makes operator training easier.

## Microprocessor

Embedded micro-controller allows easy updates of software should test standards change.

## Hardware

Standard 19" rack-mounted 3U high (5.25") compact controller with scratch and oil resistant polycarbonate overlay.

## Voltage Readout

A large digital voltage readout provides fast and accurate voltage display.

The 970 Series of AC Dielectric Test Set Controls is a more advanced control system than the standard electro-mechanical controls and is specifically designed for the needs of HV testing unlike the standard PLC type controls. It allows for manual or automatic control of the applied test voltage, either through the front panel or a separate PC. A defined test sequence can be set up by the user, run by the controller and, when using the software, the results are recorded. The test sequences can be saved and recalled for use later on.

Every AC Dielectric Test Set supplied with a Hipotronics 970AC Control System comes with the Windows™-based Data-Collection and Control Program. The software allows connection to a stand-alone PC that will operate the 970 remotely. In addition, it provides long-term storage, graphing/analysis and export of data to a delimited file.

## 970AC

- Program, save and recall 8 Test Profiles
- Step Test Setup
- Irregular Ramp Test Setup
- Manual Test
- Regular Ramp Test Setup
- Ramp and Hold Test Setup
- Highly accurate Breakdown Voltage Reading

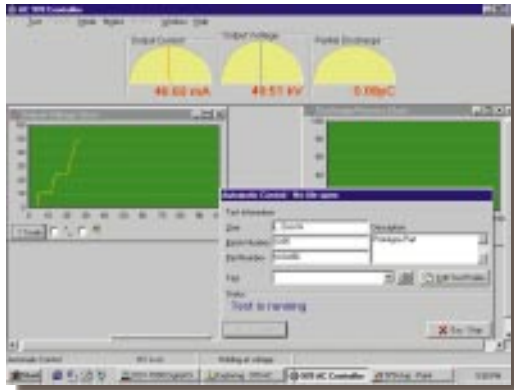
## 970 Windows™ Software

(In addition to 970AC features)

- Program, save and recall unlimited number of Test Profiles
- Test reporting
- Graphing/Analysis
- Data can be exported to file
- Pass/Fail Criteria is reported

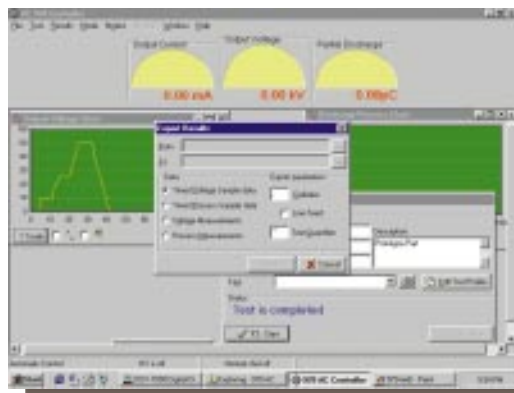
For more detailed 970AC specifications, refer to page 9.

# Windows™-Based 970AC Software



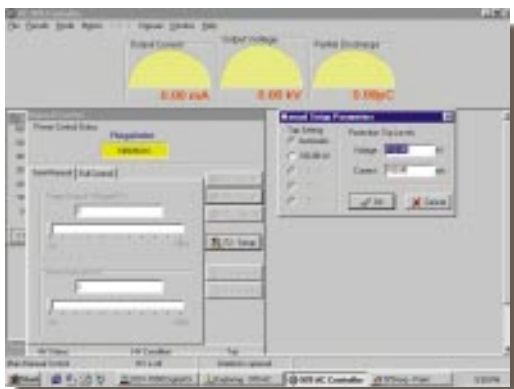
## Windows™-Based Software

The Windows-based Control and Acquisition Software provided with the 970AC Controller gives the user many advanced features in a user-friendly format. The user has the ability to enter test parameters, set up a profile, and enter test sample information. All setup information may be saved for later recall and all results may be stored for later printout.



## Test Results

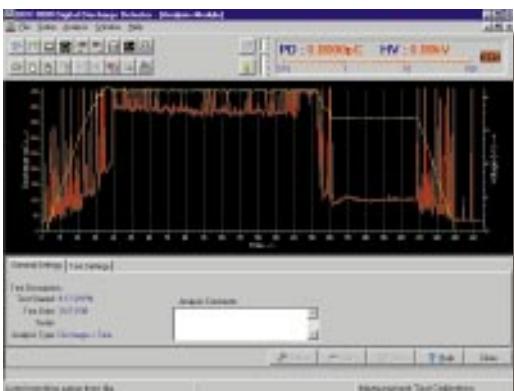
The user has complete control in displaying test results. The main meter module displays output current, output voltage, and a third user defined parameter. Below each “meter” is a digital reading of the same parameter. Graphical results can be displayed with the ability to zoom in on the graph to see a particular area. As in any other Windows-based program, various windows can be overlaid.



## Test Reports

Test results may be printed in one of three formats:

1. **Summary**—For an overview of the test procedure.
2. **970 Result Set**—For specifics of (automatic) measurements taken during a test, with breakdown voltages and pass/fail results.
3. **Graphical Results**—Provides user selectable graphs.



## 970AC and DDX™ Series Detector

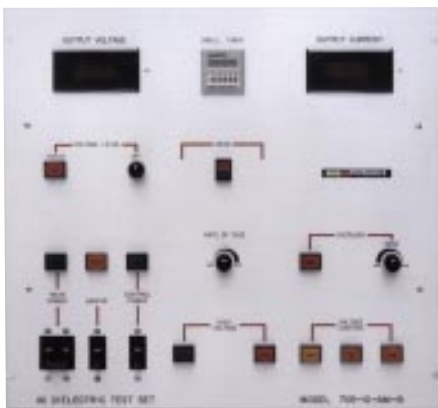
When an AC Dielectric Test Set with 970AC Controls is integrated with a DDX Series Detector for Partial Discharge (PD) Testing, all control of the AC Test Set and acquisition of all voltage and partial discharge data is performed by one computer. Data for plots of PD vs. voltage or PD vs. time is recorded during the test and displayed in a strip chart recorder format. Similar acquisition capability is possible with any PD detector that has an analog output signal for PD. (Note: This software program is different than the 970AC software.)

# Standard Control Features



Manual Controls

Hipotronics' Standard Controls are user-friendly, cost-effective controls that provide the user with push-buttons and indicator lamps to manually control the test system. This control is standard for all systems with 10 kVA output or less. For systems with 20 kVA output or more, the Auto/Manual Control Package is standard. Digital metering is standard with all AC control packages.



Auto/Manual Controls

Hipotronics' Auto/Manual Controls automate simple test routines. This control includes motorized voltage regulation for all systems.

In addition to the features listed for the manual controls, a digital dwell timer, digital voltmeter with meter relay, and digital current meter are supplied. A front panel switch selects either the automatic or manual mode of operation. In the automatic mode, depressing the "HV ON" pushbutton momentarily will cause the output voltage to rise to the preset level, dwell for the time set on the digital meter, and return to zero after the preset test time.

The rate of voltage rise during the test is also user defined. Rate of rise is adjustable over a 10:1 range with systems up to 100 kV adjustable from 30-300S and systems 100 kV or above adjustable from 60-600S.

## Manual Controls

The standard control functions are:

- Main Power Circuit Breaker
- Main Power On Indicator Lamp
- Manual Raise/Lower of Voltage
- Control Power Circuit Breaker or Fuse
- Control Power On Indicator Lamp
- Safety Interlock Status Indicator
- HV On and Off Pushbuttons
- HV On Indicator Lamp
- Overload Lamp
- Overload Trip Level (sensitivity) Potentiometer
- Overload Reset Push Button

## Auto/Manual Controls

(In addition to the Manual Control features)

- Digital Test Timer
- Digital kV Meter with Test Voltage Preset
- Adjustable Rate of Rise



# Control Technical Specifications

## 970AC Control

### Physical Specifications

INPUT VOLTAGE	115/230Vac, 50/60 Hz
OPERATING TEMPERATURE	5 to 40 degrees C
STORAGE TEMPERATURE	0 to 55 degrees C
OPERATING HUMIDITY	<95% non-condensing at 40 degrees C
CHEMICAL RESISTANCE	Front Panel resistant to mineral/silicone/natural oils. Limited resistance to solvent or acid/alkali attack
COMMUNICATIONS PORT	9-pin D-Type Socket
EMI/RFI RATING	CE Marking available

### Control Features

Key Switched OFF/REMOTE/LOCAL Operation

Emergency "Off" Pushbutton

Status Indicators

- Remote Operation
- Manual Operation
- HV ON
- Interlocks Open
- MAX Upper Voltage Limit
- MIN Lower Voltage Limit

Menu Control Keys

- ESCAPE/DELETE
- Menu UP/DOWN
- ENTER

Menu Selection Keys (4) for Selection of Test Information

Manual HV Control Keys

- HV ON
- HV OFF
- RAISE Voltage
- LOWER Voltage

Numeric Data Entry Keypad

### Display Features

- 4 x 20 Character LCD Display
  - Time (24 hour Format)
  - Date (US Format)
  - Status and Result Information
  - Menu Options

Accuracies

- Voltage (Steady-State) +/-1% of reading, 10-100% of range (12-bit A-D)
- Voltage (Breakdown) +/-1% of reading, 20-100% of range
- Current

### Automatic Test Modes

- Ramp UP/DOWN Test
- Ramp & Hold Test
- Regular Staircase Test
- User-Defined (up to 8 different steps)

### Automatic Test Features

- Storage of 256 Individual Measurements During a Test
- Breakdown Voltage Recording (+/-1% of Reading 20-100% of Range)
- 0-6 Vac RMS Auxiliary Input with Comparison Against Failure Threshold
- Adjustable Measurement Settling Lockout
- Adjustable System Lockout
- Storage/Recall of up to 8 Automatic Test Setups

### General Setup Settings (All Modes)

- Number of Measurement Acquisitions (2 to 255)
- Ramp Rate (0.1kV/s to System Max)
- Overcurrent Trip Setting (0% to 100% of System Output Current)
- System Lockout Times (0-120 seconds)
- Regulation of Output Voltage ON/OFF (Manual Mode Only)
- MAX Voltage (0 to Maximum Output) (Manual Mode Only)
- LOCK/FREE Access to Controls (Manual Mode Only)

### Ramp UP/DOWN Automatic Test Settings

- UP only or UP/DOWN
- MAXimum Voltage for Test
- STARTing Voltage for Test
- FAIL level for Auxiliary Input (0 to 9999)

### Ramp UP/DOWN Automatic Test Settings

- VOLTage for the Test
- TIME duration for the Test
- FAIL level for Auxiliary Input (0 to 9999)

### Regular Staircase Automatic Test Settings

- UP only or UP/DOWN
- Number of Steps
- STARTing Voltage for the First Step
- STEP Voltage Increment
- HOLD Time for Voltage at Each Step
- FAIL level for Auxiliary Input (0 to 9999)

### Irregular Staircase Automatic Test Settings

- Number of Steps
- VOLTage for Each Step
- HOLD Time for Voltage at Each Step
- FAIL level for Auxiliary Input (0 to 9999)

## Standard Controls

### Metering Specifications

For Manual and Auto/Manual Controls

	Kilovoltmeter	Current Meter
Displayed Value	Kilovolts	Amperes/Milliamperes
Display Type	Red LED, 3½ digits	Red LED, 3½ digits
Maximum Display	1999	3 digits
Accuracy	+/- 1%	+/- 2%
Range for Stated Uncertainty	10 to 100% of Full Scale	10 to 100% of Full Scale

# High Voltage Transformer Technical Specifications

All Hipotronics HV test transformers are conservatively designed to withstand common test environment conditions, including repeated flashovers with very fast rise times, and to exhibit low partial discharge levels for many years.

## Materials

All windings are wound using copper wire coated with a synthetic enamel insulation. Depending on size and application, they may also be wrapped with Kraft paper or Nomex insulation. In some cases, Cellulose wrapping is provided where very high voltages or very low PD levels are required.

Insulation between layers of transformer windings consists of thin sheets of thermally upgraded Kraft paper. This special insulating paper is coated with epoxy diamonds that bond together when the transformer coils are thermally cured. Bonding the layers of insulation increases the mechanical stability of the coils without sacrificing the ability to properly impregnate the windings with transformer oil.

The transformer cores utilize high quality, grain-oriented grade M6 steel. The core flux density design is sufficiently low to minimize audible noise and harmonic distortion. All core structures are bolted together with insulated bolts and connected together with insulated core plates.

## Transient Control

Hipotronics transformers utilize embedded copper sheet electrostatic shields connected to one end of a layer or "coil" to help control the capacitance to ground of each coil. This optimizes voltage distributions under the transient impulse conditions present during test sample flashovers, thus leading to long, PD-free life of the transformer.

## Partial Discharge

All transformers use conservative design practices, the highest quality materials, proprietary manufacturing techniques, and rigorous factory testing to assure low partial discharge levels and long life. For PD-free (<2 PC), standard rating is <10 PC at full voltage. Only Hipotronics uses an additional layer of cellulose insulation in the HV winding to ensure long PD-free life. This additional layer adds physical spacing between turns, prevents abrasion of wire during transportation or flashover, and ensures complete oil impregnation of the winding.

## Mechanical Design

Hipotronics mechanical design takes into consideration that nearly zero impedance short circuits are a normal occurrence throughout the life of the transformer. Blocking and adhesive bonding is used to prevent axial forces from causing movement of the conductors. By securing the windings from mechanical movement, no mechanical abrasion can occur, assuring a long PD-free life.

Custom designed welded steel brackets support and secure the core/coil assembly inside the mechanical package. The entire mechanical package is designed to withstand the electro-mechanical forces of operation and transportation.

## Mechanical Construction Features

Hipotronics HV test transformers are constructed in one of five mechanical packages as listed below:

**Air Insulated HV Transformer** designs are vacuum dried, impregnated with synthetic resin, cured, and coated with electrical paint to prevent moisture from entering the insulation system. These designs are mounted inside cabinets to limit exposure to the environment. Coaxial cables are supplied to connect output voltage to the test load.

**Oil-Filled Epoxy (Insulated) Bonnet** designs utilize an integral epoxy "bonnet" housing that acts as a tank and HV bushing. The bonnet mounts to a steel plate that forms the base of the high voltage transformer assembly. Primary voltage, voltmeter, and HV return connections are provided on the base. The top of the bonnet is fitted with oil sealing plugs to allow filling or draining of oil. The output voltage terminal is a partial discharge free HV electrode mounted to a bolt cast into the top of the bonnet. No output cable is supplied.

**Oil-Filled Metal Tank** Designs are traditional designs using LV and HV bushings (see below) and steel tanks. All tanks are welded steel construction with lifting provisions. Most tanks are designed for full vacuum to enable processing within the tank, and therefore contain valves and fittings for that purpose. Continuous duty designs are made with radiators and, for certain sizes, re-circulating pumps. No output cable is supplied.

**Oil-Filled Fiberglass (Insulated) Cylinder** Designs consist of one or more transformers vertically-mounted inside an insulating cylinder in an electrical cascade configuration. Gaskets and steel plates seal the top and bottom of the cylinder. Primary voltage, voltmeter and HV return connections are passed through the bottom plate on insulated feed-through bushings. Vacuum connection fittings and oil drain/filling valves are provided for processing. The output voltage terminal is a ring-type HV electrode. No output cable is supplied.

**Modular Cascade** systems are similar to insulated tank designs except that the insulator is divided into two sections, each rated for half voltage. The center section, where the transformer is mounted, is made of steel. This design is capable of expansion and vertical cascading with other identical modules. Continuous duty designs are available with radiators and circulating pumps.

## Output Bushings (Metal Tank Designs)

Bushings can be either epoxy or porcelain condenser type. For systems rated up to 100 kV, horizontally-mounted epoxy bushings are supplied. Epoxy bushings have the advantage of low current drain and therefore do not reduce the output current available to the test load.

For systems rated above 100 kV, porcelain condenser bushings are used. The current drawn by the porcelain bushing will be measured by the current meter.

# General Technical Specifications

## General Regulator Specifications

### PVT Variable Transformer

PVT voltage regulators are usually used on all systems with a power rating above 20 kVA. The PVT voltage regulator differs from other types in that moving, copper contacts eliminate shorted turns by using a patented circuit. PVTs have highly linear impedance versus position characteristics.

### General Specifications

POWER RATINGS	Up to 500 kVA for single unit designs
COOLING	Air convection
OVERLOAD	10 times rated current for 10 cycles
VOLTAGE RESOLUTION	< 1% (verniers available for higher resolution)
MAXIMUM IMPEDANCE	< 5%

### Toroidal Variable Transformer Description

Commercial grade toroidal auto transformers are usually used at power levels 20kVA or below. These voltage regulators use current limiting carbon brushes to contact the voltage winding.

### General Specifications

COOLING	Air convection
OVERLOAD	5 times rated current for 10 cycles
VOLTAGE RESOLUTION	< 0.5% (verniers available for higher resolution)
MAXIMUM IMPEDANCE	< 5%

## Safety System Protection Systems

Each test system is designed to be safe for operators and prevent equipment damage. Since it is common in high voltage testing to have short circuits of the output at any time, it is critically important that protection circuits operate correctly. Therefore, Hipotronics uses the following protective circuitry:

**Main Power Circuit Breaker** Each system is supplied with a manually operated circuit breaker that is rated for the maximum current that the system requires. This breaker thermally and magnetically operates during overloads.

**Fast Output Overload** The low side (primary) of the HV transformer is connected to ground via a current sensing device that provides a signal for the fast, output adjustable overload circuit. If the current level exceeds the preset value set on the control panel, the circuit will detect and trigger in several microseconds. The sensing circuit will, in turn, open a relay that interrupts the main contactor. The overall response time for the overload circuit is between 3 and 5 cycles of the input frequency.

**Main Power Contactor** An electrically actuated contactor is placed in the circuit after the main power circuit breaker. The contactor is turned on by energizing the "HV ON" control. The main power contactor is turned off if:

- HV is turned off
- The safety interlock chain is interrupted
- A power failure occurs even momentarily
- The primary connected overcurrent (magnetic) relay trips

## Interconnecting Cables

Standard sets of interconnecting cables include the following:

- Control Multiconductor Cables
- Instrumentation Coaxial Cables

Cables are 10, 15, or 20 M depending on test system voltage rating.

Cables not included in the supply are:

- Ground Cables
- Input Power Cables
- Power cables from the voltage regulator to the test transformer (if required)
- Voltage Output Cables (for systems with bushing or electrode output)

## Optional Equipment

AC systems may be ordered with options to enhance the performance for specific applications.

### Burn Feature

The "Burn Feature" adds a series inductance in the primary of the HV transformer. The inductance may be switched in or out from the control panel. When switched in, the output current of the transformer will be limited to the rated current of the system and overload circuits will not trip even if the transformer is repeatedly short circuited.

### Compensating Reactors

Compensation reactors can be added to some systems to cancel the effect of the capacitive load on the output of the test transformer. Compensation reactors are generally rated for one half of the rated power of the test system to avoid any possibility of uncontrolled resonance in the test circuit. The reactors used for compensation can be added or disconnected to the circuit when needed.

Compensation reactors are designed with two windings that can be series or parallel connected. In the series mode, the compensation is half the rated kVA. In the parallel connection, the compensation is one-eighth of the rated kVA.

### Transformer Taps

Some AC systems can be tapped to provide higher current test capability at lower voltage. Taps in AC test systems are designed for full system kVA at the specified voltage.

Depending on the system voltage and power rating, taps are available either by separate bushing or through one bushing with an internal HV tap switch for remote control.

### Dual Primary Windings

For certain ratings, the high voltage transformer may be supplied with the primary winding made in two sections. When the two sections are connected in parallel, the full voltage of the system is delivered. When the two sections are connected in series, the output of the system is half rated voltage. The advantage of this is that the resolution or precision of adjusting the voltage is improved for the reduced voltage connection. This is particularly advantageous when a higher voltage system must be used for lower voltage testing. When the dual winding primary system is added in conjunction with the compensating reactor, a wider test load range is possible.

## Special Services

Hipotronics offers complete technical services from conceptualization to operator training. The following services are offered:

### Installation Supervision

### Commissioning/Training

### Re-calibration Services

### Factory Service

### Design of Test Areas

# Selecting an AC Test Set

In order to properly size an AC Test Set, it is necessary to have the following information:

- 1. Maximum test voltage required** The maximum test voltage is determined by the relevant standard that equipment is being built to plus any additional user-defined oversizing to take into account changes to test standards, or special end-user requirements.
- 2. The power rating** To determine the power rating, the capacitance, resistance or inductance of the load must be known. High voltage test objects are usually capacitive in nature.
- 3. The duty cycle** The vast majority of high voltage AC tests are run for less than one hour. Hipotronics' standard duty cycle accommodates normal test protocol times considering two 8 hour working shifts per day. Continuous duty ratings add cost and should only be selected when the system is used for long term testing, such as life tests.
- 4. PD requirements** Partial discharge testing is usually performed at lower levels than AC withstand levels. If PD testing is required it is necessary to know the PD sensitivity level for the test and the test voltage. Specifying too high a PD test voltage or unnecessarily low PD free rating for the system inflates the cost of a test system.
- 5. Environment** Most testing is done indoors in reasonable environments. If the HV test transformer is to be located in an outdoor environment, bushing size and tank design will change.

If the load is predominantly capacitive, the test current required can be calculated by using the following formula:

$$A = 2\pi fCV$$

where

$A$  = Test current in Amps (A)

$f$  = Test frequency in Hertz (Hz)

$C$  = Total test load capacitance in Farads (F)

$V$  = Test voltage in Volts (V)

Once these four things are known, the test voltage and load current can be used to determine the rating of the system. We suggest that you consider rating your system 10-20% higher in voltage and up to 50% higher in current to accommodate future, unanticipated test requirement changes.

Unit No.	AC Output			Std. Input <sup>2</sup> (Single Phase)	Duty Cycle (kVA) 1 hr./Cont.	Control		Regulator		HV Section								
	Voltage (kV)	Current (mA)	Power <sup>1</sup> (kVA)			Dimensions <sup>3</sup> W x H x D	Weight (lbs./kg)	Dimensions <sup>3</sup> W x H x D	Weight (lbs./kg)	Dimensions <sup>3, 4, 5, 6</sup> W x H x D	Output <sup>7</sup> Type	Weight (lbs./kg)	Insulation Type	Tank Type				
705-1	0-5	200	1	1/0.6	1/0.6													
710-1	0-10	100	1	1/0.6	1/0.6													
715-1	0-15	67	1	1/0.6	1/0.6													
720-1	0-20	50	1	1/None	1/None													
730-1	0-30	33	1	115 V or 230 V, 50/60Hz	1/None	21 1/4" x 15" x 15 5/8" (540mm x 381mm x 391mm)												
705-2	0-5	400	2	2/1.2	2/1.2													
710-2	0-10	200	2	2/1.2	2/1.2													
715-2	0-15	133	2	2/1.2	2/1.2													
730-2	0-30	67	2	2/None	2/None													
750-2	0-50	40	2	2/None	2/None													
705-5	0-5	1000	5	5/4	5/4	23" x 51" x 26" (584mm x 1295mm x 660mm)												
710-5	0-10	500	5	5/4	5/4													
715-5	0-15	333	5	5/4	5/4													
720-5	0-20	250	5	5/4	5/4													
730-5	0-30	167	5	5/4	5/4	21 1/4" x 20 1/2" x 19 5/8" (540mm x 521mm x 498mm)												
750-5	0-50	100	5	5/4	5/4													
775-5	0-75	67	5	5/4	5/4													
7100-5	0-100	50	5	5/4	5/4													
705-10	0-5	2000	10	10/7.5	10/7.5													
710-10	0-10	1000	10	10/7.5	10/7.5													
715-10	0-15	667	10	10/7.5	10/7.5													
720-10	0-20	500	10	10/7.5	10/7.5	23" x 51" x 26" (584mm x 1295mm x 660mm)												
730-10	0-30	333	10	10/7.5	10/7.5													
750-10	0-50	200	10	10/7.5	10/7.5													
775-10	0-75	133	10	10/7.5	10/7.5													
7100-10	0-100	100	10	10/7.5	10/7.5													
7125-10	0-125	80	10	10/7.5	10/7.5													
705-20	0-5	4000	20	20/15	20/15	30" x 73" x 31" (762mm x 1855mm x 788mm)												
710-20	0-10	2000	20	20/15	20/15													
715-20	0-15	1333	20	20/15	20/15													
720-20	0-20	1000	20	20/15	20/15													
730-20	0-30	667	20	20/15	20/15													
750-20	0-50	400	20	20/15	20/15	23" x 51" x 26" (584mm x 1295mm x 660mm)												
775-20	0-75	267	20	20/15	20/15													
7100-20	0-100	200	20	20/15	20/15													
7150-20	0-150	113	20	20/15	20/15													
7200-20	0-200	100	20	20/none	20/none													

Unit No.	AC Output Voltage (kV)	AC Output Current (mA)	Std. Input <sup>1</sup> Power <sup>1</sup> (kVA)	Std. Input <sup>2</sup> (Single Phase)	Duty Cycle (kVA) 1 hr./Cont.	Control		Regulator		HV Section									
						Dimensions <sup>3</sup> W x H x D	Weight (lbs./kg)	Dimensions <sup>3</sup> W x H x D	Weight (lbs./kg)	Dimensions <sup>3, 4, 5, 6</sup> W x H x D	Output <sup>7</sup> Type	Weight (lbs./kg)	Tank Insulation Type						
705-40	0-5	8000	40	480 Vac, 50/60Hz	40/30					21"x36"x42"	675/307	In Controller	N/A	21"x36"x42"	(533mmx914mmx1067mm)	Bushing	950/432	Oil	Steel
710-40	0-10	4000	40	480 Vac, 50/60Hz	40/30	30" x 73" x 31"				21"x36"x42"	675/307	In Controller	N/A	21"x36"x42"	(533mmx914mmx1067mm)	Bushing	950/432	Oil	Steel
720-40	0-20	2000	40	480 Vac, 50/60Hz	40/30	(762mm x 1855mm x 788mm)				21"x36"x42"	675/307	In Controller	N/A	21"x36"x42"	(533mmx914mmx1067mm)	Bushing	950/432	Oil	Steel
730-40	0-30	1333	40	480 Vac, 50/60Hz	40/30					21"x36"x42"	675/307	In Controller	N/A	21"x36"x42"	(533mmx914mmx1067mm)	Bushing	1600/727	Oil	Steel
750-40	0-50	800	40	480 Vac, 50/60Hz	40/30					21"x36"x42"	675/307	In Controller	N/A	21"x36"x42"	(533mmx914mmx1067mm)	Bushing	1600/727	Oil	Steel
775-40	0-75	533	40	480 Vac, 50/60Hz	40/30					21"x36"x43"	675/307	In Controller	N/A	21"x36"x43"	(533mmx914mmx1092mm)	Bushing	1930/877	Oil	Steel
7100-40	0-100	400	40	480 Vac, 50/60Hz	40/30	30" x 73" x 31"				21"x36"x51"	675/307	In Controller	N/A	21"x36"x51"	(533mmx914mmx1295mm)	Bushing	2070941	Oil	Steel
7150-40	0-150	266	40	480 Vac, 50/60Hz	40/30	(762mm x 1855mm x 788mm)				38"x102"x36"	675/307	In Controller	N/A	38"x102"x36"	(965mmx2591mmx914mm)	Bushing	2650/1205	Oil	Steel
7200-40	0-200	200	40	480 Vac, 50/60Hz	40/none					42"x78"x42"	675/307	In Controller	N/A	42"x78"x42"	(1067mmx1981mmx1067mm)	Electrode	3250/1477	Oil	Fiberglass
7300-40	0-300	133	40	480 Vac, 50/60Hz	40/none					42"x90"x42"	675/307	In Controller	N/A	42"x90"x42"	(1067mmx2286mmx1067mm)	Electrode	4000/1818	Oil	Fiberglass
705-60	0-5	12000	60	480 Vac, 50/60Hz	60/50					29"x37"x38"	820/373	In Controller	N/A	29"x37"x38"	(737mmx940mmx965mm)	Bushing	1920/873	Oil	Steel
710-60	0-10	6000	60	480 Vac, 50/60Hz	60/50					29"x37"x40"	820/373	In Controller	N/A	29"x37"x40"	(737mmx940mmx1016mm)	Bushing	1920/873	Oil	Steel
720-60	0-20	3000	60	480 Vac, 50/60Hz	60/50					29"x37"x40"	820/373	In Controller	N/A	29"x37"x40"	(737mmx940mmx1016mm)	Bushing	1920/873	Oil	Steel
730-60	0-30	2000	60	480 Vac, 50/60Hz	60/50					32"x39"x41"	820/373	In Controller	N/A	32"x39"x41"	(813mmx991mmx1041mm)	Bushing	2550/1159	Oil	Steel
760-60	0-50	1000	60	480 Vac, 50/60Hz	60/50					30"x39"x44"	820/373	In Controller	N/A	30"x39"x44"	(762mmx991mmx1118mm)	Bushing	2330/1059	Oil	Steel
775-60	0-75	800	60	480 Vac, 50/60Hz	60/50	30" x 73" x 31"				31"x40"x45"	820/373	In Controller	N/A	31"x40"x45"	(788mmx1016mmx1143mm)	Bushing	2430/1105	Oil	Steel
7100-60	0-100	600	60	480 Vac, 50/60Hz	60/50	(762mm x 1855mm x 788mm)				32"x41"x51"	820/373	In Controller	N/A	32"x41"x51"	(813mmx1041mmx1295mm)	Bushing	2540/1155	Oil	Steel
7150-60	0-150	389 <sup>3</sup>	60	480 Vac, 50/60Hz	60/50					40"x106x40"	820/373	In Controller	N/A	40"x106x40"	(1016mmx2692mmx1016mm)	Bushing	3200/1455	Oil	Steel
7200-60	0-200	300	60	480 Vac, 50/60Hz	60/50					48"x78"x48"	820/373	In Controller	N/A	48"x78"x48"	(1219mmx1981mmx1219mm)	Electrode	3750/1705	Oil	Fiberglass
7300-60	0-300	200	60	480 Vac, 50/60Hz	60/NA					48"x90"x48"	820/373	In Controller	N/A	48"x90"x48"	(1219mmx12286mmx1219mm)	Electrode	4500/2046	Oil	Fiberglass
7400-60	0-400	150	60	480 Vac, 50/60Hz	60/NA					60"x118x60"	820/373	In Controller	N/A	60"x118x60"	(1524mmx2997mmx1524mm)	Electrode	5000/2272	Oil	Fiberglass
7500-60	0-500	120	60	480 Vac, 50/60Hz	60/NA					60"x130x60"	820/373	In Controller	N/A	60"x130x60"	(1524mmx3302mmx1524mm)	Electrode	6000/2727	Oil	Fiberglass
720-100	0-20	5000	100	480 Vac, 50/60Hz	100/75					30"x39"x46"	210/95		990/450	30"x39"x46"	(762mmx991mmx1168mm)	Bushing	2600/1182	Oil	Steel
730-100	0-30	3333	100	480 Vac, 50/60Hz	100/75					30"x39"x46"	210/95		990/450	30"x39"x46"	(762mmx991mmx1168mm)	Bushing	2600/1182	Oil	Steel
750-100	0-50	2000	100	480 Vac, 50/60Hz	100/75					32"x39"x46"	210/95		990/450	32"x39"x46"	(813mmx991mmx1168mm)	Bushing	2800/1273	Oil	Steel
775-100	0-75	1333	100	480 Vac, 50/60Hz	100/75					33"x41"x47"	210/95		990/450	33"x41"x47"	(838mmx1041mmx1194mm)	Bushing	3000/1364	Oil	Steel
7100-100	0-100	1000	100	480 Vac, 50/60Hz	100/75					34"x42"x53"	210/95		990/450	34"x42"x53"	(864mmx1067mmx1346mm)	Bushing	3100/1409	Oil	Steel
7150-100	0-150	666	100	480 Vac, 50/60Hz	100/75					42"x112"x42"	210/95		990/450	42"x112"x42"	(1067mmx2845mmx1067mm)	Bushing	3900/1773	Oil	Steel
7200-100	0-200	500	100	480 Vac, 50/60Hz	100/75					Consult factory	210/95		990/450	Consult factory		Bushing	Consult factory	"	Steel
7250-100	0-250	400	100	480 Vac, 50/60Hz	100/75					Consult factory	210/95		990/450	Consult factory		Bushing	"	"	Steel
7300-100	0-300	333	100	480 Vac, 50/60Hz	100/75					Consult factory	210/95		990/450	Consult factory		Bushing	"	"	Steel
7400-100	0-400	250	100	480 Vac, 50/60Hz	100/75					Consult factory	210/95		990/450	Consult factory		Bushing	"	"	Steel

Unit No.	AC Output Voltage (kV)	AC Output Current (mA)	AC Output Power <sup>1</sup> (kVA)	Std. Input <sup>2</sup> (Single Phase)	Duty Cycle (kVA) 1 hr./Cont.	Control		Regulator		HV Section				
						Dimensions <sup>3</sup> W x H x D	Weight (lbs./kg)	Dimensions <sup>3</sup> W x H x D	Weight (lbs./kg)	Dimensions <sup>3, 4, 5, 6</sup> W x H x D	Output <sup>7</sup> Type	Weight (lbs./kg)	Tank Insulation Type	
730-150	0-30	5000	150	480 Vac, 50/60Hz	150/100	210/95				32"x44"x49" (813mmx118mmx1245mm)	Bushing	3250/1477	Oil	Steel
750-150	0-50	3000	150	480 Vac, 50/60Hz	150/100	210/95				32"x44"x49" (813mmx118mmx1245mm)	Bushing	3250/1477	Oil	Steel
775-150	0-75	2000	150	480 Vac, 50/60Hz	150/100	210/95	22" x 43" x 44"	30" x 73" x 48"	1550/	32"x44"x52" (813mmx118mmx1321mm)	Bushing	3500/1591	Oil	Steel
7100-150	0-100	1500	150	480 Vac, 50/60Hz	150/100	210/95	(559mm x 1092mm x 1118mm)	(762mm x 1855mm x 1219mm)	705	34" x 44" x 57" (864mm x 1018mm x 1448mm)	Bushing	3650/1659	Oil	Steel
7150-150	0-150	1000	150	480 Vac, 50/60Hz	150/100	210/95	Deluxe slope front w/ writing desk			36" x 108" x 46" (914mm x 2743mm x 1168mm)	Bushing	4550/2068	Oil	Steel
7200-150	0-200	750	150	480 Vac, 50/60Hz	150/100	210/95				Consult factory	Bushing	3900/1773	Oil	Steel
7250-150	0-250	600	150	480 Vac, 50/60Hz	150/100	210/95				Consult factory	Bushing	Consult factory	Oil	Steel
7300-150	0-300	500	150	480 Vac, 50/60Hz	150/100	210/95				Consult factory	Bushing	"	Oil	Steel
750-200	0-50	4000	200	480 Vac, 50/60Hz	200/150	210/95				34" x 46" x 49" (864mm x 1168mm x 1245mm)	Bushing	3700/1682	Oil	Steel
7100-200	0-100	2000	200	480 Vac, 50/60Hz	200/150	210/95	22" x 43" x 44"	30" x 73" x 48"	2100/	36" x 46" x 55" (914mm x 1168mm x 1397mm)	Bushing	4170/1895	Oil	Steel
7200-200	0-200	1000	200	480 Vac, 50/60Hz	200/150	210/95	(559mm x 1092mm x 1118mm)	(762mm x 1855mm x 1219mm)	955	Consult factory	Bushing	Consult factory	Oil	Steel
7300-200	0-300	666	200	480 Vac, 50/60Hz	200/150	210/95				Consult factory	Bushing	"	Oil	Steel
7400-200	0-400	500	200	480 Vac, 50/60Hz	200/150	210/95				Consult factory	Bushing	"	Oil	Steel
7250-250	0-250	1000	250	480 Vac, 50/60Hz	200/150	210/95				Consult factory	Bushing	Consult factory	Oil	Steel
7500-250	0-500	500	250	480 Vac, 50/60Hz	250/187	210/95				Consult factory	Bushing	"	Oil	Steel
730-300	0-30	10000	300	480 Vac, 50/60Hz	250/187	210/95				Consult factory	Bushing	"	Oil	Steel
750-300	0-50	6000	300	480 Vac, 50/60Hz	300/225	210/95	22" x 43" x 44"	30" x 73" x 48"	3150/1430	32"x44"x52" (813mm x 118mm x 1321mm)	Bushing	"	Oil	Steel
7300-300	0-300	1000	300	480 Vac, 50/60Hz	300/225	210/95	(559mm x 1092mm x 1118mm)	(762mm x 1855mm x 1219mm)	3150/1430	Consult factory	Bushing	"	Oil	Steel
7200-400	0-200	2000	400	480 Vac, 50/60Hz	300/225	210/95				Consult factory	Bushing	"	Oil	Steel
7400-400	0-400	1000	400	480 Vac, 50/60Hz	400/300	210/95				Consult factory	Bushing	"	Oil	Steel
7250-500	0-250	2000	500	480 Vac, 50/60Hz	400/300	210/95				Consult factory	Bushing	"	Oil	Steel
7500-500	0-500	1000	500	480 Vac, 50/60Hz	500/375	210/95				Consult factory	Bushing	"	Oil	Steel

**Notes:**

1. Half of capacitive load is cancelled out by reactance of HV transformer for systems rated 300kVA or larger.
2. Other input voltages are also available.
3. Optional < 2pC PD free rating may increase size. Consult factory for estimated dimensions.
4. HV section dimensions for systems ≤ 150kV and ≤ 60kVA are absolute and include output bushings, connection boxes, flanges, etc. Consult factory for tank only dimensions.
5. Tank dimensions on systems 100kVA or larger are estimates only. Exact dimensions can be provided upon order placement.
6. Dimensions for systems > 150kV and > 60kVA do not include angle-mounted porcelain bushing or electrode termination.
7. Output Cables are not supplied for systems with Electrode or Bushing output.



**HIPOTRONICS**<sup>®</sup>  
THE MEASURE OF A LEADER

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