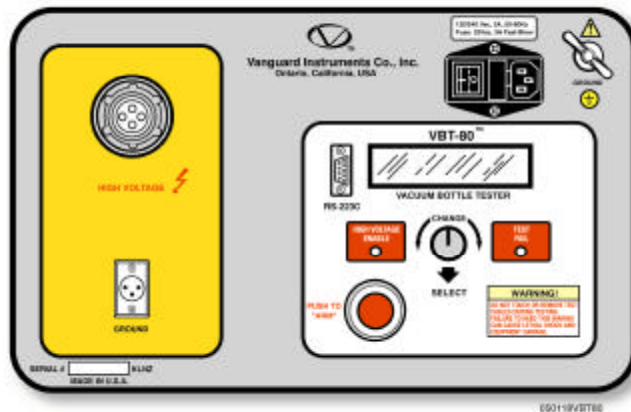
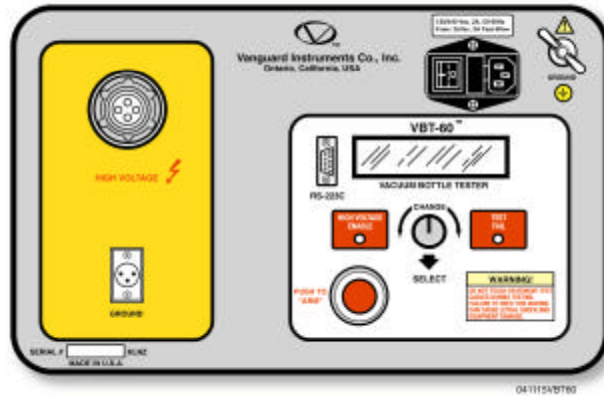


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**OPERATING INSTRUCTIONS**  
for the  
**VBT-60/80**  
Vacuum Bottle Tester



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## **SAFETY SUMMARY**

### **NOTICE**

*This manual applies to Models VBT-60, and VBT-80. The operating procedures are virtually the same for all models; any differences are clearly described in the step-by-step procedures.*

### **Follow Exact Operating Procedures**

Any deviation from the procedures described in this operator's manual may create one or more safety hazards, damage the VBT, or cause errors in the test results; Vanguard Instruments Co., Inc. assumes no liability for unsafe or improper use of the VBT.

The following safety precautions must be observed during all phases of test set up, test hookups, testing, and test-lead disconnects.

### **SAFETY WARNINGS AND CAUTIONS**

This device shall be used only by **trained operators**.

All circuit breakers under test shall be off line and fully isolated.

### **Do Not Modify Test Equipment**

Because of the risk of introducing unknown hazards, do not install substitute parts or perform any unauthorized modification to any Model VBT Test unit. To ensure that all designed safety features are maintained, it is recommended that repairs be performed only by Vanguard Instruments Co. factory personnel or by an authorized repair service. Unauthorized modifications can cause serious safety hazards and will nullify the manufacturer's warranty.

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# VBT-60/80 Operating Procedures

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## 1.0 INTRODUCTION

### 1.1 Applicability

This manual applies to the Model VBT-60™ and Model VBT-80™ (hereafter, VBT), made by Vanguard Instruments Company, Inc.

### 1.2 General Description

The VBT-60 and VBT-80 are light-weight DC vacuum bottle testers made by Vanguard Instruments Company. The VBT tests the vacuum bottle integrity by applying a DC voltage across the bottle under test. A simple “PASS” or “FAIL” message indicates the condition of the bottle after each test. The VBT is field-portable, rugged, and is easily operated by first-time users having a minimum of training. It features a “Turn-then-Press” control knob for entering test parameters and control functions.

*Turning the knob* scrolls through a menu of possible options (which display in sequence) and *pressing the knob* activates the selected function

A 2-line by 16-character LCD alpha/numeric readout is used for displaying control-option menus, and test results. The operation requires little more than connecting test leads to the vacuum bottle, selecting the desired test voltage and test duration.

### 1.3 Functional Description

Using a voltage multiplier, the VBT-60 generates a programmable test voltage from 10,000 V dc to 60,000 V dc (or 10,000 V dc to 80,000 for VBT-80) with 5,000 V dc steps.

The test voltage can be applied at different time durations: 5 seconds, 10 seconds, 30 seconds, 1 minute, or 2 minutes. Test current is monitored by the VBT electronics during test. If this test current exceeds a preset threshold, the test is terminated and a test “FAIL” message is displayed. The over-current threshold is programmable at 100 micro-amps, or 200 micro-amps, or 300 micro-amps.

A “FAIL” message will be displayed on the LCD and “TEST FAIL” indicator will be illuminated on the front panel.

A test is considered successful if the selected test voltage was applied for the full test duration and the test current did not exceed the preset threshold.

The VBT’s LCD displays “PASS” message along with the test voltage and test duration if a test is successful.

### 1.4. Furnished Test Accessories

The VBT is supplied with one 10-foot long high-voltage test cable, one 10-foot long voltage-return lead with alligator clamps. A Ground cable, power cord and a shipping case are also included with each VBT.



**Figure 1. High voltage cable**



**Figure 2. High Voltage return cable**

## **VBT-60/80 Operating Procedures**

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### **2.0 VBT SPECIFICATIONS**

#### **2.1 VBT-60 Specifications**

VBT-60 specifications and leading particulars are listed in Table 1.0.

**Table 1.0. VBT-60 Specifications**

---

<b>MODEL</b> .....	VBT-60
<b>TYPE</b> .....	Special-Purpose Test Equipment, portable 60 kV vacuum bottle tester
<b>SIZE (inches)</b> .....	16.8 W by 3.5 H by 10.6 D (42.7 cm by 8.9 cm by 26.9 cm)
<b>WEIGHT</b> .....	10 pounds (4.53 Kg)
<b>INPUT POWER</b> .....	2 amps, 90-240 Vac, 50/60 Hz
<b>OUTPUT VOLTAGE</b> ...	10kV to 60kV dc in 5,000 volt steps
<b>OUTPUT RIPPLE VOLTAGE</b> .....	3% max
<b>DISCHARGE TIME</b> .....	Maximum discharge time for internal high voltage is 0.3 seconds
<b>DISPLAY</b> .....	Backlit LCD, 2-lines by 16 characters
<b>INDICATORS</b> .....	Test failure indicator: LED is turned on if test current exceeds the preset current threshold (100? A, 200? A or 300? A). High Voltage Enable Indicator: LED is turned on when high voltage is present at high voltage cable.
<b>CONTROL</b> .....	Single knob selector (turn-and-press selection)
<b>COMPUTER INTERFACE</b> .....	RS-232C port, 19,200 Baud (Factory Calibration and Diagnostic)
<b>ENVIRONMENT</b> .....	Operating: -10°C to 55°C (15°F to +122°F) Storage: -30°C to 70°C (-22°F to +158°F)
<b>FURNISHED ITEMS</b> ...	One power cord, one ground cable, one 10-ft. high-voltage cable, One 10-ft. high-voltage return cable.
<b>OPTIONS</b> .....	Transportation case included
<b>WARRANTY</b> .....	One-Year Parts & Labor (Post-Warranty Service Contracts Available)

*VBT-60 SPECIFICATIONS ARE SUBJECT TO UPGRADES AND MAY BE CHANGED WITHOUT PRIOR NOTICE.*

---

## **VBT-60/80 Operating Procedures**

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### **2.2 VBT-80 Specifications**

VBT-80 specifications and leading particulars are listed in Table 2.0

**Table 2.0. VBT-80 Specifications**

---

<b>MODEL</b> .....	VBT-80
<b>TYPE</b> .....	Special-Purpose Test Equipment, portable 80 kV vacuum bottle tester
<b>SIZE (inches)</b> .....	16.8 W by 3.5 H by 10.6 D (42.7 cm by 8.9 cm by 26.9 cm)
<b>WEIGHT</b> .....	10 pounds (4.53 Kg)
<b>INPUT POWER</b> .....	2 amps, 90-240 V ac, 50/60 Hz
<b>OUTPUT VOLTAGE</b> ...	10 kV to 80 kV dc in 5,000-volt steps
<b>OUTPUT RIPPLE VOLTAGE</b> .....	3% max
<b>DISCHARGE TIME</b> .....	Maximum discharge time for internal high voltage is 0.3 seconds
<b>DISPLAY</b> .....	Backlit LCD, 2-lines by 16 characters
<b>INDICATORS</b> .....	Test failure indicator: LED is turned on if test current exceeds the preset current threshold (100? A, 200? A or 300? A). High Voltage Enable Indicator: LED is turned on when high voltage is present at high voltage cable.
<b>CONTROL</b> .....	Single knob selector (turn-and-press selection)
<b>COMPUTER INTERFACE</b> .....	RS-232C port, 19,200 Baud (Factory Calibration and Diagnostic)
<b>ENVIRONMENT</b> .....	Operating: -10°C to 55°C (15°F to +122°F) Storage: -30°C to 70°C (-22°F to +158°F)
<b>FURNISHED ITEMS</b> ...	One power cord, one ground cable, one 10-ft. high-voltage cable, One 10-ft. high-voltage return cable.
<b>OPTIONS</b> .....	Transportation case included
<b>WARRANTY</b> .....	One-Year Parts & Labor (Post-Warranty Service Contracts Available)

*VBT-80 SPECIFICATIONS ARE SUBJECT TO UPGRADES AND MAY BE CHANGED WITHOUT PRIOR NOTICE.*

---

## VBT-60/80 Operating Procedures

### 3.0 CONTROL AND DISPLAY

#### 3.1 VBT-60 Front Panel

The VBT-60 controls and displays are shown in Figure 3. Pointing leader lines reference each item with an index number. Each index number is cross-referenced to a functional description in Table 3, which describes the function and purpose of each item on the control panel. Although the purpose of these controls and the display may seem obvious and intuitive, users should become familiar with them before attempting to use the VBT-60. First-time users should also review and become familiar with the Safety Summary on the front page.

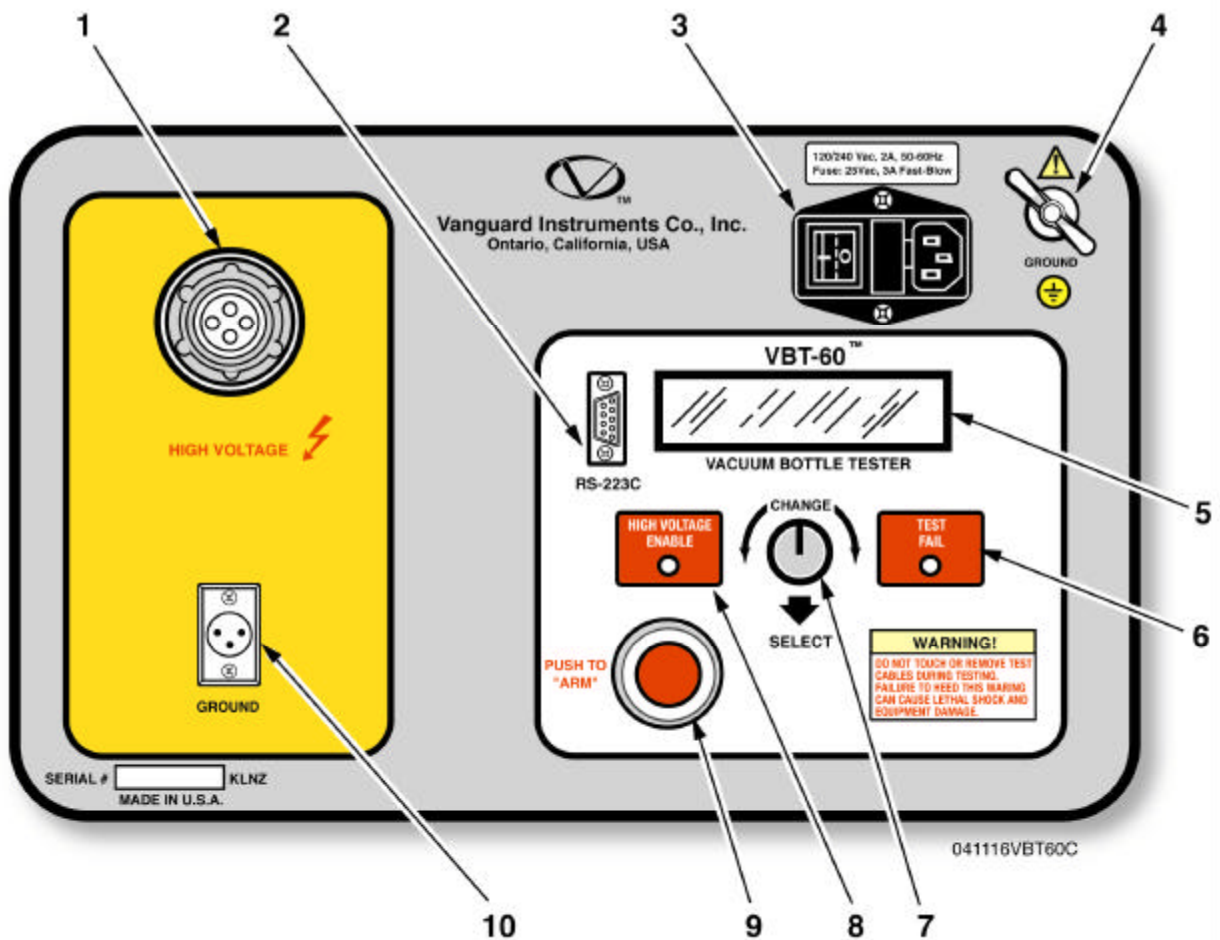


Figure 3. VBT-60 Control-Panel Controls and Display

Table 3.0. Functional Description of VBT-60 Controls and Display

Figure 1 Index #	Adjacent Panel Marking	Functional Description								
1	(Connector)	High-voltage-cable connector								
2	<b>RS-232C</b>	RS-232C interface port; 9-pin connector; female DB type. The data are set to 19,200 baud, 1 start bit, 8 data bits, and no parity bit; <table style="margin-left: auto; margin-right: auto;"> <tr> <td><u>PIN</u></td> <td><u>SIGNAL</u></td> </tr> <tr> <td>2</td> <td>Rx</td> </tr> <tr> <td>3</td> <td>Tx</td> </tr> <tr> <td>5</td> <td>Signal Gnd</td> </tr> </table> <p>This serial port is for factory calibration and firmware updates</p>	<u>PIN</u>	<u>SIGNAL</u>	2	Rx	3	Tx	5	Signal Gnd
<u>PIN</u>	<u>SIGNAL</u>									
2	Rx									
3	Tx									
5	Signal Gnd									
3	<b>90-230 Vac, 8A, 50- 60 Hz</b>	Input power connector with built-in fuse holder and power switch.								
4	<b>GROUND</b> (Wing Nut)	VBT ground stud. Connect ground stud to substation ground using the provided cable.								
5	No marking	LCD; 2-line by 16-character; back-lighted; displays menus of selections, operator entries, and test-measurement results.								
6	<b>TEST FAIL</b>	Test Fail Indicator. This indicator is turned on if the test current exceeds the preset current threshold (100, 200, or 300 ? A).								
7	<b>CHANGE SELECT</b>	VBT control knob. Turn knob to desired new feature. Press knob to select that new feature								
8	<b>HIGH VOLTAGE ENABLE</b>	LED indicator, red; Lights when high-test-voltage is present at the test leads.								
9	<b>PUSH TO "ARM"</b>	Arm switch; Press and hold during test								
10	<b>GROUND</b>	High-voltage-return cable connector.								

## VBT-60/80 Operating Procedures

### 3.2. VBT-80 Front Panel

The VBT-80 controls and displays are shown in Figure 4. Pointing leader lines reference each item with an index number. Each index number is cross-referenced to a functional description in Table 4, which describes the function and purpose of each item on the control panel. Although the purpose of these controls and the display may seem obvious and intuitive, users should become familiar with them before attempting to use the VBT-80. First-time users should also review and become familiar with the Safety Summary on the front page.

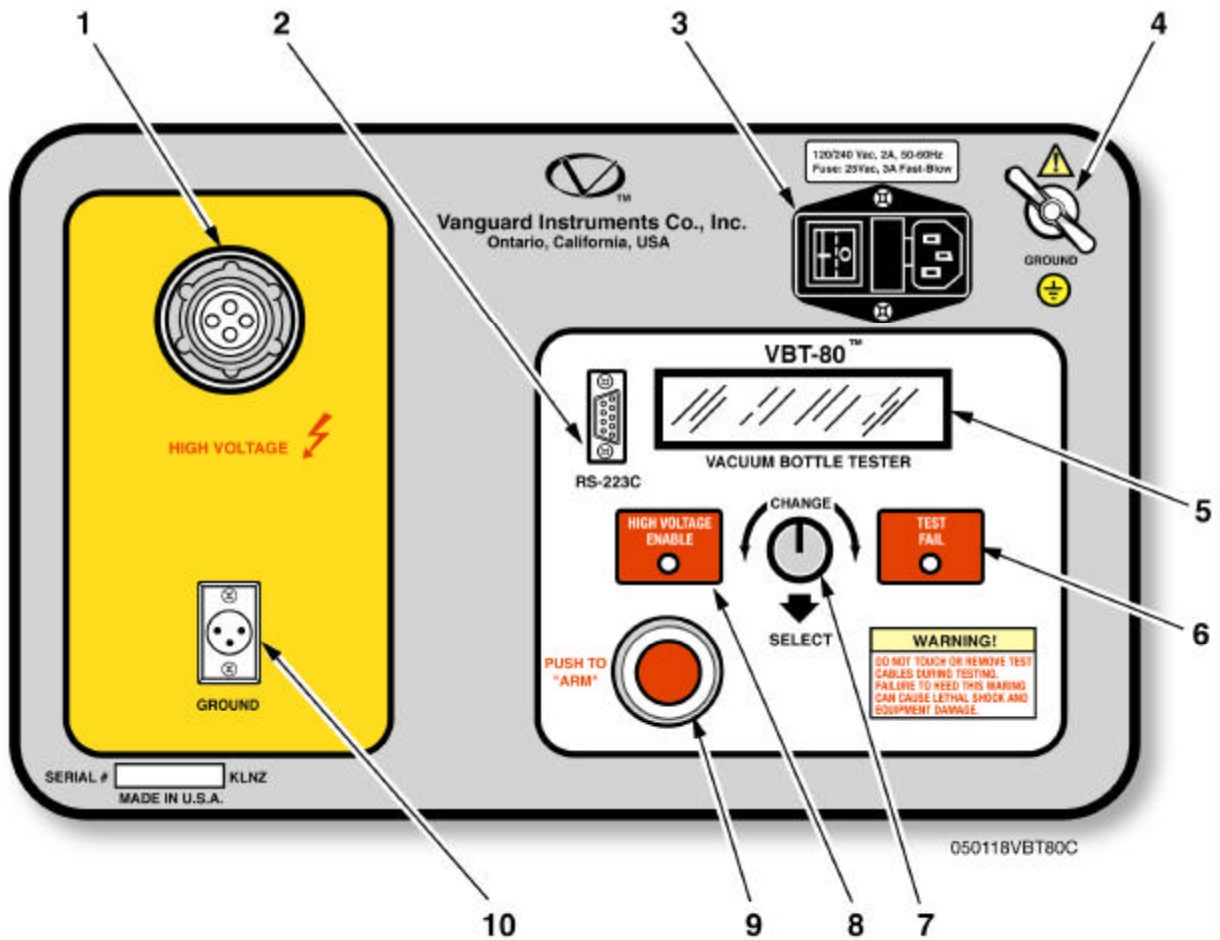


Figure 4. VBT-80 Control-Panel Controls and Display

Table 4.0 Functional Description of VBT-80 Controls and Display

Figure 1 Index #	Adjacent Panel Marking	Functional Description
1	(Connector)	High-voltage-cable connector
2	<b>RS-232C</b>	RS-232C interface port; 9-pin connector; female DB type. The data are set to 19,200 baud, 1 start bit, 8 data bits, and no parity bit; <u>PIN</u> ..... <u>SIGNAL</u> 2                Rx 3                Tx 5                Signal Gnd This serial port is for factory calibration and firmware updates
3	<b>90-230 Vac, 8A, 50- 60 Hz</b>	Input power connector with built-in fuse holder and power switch circuit breaker.
4	<b>GROUND</b> (Wing Nut)	VBT ground stud. Connect ground stud to substation ground using the provided cable.
5	No marking	LCD; 2-line by 16-character; back-lighted; displays menus of selections, operator entries, and test-measurement results.
6	<b>TEST FAIL</b>	Test Fail Indicator. This indicator lights if the test current exceeds the preset current threshold (100, 200, or 300 ?A).
7	<b>CHANGE SELECT</b>	VBT control knob. Turn knob to desired new feature. Press knob to select that feature.
8	<b>HIGH VOLTAGE ENABLE</b>	LED indicator, red; Lights when high-test-voltage is present at the test leads.
9	<b>PUSH TO "ARM"</b>	Arm switch; Press and hold during test
10	<b>GROUND</b>	High-voltage-return cable connector.

## **VBT-60/80 Operating Procedures**

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### **4.0 VBT-60/80 IMPORTANT FEATURES**

#### **4.1 Operating Voltages**

The VBT-60/80 operates with voltages between 90-240Vac, 50/60Hz.

#### **4.2 VBT-60/80 Serial Interface**

A built-in, RS-232C port is used to calibrate the VBT at the factory and to perform field firmware upgrade.

# VBT-60/80 Operating Procedures

## 5.0 CABLE CONNECTION

The VBT is supplied with one 10-foot “High Voltage” cable and one 10-foot voltage-return cable. Both cables are terminated with alligator clamps to connect to the vacuum bottle being tested. A typical cable connection for the VBT to a Vacuum bottle under test is shown in Figure 5 and Figure 6. To protect the VBT against static discharge in the substation, always connect the unit’s ground stud to the substation ground.

**Note:**

1. The circuit breaker must be off line and completely isolated. The vacuum bottle under test should be in the open position.

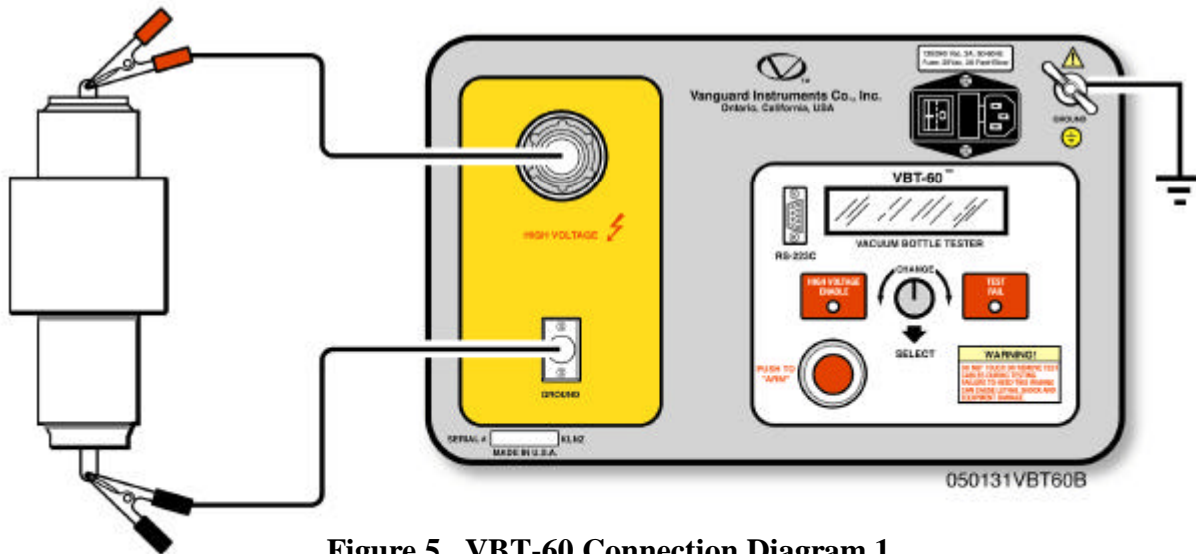


Figure 5. VBT-60 Connection Diagram 1

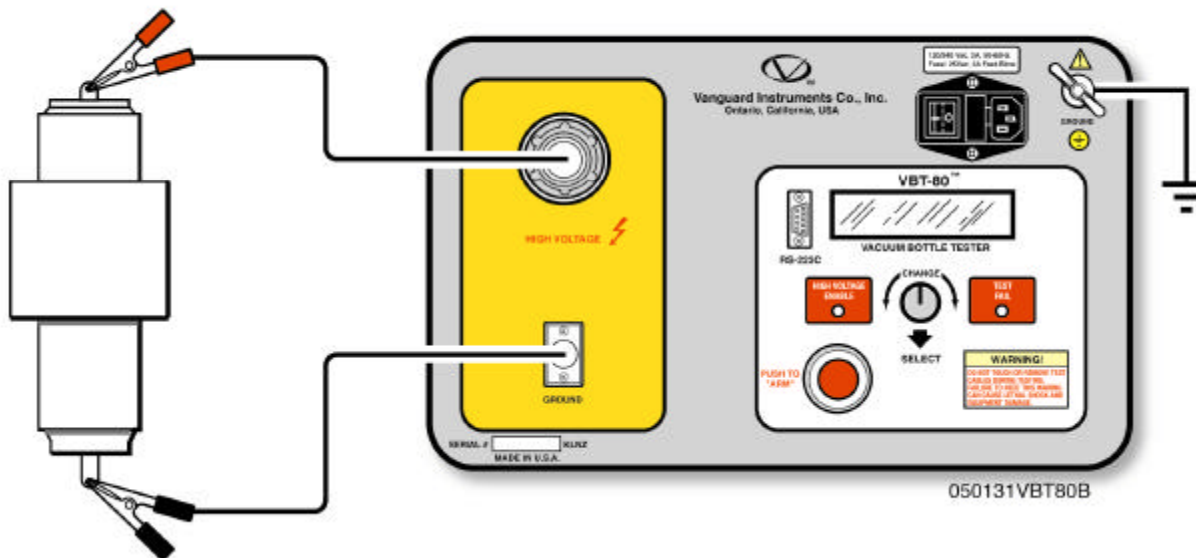


Figure 6. VBT-80 Connection Diagram 2

## VBT-60/80 Operating Procedures

### 6.0 OPERATING PROCEDURES

Review Figures 5 and 6 before proceeding with the step-by-step procedures that follow.

#### 6.1 0 Preparations

- a. Make sure the circuit breaker under test is off line and isolated. The vacuum bottle under test should be isolated and in opened position.
- b. Make sure the VBT power switch is in the off position.
- c. Ground the VBT to Substation ground.
- d. Plug the VBT power cable into a power outlet.
- e. Connect the VBT high-voltage cable end (Red clip) to one side of vacuum bottle (see Figures 5 & 6).
- f. Connect the VBT high-voltage-return cable (black clip) to the other side of the vacuum bottle.
- g. Turn on the VBT power, by pressing the rocker switch to the ON position.

#### 6.1.1 Setup and Run Test Procedure

The following steps are required to run a test with the VBT-60/80 (when power is first applied to the VBT-60/80).

Table 5. Setup and Run Test Procedure

STEP	DESCRIPTION	DISPLAY	ACTION
1	Initiate a test	MAIN: <RUN TEST> 18:02:00	Press knob
2	Select Test Duration	TIME: <5 Sec> 18:02:05	Turn knob to desired time
3	Confirm Test Duration	TIME: <10 Sec> 18:02:07	Press knob
4	Select Test Voltage	VLTG: <10 KV> 18:02:10	Turn knob to desired voltage
5	Confirm Test Voltage	VLTG: <60 KV> 18:02:15	Press knob
6	Select Flash-Over Threshold	Thres: <100 uA> 18:02:17	Turn knob to desired threshold
7	Confirm Threshold	Thres: <300 uA> 18:02:20	Press knob
8	Confirm Test setting	“PRESS” IF OKAY 60KV 10Sec 300uA	Press knob
9	Start Test Now	PRESS RED SWITCH TO START TEST	Press and hold RED Switch
10	Test in progress	60.0KV 0.20uA Time: 00.04	Press and hold RED Switch
11	Observe PASS/FAIL	60KV 10Sec 300uA >>PASS<<	Release “RED” switch
12	Return to Main Menu	60KV 10Sec 300uA >>PASS<<	Press knob

## VBT-60/80 Operating Procedures

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### 6.1.2. Repeat Test Procedure

The following steps shall be used to repeat a test.

**Table 6. Repeat Test Procedure**

STEP	DESCRIPTION	DISPLAY	ACTION
1	Initiate a test	MAIN: <RUN TEST> 20:02:00	Press knob
2	Confirm current setting	“PRESS” IF OKAY 60KV 10Sec 300uA	Press knob
3	Start Test Now	PRESS RED SWITCH TO START TEST	Press and hold RED Switch
4	Test in progress	60.0KV 0.20uA Time: 00.04	Press and hold RED Switch
5	Observe PASS/FAIL	60KV 10Sec 300uA >>PASS<<	Release RED Switch
6	Return to Main Menu	60KV 10Sec 300uA >>PASS<<	Press knob

**Note:**

1. To change the Test Voltage, Test duration, or Over current setting, use SET UP menu.
2. A “FAIL” message will be displayed on the LCD and “TEST FAIL” indicator will be illuminated on the front panel.
3. The VBT’s LCD displays “PASS” message along with the test voltage and test duration if a test is successful.

## VBT-60/80 Operating Procedures

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### 6.1.3. Change VBT Test Duration, Test Voltage and Test Current Threshold

The test duration can be set at 5 seconds, 10 seconds, 30 seconds, 1 minute, or 2 minutes.

The test voltage for the VBT-60 can be set from 10 kv DC to 60 kv DC with 5 kv DC steps.

The test voltages for the VBT-80 can be set from 10 kv DC to 80 kv DC with 5 kv DC steps.

Test current threshold can be set at 100 ?A or 200?A or 300?A.

Use the following steps to select test duration, test voltage and test current threshold.

**Table 7. Set VBT Test Duration, Voltage, Current**

STEP	DESCRIPTION	DISPLAY	ACTION
1	Select SETUP mode	MAIN: <RUN TEST> 21:02:00	Turn knob
2	Go to SETUP mode	MAIN: <SETUP> 21:02:05	Press knob
3	Change time duration	TIME: <5 Sec> 21:02:06	Turn knob to change time.
4	Select 10 second test time	TIME: <10 Sec> 21:02:07	Press knob to select
5	Change voltage setting	VLTG: <10 KV> 21:02:08	Turn knob to change voltage
6	Select 20 KV test voltage	VLTG: <20 KV> 21:02:09	Press to select voltage
7	Change Current threshold setting	Thres: <100 ? A> 21:02:10	Turn knob then press to select
8	Return to Main Menu	MAIN: <RUN TEST> 21:02:05	None

## VBT-60/80 Operating Procedures

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### 6.1.4. Set VBT Clock

Use the following steps to set the VBT real time clock.

Table 8. Set VBT Clock

STEP	DESCRIPTION	DISPLAY	ACTION
1	Select Utility Mode	MAIN: <RUN TEST> 21:02:00	Turn knob
2	Confirm Utility Mode Setting	MAIN: <UTIL> 21:02:05	Press knob
3	Change Time	UTIL: <SET TIME> 21:02:06	Press to select
4	Change Month	MM-DD-YY HH:MM 0	Turn knob then press to select
5	Change Day setting	MM-DD-YY HH:MM 05-	Turn knob then press to select
6	Change Year setting	MM-DD-YY HH:MM 03-02-0	Turn knob then press to select
7	Change Hour setting	MM-DD-YY HH:MM 03-02-05 0	Turn knob then press to select
8	Change Minute setting	MM-DD-YY HH:MM 03-02-05 21:0	Turn knob then press to select
9	Return to Main Menu	MAIN: <RUN TEST> 21:05:00	None

### 6.1.5. Set VBT LCD Contrast

Use the following steps to set the VBT LCD contrast. The contrast setting will be saved in memory.

Table 9. Set VBT LCD Contrast

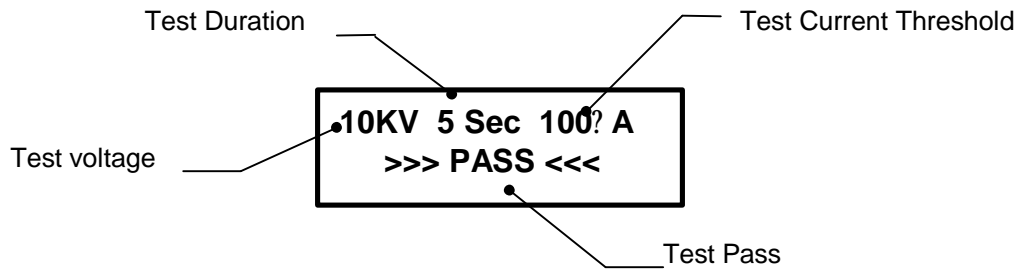
STEP	DESCRIPTION	DISPLAY	ACTION
1	Select Contrast Mode	MAIN: <RUN TEST> 21:02:00	Turn knob
2	Confirm Contrast Mode Setting	MAIN: <CONTRAST> 21:02:05	Press knob
3	Adjust LCD contrast	CONTRAST ADJUST "PRESS" To EXIT	Turn knob then press to select
4	Return to Main Menu	MAIN: <RUN TEST> 21:05:00	None

## VBT-60/80 Operating Procedures

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### 6.1.5 VBT Test PASS Display

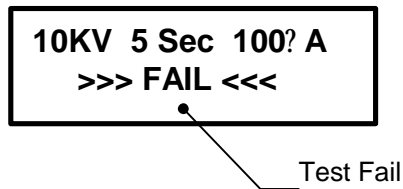
After a successful test, the VBT will display the following message on the LCD. Turn or press the control knob will return the display to the main menu.



**Figure 7. "PASS" Message**

### 6.1.6 VBT Test FAIL Display

After a failed test, the VBT will display the following message on the LCD and the "TEST FAIL" indicator is also illuminated.



**Figure 8. "FAIL" Message**



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