VBT-75P
VACUUM BOTTLE TESTER

USER'S MANUAL

Vanguard Instruments Company, Inc.

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SAFETY SUMMARY

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-75P, or cause errors in the test results; Vanguard Instruments Co., Inc. assumes no liability for unsafe or improper use of the VBT-75P. 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**.

SERVICE AND REPAIR

- Do not install substitute parts or perform any unauthorized modification to any VBT-75P test unit.
- Repairs must be performed only by Vanguard Instruments Company factory personnel or by an authorized repair service provider. Unauthorized modifications can cause safety hazards and will void the manufacturer's warranty.

EQUIPMENT RATINGS

IP Rating: The enclosure for the VBT-75P has an IP rating of 32.

Pollution Degree: The VBT-75P has a pollution rating of 2.

Operating Voltage: The VBT-75P is rated for use with an operating voltage of 120V or 240V, auto-ranging ±10% of selected voltage.

Power Cord: The VBT-75P is supplied with a 16 AWG, 16A power cord with a NEMA 5-15P plug. Replacement cable shall have the same or better rating and is available through the manufacturer.

VENTILATION REQUIREMENTS

The VBT-75P must be operated with the enclosure lid open.

SAFETY SYMBOLS

Indicates that caution should be exercised

OR   Indicates location of chassis ground terminal

CLEANING

To clean the VBT-75P:
- Disconnect all cables and turn the unit off.
- Use a soft, lint-free cloth to wipe all surfaces clean.
- Avoid getting moisture in openings and connectors.
- Don't use any cleaning products or compressed air.

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CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

- A key or switch on the VBT-75P is indicated as **[KEY]** and **[SWITCH]**.

- Screen and menu names are referenced as "SCREEN/MENU NAME".

- VBT-75P LCD screen output is shown as:

```
DISPLAY TEXT LINE 1
DISPLAY TEXT LINE 2
DISPLAY TEXT LINE 3
DISPLAY TEXT LINE 4
```

- Warning messages are indicated as:

> Warning message
>
> **WARNING**

- Important notes are indicated as:

> Note details
>
> **NOTE**

1.0   INTRODUCTION

1.1   General Description and Features

The VBT-75P is a microprocessor-based, portable 75 kV dc vacuum bottle tester. This lightweight, portable tester is designed for testing circuit-breaker vacuum bottles in the field and at the shop.

Test voltages can be selected from 10 kV dc to 75 Kv dc in 1 Kv steps. The high voltage test time can be set from 5 seconds to 2 minutes. The test voltage is raised to the selected voltage and held for the test time duration. After the test time duration has elapsed and the leakage current did not pass the pre-set value of 100 µA, 200 µA, or 300 µA, the test voltage is returned to zero and a "Pass" message is displayed. If a flash-over condition occurs, such as bottle failure, the test voltage is immediately turned off, a "Failure" message is displayed on the LCD screen, and the "TEST FAIL" LED light on the unit is also illuminated.

The presence of high voltage is indicated by an audible tone and an illuminated "HIGH VOLTAGE" LED light. For additional operator safety, an "ARM" switch must be held down during testing.

The VBT-75P features a back-lit LCD screen (20 characters by 4 lines) that is viewable in both bright sunlight and low-light levels. A rugged, 16-key, membrane keypad is used to control the unit. Test results can be printed on the built-in 2.5" wide thermal printer.

The VBT-75P can store up to 84 records of 16 readings in Flash EEPROM. Test records can be retrieved and printed on the built-in thermal printer, or they can be transferred to a PC via the unit's RS-232C interface. Windows®-based software is provided with each unit. Using this software, test records can be retrieved from the VBT-75P and then stored on the PC for future analysis and report generation. Additionally, test records can be exported in PDF, Excel, and XML formats.

The VBT-75P is furnished with a 10-foot test cable that is terminated with a quick-disconnect test clip. A transportation case is also included.

1.2   Printer Paper

The VBT-75P's built-in thermal printer uses 2.5-inch wide thermal paper for printing test results. To maintain the highest print quality and to avoid paper jams, the use of thermal paper supplied by Vanguard Instruments Company is highly recommended. Additional paper can be ordered from the following sources:

Vanguard Instruments Co, Inc.
1520 S. Hellman Avenue
Ontario, CA 91761
Tel: 909-923-9390
Fax: 909-923-9391
Part Number: VIC TP-3 paper

BG Instrument Co.
13607 E. Trent Avenue
Spokane, WA 99216
Tel: 509-893-9881
Fax: 509-893-9803
Part Number: VIC TP-3 paper

1.3   Technical Specifications

Table 1. VBT-75P Technical Specifications

TYPE	Portable 75 kV vacuum bottle tester
PHYSICAL SPECIFICATIONS	Dimensions: 17"W x 10.5"H x 6.5" D (42.7 cm x 26.9 cm x 16.5 cm) Weight: 12 lbs. (5.44 Kg)
INPUT POWER	2 amps, 90-240 Vac, 50/60 Hz
OUTPUT VOLTAGE	10 kV to 75 kV dc in 1 kV steps; accuracy: 1.5%
OUTPUT RIPPLE VOLTAGE	3% max
DISCHARGE TIME	Maximum discharge time for internal high voltage is 3 seconds
DISPLAY	back-lit LCD (20 characters x 4 lines); viewable in bright sunlight and low-light levels
KEYPAD	rugged membrane keypad (10 alpha-numeric keys, 6 function keys)
COMPUTER INTERFACE	one RS-232C port
INTERNAL DATA STORAGE	stores up to 84 records of 16 readings each
PC SOFTWARE	Windows-based software is included with purchase price
PRINTER	Built-in 2.5" wide thermal printer
ENVIRONMENT	Operating: -10˚ to 50˚ C (15˚ to +122˚ F); Storage: -30˚ C to 70˚ C (-22˚ to +158˚ F)
HUMIDITY (MAX)	90% RH @ 40˚ C (104˚ F) non-condensing
ALTITUDE (MAX)	2000m (6562 ft) to fully safety specifications
CABLES	one 10-foot high-voltage cable, one 10-foot high voltage return cable, one ground cable, one power cord
FURNISHED ACCESSORIES	Shipping case is included
WARRANTY	One year on parts and labor

The above specifications are valid at nominal operating voltage and at a temperature of 25°C (77°F). Specifications may change without prior notice.

NOTE

1.4 VBT-75P Controls and Indicators

The VBT-75P's controls and indicators are shown in Figure 1 below. A leader line with an index number points to each control and indicator, which is cross-referenced to a functional description in Table 2. The table describes the function of each item on the control panel. The purpose of the controls and indicators may seem obvious, but users should become familiar with them before using the VBT-75P. Accidental misuse of the controls will usually cause no serious harm. Users should also be familiar with the safety summary found on the front page of this User's Manual.

Figure 1. VBT-75P Controls and Indicators

Table 2. Functional Descriptions of VBT-75P Controls and Indicators

Item Number	Panel Markings	Functional Description
1	HIGH VOLTAGE	High voltage cable connector
2		Built-in 2.5" wide thermal printer
3	RS-232C	RS-232C port
4		Input power connector with built-in fuse holder and power switch
5	TEST FAIL	Test failure indicator. This indicator turns on if the test current exceeds the present current threshold (100, 200, or 300 µA).
6		Back-lit LCD screen (20 characters x 4 lines)
7	PUSH TO "ARM"	Arm switch; press and hold during testing.
8	HIGH VOLTAGE ENABLE	This indicator turns on when high test voltage is present at the test leads.
9		Rugged membrane keypad
10	GROUND	High voltage return cable connector
11	GROUND	VBT ground stud. Connect ground stud to substation ground using the provided cable.

2.0   CABLE CONNECTIONS

The VBT-75P comes furnished with one 10-foot (3.05m) high voltage cable and one 10-foot voltage return cable. Both cables are terminated with alligator clamps that are used to connect to the vacuum bottle being tested. A typical cable connection is shown in Figure 2 below.

> ⚠️ **WARNING**
> - To protect the VBT-75P against static discharge in the substation, always connect the unit's ground stud to the substation ground.
> - The circuit breaker must be off-line and completely isolated.
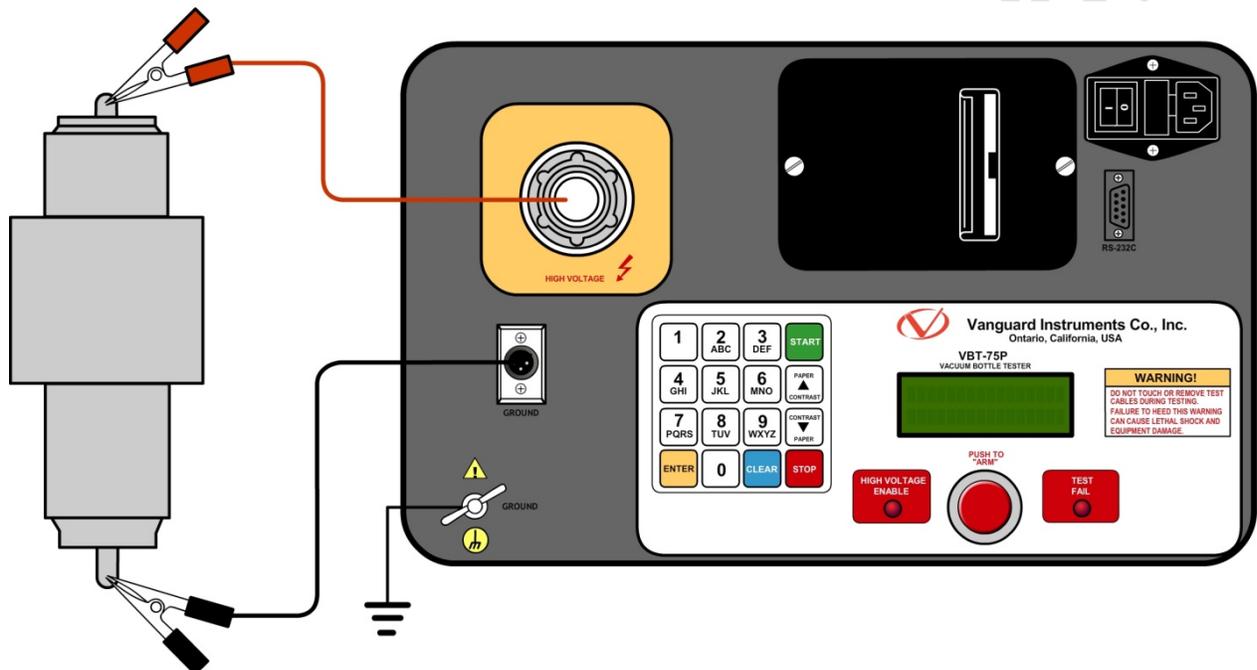> - The vacuum bottle under test should be in the OPEN position.

Figure 2. VBT-75P Connection Diagram

3.0   OPERATING PROCEDURES

3.1   Setting the Date and Time

Follow the steps below to set the date and time for the VBT-75P's internal clock:

   a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    09:00:51
```

   Press the **[2]** key (*SETUP*).

   b. The following screen will be displayed:

```
1.ENTER ID
2.REVIEW RECORD
3.RESTORE RECORD
4.NEXT PAGE
```

   Press the **[4]** key (*NEXT PAGE*).

   c. The following screen will be displayed:

```
1.COMPUTER CONTROL
2.SET TIME
```

   Press the **[2]** key (*SET TIME*).

   d. The following screen will be displayed:

```
MM-DD-YY       HH:MM
_
```

   Enter the date and time using the membrane keypad. The date and time will be set and you will be returned to the "START-UP" menu.

3.2   Adjusting LCD Screen Contrast

To adjust the LCD screen contrast, press and hold either the **[▲]** key to increase the contrast or the **[▼]** key to decrease the contrast. Release the key once the desired screen contrast has been achieved.

3.3 Entering Test Record Header Information

You can enter the test record header information before performing tests. The record header includes identifying information such as the company, station, circuit, manufacturer, etc. Once the header information has been set, it will apply to all subsequent test records. Follow the steps below to enter the test header information:

a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    09:00:51
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1.ENTER ID
2.REVIEW RECORD
3.RESTORE RECORD
4.NEXT PAGE
```

Press the **[1]** key (*ENTER ID*).

c. The following screen will be displayed:

```
COMPANY:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

Type the company name using the keypad.

When pressing a key, the corresponding number on the key will be displayed first. Pressing the key again will display the first letter on the key. Pressing the key again will display the second letter on the key. For example, to type the letter "A", you must press the **[2]** key twice. To erase the character at the cursor position, press the **[CLEAR]** key. Press the **[▲]** key to move to the next character. Press the **[▼]** key to move to the previous character. Press the **[ENTER]** key when you are done typing.

d. The following screen will be displayed:

```
STATION:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

Type the station name using the keypad and then press the **[ENTER]** key.

e. The following screen will be displayed:

```
CIRCUIT:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

f. Type the circuit information using the keypad and then press the **[ENTER]** key.

g. The following screen will be displayed:

```
MANUFACTURER:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

Type the manufacturer name using the keypad and then press the **[ENTER]** key.

h. The following screen will be displayed:

```
MODEL:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

Type the model information using the keypad and then press the **[ENTER]** key.

i. The following screen will be displayed:

```
SERIAL NUMBER:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

Type the serial number using the keypad and then press the **[ENTER]** key.

j. The following screen will be displayed:

```
OPERATOR:
_
UP/DOWN TO POSITION
"ENTER" TO ACCEPT
```

Type the operator's name using the keypad and then press the **[ENTER]** key. All header information will be saved, and you will be returned to the "START-UP" menu.

3.4   Performing a Test

Follow the steps below to perform a test:

a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    09:05:55
```

Press the **[1]** key (*RUN TEST*).

b. The following screen will be displayed:

```
1. 5 Sec  2. 10 Sec
3. 30 Sec 4. 60 Sec
5. 2 Min
```

Select the test time by pressing the corresponding number on the keypad. For this example, we will use the 5 second test time by pressing the **[1]** key.

c. The following screen will be displayed:

```
ENTER TEST VOLTAGE:
    (10 to 75)
       0 KV
```

Type the desired test voltage using the numeric keypad and then press the **[ENTER]** key.

d. The following screen will be displayed:

```
1. 300µA
2. 200µA
3. 100µA
```

Select the leakage current limit by pressing the corresponding number on the keypad. For this example, we will select 300µA by pressing the **[1]** key.

e. The following screen will be displayed summarizing the test parameters:

```
TEST PARAMETERS:
75KV  5Sec  300 µA
"CLEAR TO CHANGE OR
"ENTER" TO CONTINUE
```

Press the **[ENTER]** key to confirm the test parameters.

f. The following screen will be displayed:

```
PRESS RED SWITCH

  TO START TEST.
```

Press and hold the red **[ARM SWITCH]**.

g. The VBT-75P will initiate the test and start the timer based on the test duration selected. The screen will be updated with the test voltage and the leakage current as shown below:

```
TEST IN PROGRESS
74.9KV        186 µA
    Time: 00:03
```

h. After the test time duration has elapsed, the test results will be displayed. If the leakage current did not pass the preset value set in step d, the test voltage is returned to zero and a "PASS" message is displayed as shown below:

```
   TEST COMPLETE
75KV   5Sec   300 µA

   >>> PASS <<<
```

However, if a flash-over condition occurred, such as bottle failure, the test voltage is immediately turned off and a "FAIL" message is displayed as shown below:

```
   TEST COMPLETE
75KV   5Sec   300 µA

   >>> FAIL <<<
```

The "TEST FAIL" LED on the front panel will also be illuminated to indicate a test failure.

Release the **[ARM SWITCH]** and press any key to continue.

i. The following screen will be displayed:

```
PRINT TEST RESULTS?
1.YES
2.NO
```

Press the **[1]** key (*YES*) to print the test results. A sample test results printout is shown in Figure 3.

j.   The test results will be printed, and the following screen will be displayed:

```
KEEP THIS READING?
1.YES
2.NO
```

Press the **[1]** key (*YES*) to keep the test reading.

k.   The following screen will be displayed:

```
    TEST SAVED
```

Press any key to continue.

l.   The following screen will be displayed:

```
RUN ANOTHER TEST?
1.YES
2.NO
```

Press the **[2]** key (*NO*).

m.   The following screen will be displayed:

```
SAVE THIS RECORD?
1.YES
2.NO
```

Press the **[1]** key (*YES*) to save the test record.

n.   The following screen will be displayed:

```
RECORD NUMBER   1
  HAS BEEN SAVED!
```

Press any key to return to the "START-UP" menu.

Figure 3. Sample Test Results Printout

3.5   Printing a Directory of Test Records Stored in the VBT-75P's Memory

You can print a directory of all the test records stored in the VBT-75P's Flash EEPROM using the steps below:

a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    10:10:10
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1.ENTER ID
2.REVIEW RECORD
3.RESTORE RECORD
4.NEXT PAGE
```

Press the **[3]** key (*RESTORE RECORD*).

c. The following screen will be displayed:

```
1.RESTORE RECORD
2.DIRECTORY
3.ERASE RECORDS
```

Press the **[2]** key (*DIRECTORY*).

d. The following screen will be displayed:

```
1.PRINT DIRECTORY
2.SCROLL DIRECTORY
```

1. *PRINT DIRECTORY*

Press the **[1]** key to print the test record directory on the unit's built-in thermal printer. The following screen will be displayed:

```
   PRINT DIRECTORY

1.FULL DIRECTORY
2.SHORT DIRECTORY
```

Press the **[1]** key to print a full directory listing of all the test records stored in the unit's Flash EEPROM. The directory listing will be printed on the thermal printer and you will be returned to the "START-UP" menu.

Press the **[2]** key to print a short directory listing of the stored test records. The short directory option prints the last 10 records stored in the unit's Flash EEPROM. The short directory listing will be printed on the thermal printer and you will be returned to the "START-UP" menu.

A sample directory printout is shown in figure x.

2. *SCROLL DIRECTORY*

Press the **[2]** key to scroll through the record directory on the unit's LCD screen. The following screen will be displayed:

```
RECORDS DIRECTORY

"UP" TO SCROLL FWD
"DWN" TO SCROLL RVS
```

Press either the **[▲]**key or the **[▼]**key to display the next or previous test record, respectively. The test record information will be displayed as shown:

```
03/16/15  08:59
       1 TEST
```

Press the **[STOP]** key to return to the "START-UP" menu.

```
TEST DIRECTORY

RECORD NUMBER: 3
DATE/TIME: 03/04/15   07:22:42
NUMBER OF TESTS: 2
STATION:
CIRCUIT:
MFR:
MODEL:
S/N:

RECORD NUMBER: 2
DATE/TIME: 03/04/15   20:59:49
NUMBER OF TESTS: 2
STATION:
CIRCUIT:
MFR:
MODEL:
S/N:

RECORD NUMBER: 1
DATE/TIME: 03/04/15   20:53:00
NUMBER OF TESTS: 1
STATION:
CIRCUIT:
MFR:
MODEL:
S/N:
```

Figure 4. Sample Test Record Directory Printout

3.6   Reviewing a Test Record

If you have just performed a test or just restored a test record from the unit's internal memory, it will be stored in the unit's temporary working memory. You can review the test record stored in the working memory by following the steps below:

a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    10:10:10
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1.ENTER ID
2.REVIEW RECORD
3.RESTORE RECORD
4.NEXT PAGE
```

Press the **[2]** key (*REVIEW RECORD*).

c. The following screen will be displayed

```
   REVIEW RECORD

1.SCROLL TEST RECORD
2.PRINT TEST RECORD
```

Press the **[1]** key (*SCROLL TEST RECORD*) if you would like to review the test record in the working memory on the unit's LCD screen. **Continue to step d**.

Press the **[2]** key (*PRINT TEST RECORD*) to print the test record in the working memory on the unit's built-in thermal printer. The test record will be printed, and you will be returned to the "START-UP" menu.

d. The following screen will be displayed:

```
   RECORD ID INFO:
```

Press any key to continue.

e. The following screen will be displayed:

```
        1 TESTS

  03/16/15   08:59:56
```

Press any key to continue.

f. The following screen will be displayed:

```
  TEST NUMBER:     1
  75KV    5Sec    300µA
    185 µA AT 74.9KV
      TEST PASSED!
```

Press the **[STOP]** key to return to the "START-UP" menu.

3.7 Restoring a Test Record

Follow the steps below to restore a test record from the VBT-75P's Flash EEPROM to the working memory:

a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    10:10:10
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1.ENTER ID
2.REVIEW RECORD
3.RESTORE RECORD
4.NEXT PAGE
```

Press the **[3]** key (*RESTORE RECORD*).

c. The following screen will be displayed:

```
1.RESTORE RECORD
2.DIRECTORY
3.ERASE RECORDS
```

Press the **[1]** key (*RESTORE RECORD*).

d. The following screen will be displayed:

```
   RESTORE RECORD

1.ENTER RECORD NUMBR
2.SCROLL TO SELECT
```

1. ENTER RECORD NUMBER

If you know the record number that you would like to restore, press the **[1]** key (*ENTER RECORD NUMBR*) . The following screen will be displayed:

```
   RESTORE RECORD
    NUMBER:
```

Type the record number using the keypad and then press the **[ENTER]** key. The following screen will be displayed:

```
RECORD RESTORED!
```

Press any key to continue. **Continue to step c of section 3.6.**

2. *SCROLL TO SELECT*

Press the **[2]** key (*SCROLL TO SELECT*) if you would like to scroll through a directory of the stored test records. The following screen will be displayed:

```
RECORDS DIRECTORY

"UP" TO SCROLL FWD
"DWN" TO SCROLL RVS
```

Press either the **[▲]**key or the **[▼]**key to display the next or previous test record, respectively. The test record information will be displayed as shown:

```
03/16/15  08:59
      1 TEST
```

When you have located the test record that you would like to restore, press the **[ENTER]** key. The following screen will be displayed:

```
RECORD RESTORED!
```

Press any key to continue. **Continue to step c of section 3.6.**

3.8   Deleting Test Records

Follow the steps below to delete one or more test records from the VBT-75P's Flash EEPROM:

a. Start from the "START-UP" menu:

```
1.RUN TEST 03/16/15
2.SETUP    10:10:10
```

Press the **[2]** key (*SETUP)*.

b. The following screen will be displayed:

```
1.ENTER ID
2.REVIEW RECORD
3.RESTORE RECORD
4.NEXT PAGE
```

Press the **[3]** key (*RESTORE RECORD*).

c. The following screen will be displayed:

```
1.RESTORE RECORD
2.DIRECTORY
3.ERASE RECORDS
```

Press the **[3]** key (*ERASE RECORDS*).

d. The following screen will be displayed:

```
     ERASE RECORD

1.ERASE SINGLE REC.
2.ERASE ALL RECORDS
```

1. ERASE SINGLE REC.

Press the **[1]** key if you would like to erase a single record. The following screen will be displayed:

```
    ERASE RECORD
    NUMBER:
```

Type the record number to be erased and press the **[ENTER]** key.

- You can press the **[STOP]** key to cancel the process.
- If you do not know the record number, you can first print a test record directory using the instructions in section 3.5.

The following screen will be displayed:

```
RECORD NUMBER 1
  ERASED!


```

Press any key to return to the "START-UP" menu.

2. ERASE ALL RECORDS

Press the **[2]** key if you would like to erase all of the test records stored in the VBT-75P's Flash EEPROM. The following screen will be displayed:

```
 ERASE ALL RECORDS!
    Are you SURE?

"ENTER" TO
CONTINUE.
```

If you would like to CANCEL the erasure process, press the **[STOP]** key. No records will be erased and you will be returned to the "START-UP" menu.

Press the **[ENTER]** key to proceed with the erasure process. The following screen will be displayed while the records are being erased:

```
 ERASING RECORDS

   PLEASE WAIT...

```

The following screen will be displayed after all of the test records have been erased:

```
  RECORDS ERASED!


```

Press any key to return to the "START-UP" menu.

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