MACHINE SOLUTIONS INC.

USER MANUAL

HYDRAULIC BURST/LEAK TESTER

SOFTWARE VERSION 2.60

Crescent DESIGN
A Machine Solutions Company

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The Crescent Design Hydraulic Burst/Leak Tester (HBLT) system uses distilled water to accurately pressurize an item according to programmable profiles. These programmed profiles are referred to as "tests." The HBLT features simple, yet extensive menus for defining, saving, and running up to 40 different tests, as well as special functions.

The *HBLT* has a backlit LCD screen with a touch-sensitive front for user input. Pressurization is achieved using a hydraulic cylinder. A motor connected to a linear actuator drives its piston. The system is controlled using Crescent Design, Inc. proprietary electronics and firmware.

With optional *Pressure Manager* software, PC compatible computer systems can be used to edit, store, recall, print, and run complex tests of several hundred steps. The *HBLT* may therefore run as a "slave" to a PC compatible system or "stand alone," switching back and forth between these modes.

Leaks detected by the *HBLT* are defined in terms of drop in pressure over 1 second or by absolute drop in pressure from the end of maintain. Bursts (also known as "ruptures") are essentially dramatic (rapid) leaks. In

order to detect these hydraulic faults, the *HBLT* checks for pressure drops every one-tenth (0.1) second.

This manual contains complete instructions for setting up and using the *HBLT*.

SAFETY NOTICE

This safety notice summarizes information basic to the safe operation of the equipment described in this manual. The international symbols displayed below are a reminder that all safety instructions should be read and understood before installation, operation, maintenance, or repair of this instrument is attempted. When you see the symbol on other pages, pay special attention to the safety information presented. Observance of safety precautions and the instructions for proper instrument operation will also help to avoid actions that could damage or adversely affect the performance of the instrument.

Other symbols may also be displayed on the equipment. These are reproduced and described under CONVENTIONS, below.

Safety During Installation and/or Maintenance

Any servicing of the equipment that requires removal of any covers can expose parts that involve the risk of electric shock or personal injury. Make sure that the power switch is turned off and the instrument is disconnected from the main power source, and refer such servicing to qualified personnel.

Electrical Safety

To reduce the risk of electrical shock, this equipment uses a three-wire electrical cord and plug to connect it. Make sure that the matching wall outlet receptacle is properly wired and earth-grounded.

Safety Against Risk of Fire

Fuses protect certain electrical circuits within this instrument against over current conditions. For continued protection against the risk of fire, replace only with the same type and rating specified.

SAFETY MESSAGES

Your safety and the safety of others is very important. We have provided many important safety messages in this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:

General Warning/Caution: Refer to the instruction for details on specific danger.

Caution: Hot Surface

Caution: Electrical Shock Hazard

Caution

The HBLT should be used for the purpose and in the manner described in this manual.

If you use the HBLT in a manner other than that for which it was intended, unpredictable behavior could ensue with possibly hazardous consequences.

⚠

CAUTION
RISK OF ELECTRICAL SHOCK. DISCONNECT POWER
BEFORE PERFORMING THE FOLLOWING OPERATIONS.
THE OPERATIONS DESCRIBED IN THE FOLLOWING PARTS
OF THIS MANUAL ARE TO BE PERFORMED BY QUALIFIED
MAINTENANCE PERSONNEL ONLY.

Specifications

Operating Temperature Range	59-104□F,(15-40□C)
Humidity Range	35-85% RH, Non-Condensing
Dimensions (H x W x D)	6 ¾" x 20 7/8" x 17 ¾" (17cm x 53cm x 45cm)
Weight	non-XV models 56 lb. (25.4 kg)
	XV models 69 lb. (31.3 kg)
Power	105-130V, 3.15A, 47/63HZ
	210-260V, 1.6A, 47/63HZ
Environmental Conditions	Installation Category (Overvoltage Category) II
	Pollution Degree 2
Maximum Operating Altitude	6560 feet, (2000 meters)

Model	Maximum Pressure	Maximum Deliverable Volume	Pressure Accuracy	Resolution
25	25 PSI / 1.7 ATM / 1.7 BARS / 172 KPA	68 cc / 184 cc XV	+/- 0.25 PSI	0.01 psi
LH25	25 PSI / 1.7 ATM / 1.7 BARS / 172 KPA	1300 cc	+/- 0.25 PSI	0.01 psi
100	100 PSI / 6.8 ATM / 9 BARS / 689 KPA	68 cc / 184 cc XV	+/- 0.5 PSI	0.1 PSI
LH100	100 PSI / 6.8 ATM / 9 BARS / 689 KPA	1300 cc	+/- 0.5 PSI	0.1 PSI
250	250 PSI / 17 ATM / 17 BARS / 1724 KPA	68 cc / 184 cc XV	+/- 1 PSI	0.1 PSI
500	500 PSI / 34 ATM / 34 BARS / 3447 KPA	68 cc / 184 cc XV	+/- 2 PSI	0.5 PSI
1000	1000 PSI / 68 ATM / 69 BARS / 6895 KPA	42 cc / 106 cc XV	+/- 4 PSI	1 PSI
2000	2000 PSI / 136 ATM / 138 BARS / 13790 KPA	26 cc / 62 cc XV	+/- 8 PSI	1 PSI
3000	3000 PSI / 204 ATM / 206 BARS / 20684 KPA	10 cc / 24 cc XV	+/- 8 PSI	1 PSI
5000	5000PSI / 340 ATM / 345 BAR / 32767 KPA	10 cc / 24 cc XV	+/- 8 PSI	1 PSI

Table 1 – Features by model.

Machine setup

Perform the following steps before using the HBLT. Read all steps before starting. The HBLT is a heavy instrument, so keep in mind that wherever it is set up should be a "permanent" location.

Remove from carton

Carefully remove the *HBLT* from its packing carton. It contains electronic and mechanical components that can break if dropped. Set it on a level-operating surface where the height of the touchscreen display is convenient for an operator. The *HBLT* operates best in an environment where the temperature is between 15-26 °C. Since it operates on distilled water and has sensitive components, care must be taken not to expose the unit to temperatures much outside this range.

Connect power

The operating voltage on the HBLT is selectable between two voltage ranges. It is shipped with the proper voltage setting for the intended destination. If necessary, use the power selector on the back of the instrument to switch between the 105 - 130 Volts AC and 210 - 260 Volts AC settings. This selector is located just under the power cord receptacle. To change it, remove the power cord and pry out the selector, then replace it in the desired orientation. Connect the HBLT to a suitable electrical outlet with the power cord provided. The HBLT consumes a maximum of 400 Watts and operates on any AC frequency between 47 to 63 Hz.

Connect fluid

A quick-disconnect fitting with a built-in shutoff valve is shipped with the *HBLT*. Connect this fitting with a hose to a clean water reservoir. Fill the reservoir with <u>clean</u> <u>distilled</u> water. Connect the fitting to its mating half on the front of the *HBLT*.

IMPORTANT: Do **not** connect the *HBLT* to any kind of <u>pressurized</u> water source. Use a clean distilled water source only.

Connect the printer

The *HBLT* uses a printer for printing the defined tests and for printing test results during test execution (see the corresponding sections of this manual for more explanation of these printouts).

The printer must use a standard parallel interface. Attach a parallel printer cable to the DB-25 connector on the back of the *HBLT*. Connect the other (36 pin Centronics) connector to the printer. The printer must be an ASCII printer. Do not use printers that require an operating system driver.

Make sure that the printer is turned on, on-line, and has paper properly loaded before you attempt any printouts. If the printer is not selected, reports will be buffered, up to a maximum of 6000 characters. An optional page eject can be sent after each report. When the HBLT is switched off or no longer connected, buffering is canceled.

Turning on the HBLT

When the *HBLT* is turned on, it will beep (two long, three short) and show the greeting screen with the Crescent Design logo, the software versions (kernel and application), and maximum pressure for your particular machine. Press the on-screen GO to proceed to the main menu.

If the HBLT has a name, that name appears below the CDI logo. See the Engineering Configuration section for naming the HBLT.

Main Menu

This screen allows the user to go to the purging screen, perform a test, or access the engineering menu screen. The engineering menu allows tests to be created and edited.

Engineering Menu

This screen offers the choices described below, as well as the means to jump back up to the main menu.

Edit test information

This takes the user to the screen where tests are created, changed, printed, deleted, imported, and exported. It is also where the engineering password is changed. The Export TestScan function is also here. Use it to export Scan Mode tests to a PC running the TestScan software.

Perform calibration

This choice comes up automatically when the *HBLT* is first installed, and also may be accessed by touching the menu button labeled **Perform calibration** on the **Engineering Menu**. The following functions are available on the Calibrations Functions menu.

This choice is now password protected by its own password. This choice was previous protected by use of the engineering password. This change

allows both engineers and calibration staff to have protected access to their respective areas while protecting the other area.

Perform Calibration

See Appendix K for calibration procedures.

Set Calibration Expiration

This option opens the Calibration Expiration screen. Use this screen to select the number of days for the calibration to expire. The options are: 30 days, 91 days, 183 days, 365 days, custom or none. The Next Screen button uses the currently defined days and changes to the When Calibration Expires screen.

After selecting the days option, the HBLT prompts for the action to perform when the calibration expires. The action options are: Alert at Power On, Alert Before Testing, Do Not Allow Testing, or Take No action.

Remember that the expiration settings do not take effect until the next complete calibration.

Set Calibration Warning

This option opens the Calibration Warning screen. Use this screen to select the number of warning days before the calibration expires. Press the Set Warning days button to enter the number of warning days. The value must be between 1 and 1 less than the expiration days. The HBLT warns you if the number entered is out of range. In addition, the expiration days must be non-zero in order to set the warning days.

After setting the warning days, select one of the warning actions. The warning actions are: Warn at Power On, Warn Before Testing, or No Warning.

Remember that the warning settings do not take effect until the next complete calibration.

Display Calibration Report

This function opens the Display Calibration Report screen and displays the calibration offset, scale, and date.

Pressing the Print button prints the current calibration expiration and warning information along with the pressure transducer scale and offset values to the printer port (parallel port). After each calibration, print this report and file it in a safe place. A history of the scale and offset values changes can give an indication of how frequently calibrations should be done.

Press the ESC key to return to the Calibration menu.

Skip Calibration

This function allows the user to skip an initial calibration to perform another function such as purge. The HBLT will not allow test execution or remote tests or scripts until the HBLT is calibrated. If the current calibration is valid, the HBLT leaves the setting as they were. If the current calibration is invalid due to check sum error or values outside limits, the HBLT initializes the values using the default settings.

Calibration Password

This function allows the user to set a password to protect the calibration. This allows access to calibration functions without allowing access to the other engineering functions.

To set the calibration password, first set the dual passwords option to YES using the engineering configuration screens. The HBLT sets the calibration password to the same value as the engineering password. The operator can then set the calibration password. If the dual password is not set, the HBLT displays an alert message advising the operator to set the dual password mode.

System configuration

System configuration consists of setting the criteria for communication with the HBLT. Below are the options and their definitions. Most options have on-screen buttons that read, "YES" or "NO". All buttons (or their prompts) show their current settings for respective options. To change an option, touch its related button and then choose the new setting from the screen prompt.

Set the baud rate

The baud rate is the serial data transfer rate into and out from the *HBLT*. The Import and Export features (under *Edit Test Information*) use serial data transfer, as well as the *Remote control, Pressure Manager* and *Download New Program* functions. When using *Remote control*, be sure and select a baud rate high enough to accommodate the CPS (characters per second) that are output during streaming mode. See Appendix A for details.

From the **Configuration Menu**, touch the on-screen menu button next to the words "Set the baud rate". Eight rates are shown (in bits per second). Touch the menu button next to the rate required to change the current baud rate. Touch the ESC button to return to the previous menu without changing the baud rate.

If using the Scan Mode or Output Test Result Messages options, the HBLT sets the baud rate at 9600.

Maintain beep option

This option selects whether or not a "beep" is generated when the *Maintain Pressure Time* ends (see below). It is useful to cue operators on when to take a measurement after pressure has been applied to a product for a certain amount of time.

Page eject option

If you want a page eject command to be sent after printed reports, select this option. It is handy for cut-sheet printers, like lasers and inkjets. Ejects apply to test summaries as well as process program printouts.

Purge exhaust speed

The Main Menu contains an option for "purging." Purging is the process of pumping water through a product (and whatever interconnected tubing) with the goal of removing any air that may be trapped inside. The purge exhaust speed option allows you to specify at what rate water will be pumped out the outlet port when purging. Some products have a very small passage for fluid, and others have relatively large passages. Use lower purging speeds for small passage devices. Use higher purging speed for large passage devices. Please note that this option adjusts the purge function only. Individual tests have a separate and different setting for "filling."

The following table gives the purge exhaust minimum and maximum volume speeds.

Model PSI	Minimum cc/sec	Maximum cc/sec
25	0.1	7.0
LH25	0.1	20.0
100	0.1	7.0
LH100	0.1	20.0
250	0.1	7.0
500	0.1	7.0
1000	0.1	4.0
2000	0.1	2.0
3000	0.1	1.0
5000	0.1	1.0

Table 2 - Purge exhaust maximum and minimum by model.

Purge intake speed

The Main Menu contains an option for "purging." Purging is the process of pumping water through a product (and whatever interconnected tubing) with the goal of removing any air that may be trapped inside. The purge intake speed option allows you to specify at what rate water will be drawn in the intake when purging or filling. Use lower purging when using higher viscosity fluids such as diluted glycerin. This option controls the intake speed for both purge and fill operations.

The following table gives the purge intake minimum and maximum volume speeds.

Model PSI	Minimum cc/sec	Maximum cc/sec
25	0.1	7.0
LH25	0.1	20.0
100	0.1	7.0
LH100	0.1	20.0
250	0.1	7.0
500	0.1	7.0
1000	0.1	4.0
2000	0.1	2.0
3000	0.1	1.0
5000	0.1	1.0

Table 3 – Purge intake maximum and minimum by model.

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The **Configuration Menu** has multiple screens. The *Next Page* button switches between these screens.

Enable remote control

When this option is set to YES, special characters received on the serial channel (obeying whatever baud rate choices are set above) will enable *Remote Control* of *HBLT* tests as if an operator were pressing on-screen buttons. The optional *Pressure Manager* software also requires that this option be set to YES. Please refer to *Appendix A* for an explanation of the remote-control functions, how they work, and when they apply.

This option is mutually exclusive with the Scan Mode and Output Test Result Messages options described below. Setting this option disables these other options.

Perform the volume correction before enabling this function. Otherwise, the HBLT displays an alert message warning the operator that the HBLT will report zero for the volume reporting.

When selecting this option, ensure that the baud rate is set to 38,400 baud for Pressure Manager and LabGenie operation.

Select Remote Output

This option allows the operator to choose the **Select Output Format** menu. This menu allows the user to alter the output format and data rate used during remote operation streaming mode.

Pressure Manager selects the remote output options that it needs. However, Pressure Manager does not restore the previous settings.

This option is not available when using the Output Test Result Messages option.

Download New Program

This option allows the operator to start the download of a new program procedure. See the **Download new program** heading below.

Refill After Downramp

This option enables the refill cylinder option when a downramp drops below 2 PSI. This allows the testing of a leaky product. This option applies to all tests. When using this option, make sure that each tests leak rate is high enough. The cylinder does not refill after the last down ramp.

Enable Scan Mode

When this option is enabled, the operator must specify the test to run by scanning a TestScan image containing the test information. The operator id and lot number may also be scanned from separate images or entered using the existing touch screen input. See Appendix O for setup and operation.

This option disables the Enable remote control option and sets the serial port baud rate to 9600 baud. The baud rate is fixed at 9600 baud while this option is enabled.

Enable dual passwords

This option enables the dual password mode. This mode allows the operator to set a password for the engineering functions and to set a password for the calibration functions. When set to NO, the single password protects both engineering and calibration functions. When set to YES, the passwords are split between engineering and calibration.

When enabling dual passwords, the HBLT initially copies the engineering password to the calibration password. Then, the operator can navigate to the calibration functions screen. There, the operator can change the calibration password.

To disable the dual password mode, first set the calibration password to no characters (null password). Then set the Enable dual passwords option to NO.

Enable safety door

The *HBLT* has an optional connection for a safety switch, assumedly connected to an enclosure where products are hydraulically tested. When this option is enabled (set to YES), no testing will commence until the safety switch indicates that the safety door of such an enclosure is "closed".

Also, the HBLT stops a test if the safety switch opens. The operator may then close the switch and press the Resume button on the touch panel. If using Pressure Manager, click the Resume button.

Vacuum position select

This option allows setting the piston position to prevent intake alarms when a return pressure is less than zero psi. When selected, this option displays a screen that allows the operator to select the piston position from 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, or Legacy. The percentages are a percentage of the full piston stroke. The Legacy option sets the piston to 15% for return pressures ranging from less than 0psi to -5psi; to 30% for return pressures ranging from less than -5psi to -10psi; to 45% for return pressures ranging from less than -10psi to -12psi. This option affects fatigue tests, incremental tests, custom tests, and scripts with pressure targets below zero. The default vacuum selection is Legacy.

Use this option when a test errors with an Intake limit alarm. This is more likely to occur when there is a Smart Manifold attached and the Smart Manifold mode is parallel.

When running a group test, the HBLT selects the piston position corresponding to the deepest vacuum setting among all the tests.

Print the test settings

This option directs the HBLT to print the test settings before the test results on the test results printed report. The default value for this option is "No". Do not use this option when using Pressure Manager. Pressure Manager already includes the test settings in its report.

HBLT name:

This option sets the name that the HBLT displays below the CDI logo on the title screen. The HBLT also prints this name on the test results, the calibration report, and the print test reports. Use this name to identify which HBLT the report came from.

Skip test start screens

This option directs the HBLT to not display the Operator screen, the Lot code screen, and the Information about this test screen when starting a test from the main menu.

Force group start

This option directs the HBLT to force a wait at the Start button for each test when running a group test. Normally, the HBLT waits at the Start button for the first test only.

Diagnostics

This option allows the operator to choose the **Diagnostics Menu**. See the **Diagnostics Menu** heading below.

Set cycle counter changes

This option allows the operator to choose the **When cycle counter changes** menu. See the **When cycle counter changes** heading below.

Output Test Result Messages

Enable this option to send the test results to a remote data collection system via the RS-232 channel. See Appendix P for setup and operation.

This option disables the Enable remote control option and sets the serial port baud rate to 9600 baud. The baud rate is fixed at 9600 baud while this option is enabled.

Diagnostic Menu

This menu allows you to perform diagnostics on the *HBLT* and analyze its performance.

Touch Screen Test

This screen allows you to test all the buttons on the *HBLT*'s touchsensitive front panel. The screen is filled with buttons which, when pressed, change to "OK". Press each button to determine if the button is operable. Press the "ESC" button to return to the **Diagnostic Menu**. In the

event the "ESC" button is inoperable, turn off the *HBLT* and contact Crescent Design for assistance.

Pressurization Count

In order to give Crescent Design's technicians an indication of the *HBLT*'s level of usage, a counter is incremented every time the *HBLT* is pressurized. The pressurization count screen displays this counter.

Smart Manifold tests

See Appendix H for instructions on using this diagnostic.

When cycle counter changes

The option specifies when the cycle counter changes. The options are:

1. Default – This option specifies that the cycle counter increments as version 2.54 and earlier HBLT versions did. That is, the cycle increments at the beginning of the cycle and does not terminate tests early if there is a Smart Manifold attached in parallel mode.
2. Start of up ramp – This option increments the cycle counter at the start of the up ramp.
3. End of up ramp – This option increments the cycle counter at the end of the up ramp.
4. End of maintain – This option increments the cycle counter at the end of the maintain period.
5. End of Dwell – This option increments the cycle counter at the end of the dwell period.
6. End of down ramp – This option increments the cycle counter at the end of the down ramp.
7. ESC return to previous menu – This option returns to the previous menu without changing this option.

The current setting is indicated by a right arrow button instead of the dot button.

When using a Smart Manifold and selecting options 1 through 6, the HBLT enables a feature that stops a fatigue test early when the total cycles specified by the test occurs. This includes any cycles performed during a leak hunt. This prevents the test from performing extra cycles if there are one or more leak hunts. However, when a leak hunt occurs at the end of a fatigue test, the HBLT does perform the hunt and count the cycles because the HBLT must find the failed port.

For options 1 through 6, a valid cycle is defined as reaching the selected option condition and reaching the target pressure.

The following graphic shows the relative locations of the cycle increments.
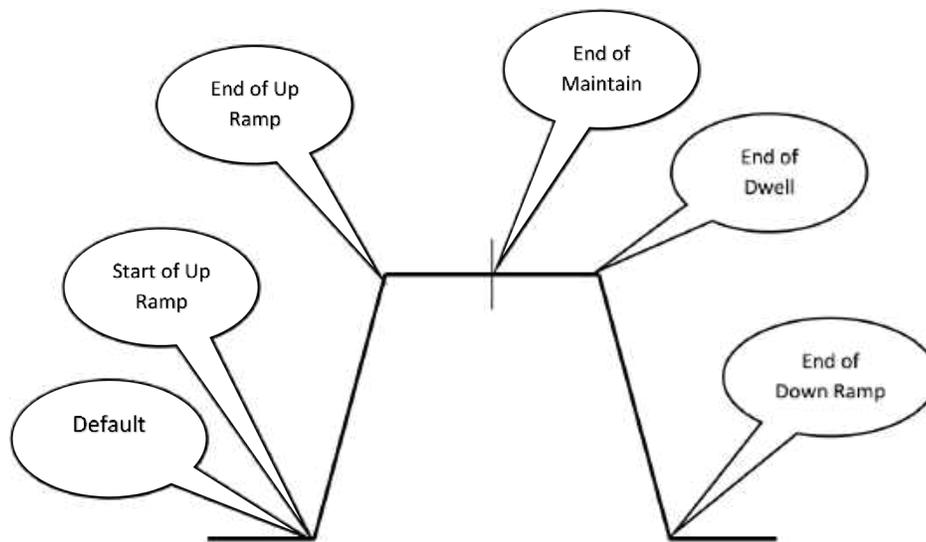
Locations of the cycle increment options relative to the cycle.

Download new program

This function permits the re-programming of the *HBLT* by running the Crescent Design downloading program on your PC. This program will be supplied to you with any software updates. See Appendix E for more on downloading.

Set the date & time

This **Engineering Menu** displays the current time and date at the top of the screen. Buttons allow you to adjust the MINute, HOUR, DATE, MONth, and YEAR by touching the "up" and "down" arrows next to these words. New settings will appear at the top of the screen as you adjust. Touch the "OK" button to save the new information, or "ESC" to exit without changing the current settings.

If using an engineering passcode, the HBLT prompts for the passcode before allowing access to setting the date and time.

Browse Tests

This function allows the operator to select and view a test's settings without the ability to change the test. This allows operators to verify a test prior to testing without having the password to the engineering edit menu.

The number of screens and content vary depending on the test and whether a Smart Manifold is attached.

Initialize HBLT

The initialize HBLT function returns the HBLT to factory defaults. This is useful when the engineering password or calibration password is no longer known. The initialization clears the calibration values requiring a new calibration before use. Follow these steps to initialize the HBLT:

1. Call Crescent Design, Inc at (858) 452-3240 and request the Initialize HBLT password.

2. Press the Engineering menu button on the main screen.

3. Press the Page button.

4. Press the Initialize HBLT button.

5. Enter the initialize HBLT password or press the ESC button to cancel the initialization.

6. Press the password screen OK button.

7. Press the Initialize the HBLT button to start the initialization countdown without printing the engineering options, calibration options, and tests. Do this if you have previously documented the HBLT engineering options, calibration options, and all tests.

8. Press the Print tests & options button to print the engineering options, calibration options, and test before starting the initialization countdown.

9. Press the ESC button to cancel the printout, if started, and initialization. The printer may continue printing until its printer buffer empties. The HBLT flushes its printer buffer.

10. When the countdown screen appears, the HBLT initializes in 30 seconds. Pressing the ESC button before the 30 seconds expires cancels the initialization.

11. Wait until the initialization completes.

12. If required, enter any calibration options changes using the printout or your documented settings.

13. Calibrate the HBLT.

14. If using Pressure Manager, LabGenie, or remote operation, perform the volume correction procedure.

15. If required, enter any engineering options changes using the printout or your documented settings.

16. Enter the tests using the printout or your documented tests.

It is good practice to record HBLT passwords in a secure location know to supervisory personnel. In the event that an employee is no longer available to enter the password, there is an administrative path to recover the password.

Print HBLT settings

This option prints the engineering settings, the calibration settings and all of tests. Attach a printer to the HBLT 25 pin printer port and press the Print HBLT settings button.

Tare Pressure

This option allows the operator to reset the pressure zero settings for the HBLT. Open the HBLT outlet port to atmosphere and follow the screen instructions to tare the HBLT. Pressing the ESC button at any time cancels the tare function without changing anything.

Purging

Purging is the first of the choices appearing on the **Main Menu**. The object of purging is to remove air bubbles from the fluid path inside the machine. The *HBLT* should be purged prior to each use. Water will exit from the outlet when purging, so it is advisable to set it up so that it may drain into a suitable container.

Select "Purge the tester" from the **Main Menu**. There are two purge modes available. The first purge mode is continuous purge. This purge mode is useful when filling the *HBLT* for the first time and for filling test fixtures. The second purge mode is single cycle purge. This purge mode uses a syringe and a graphic display to purge trapped bubbles from the system.

Check for proper water reservoir installation to the HBLT, and that the reservoir contains clean distilled water. Then select either single cycle purge or continuous purge by touching the button to the left of the desired mode.

Touch the "OK" button.

If you select continuous purge, the HBLT displays a text screen that shows exhaust or intake status. There is a "STOP" button to exit continuous purging.

If you select single cycle purge, a graphic display guides you through the purging process. Use the syringe and follow the instructions on the HBLT

display. The use of the syringe is the best method for removing trapped bubbles from the system. Be sure and pull a hard vacuum when directed by the display.

The last option is volume correction. This option directs the HBLT to calibrate itself to remove the HBLT internal compliance when reporting total volume to Pressure Manager. Use this option only when using the Pressure Manager Protocol or remote operation settings. Calibrate and purge the HBLT prior to volume calibration.

If you select Volume Correction, the HBLT displays a text screen prompting you to open and then close the outlet valve. Press the OK button to continue or the ESC button to cancel. Pressing OK opens a status screen that displays the current pressure. Wait until the HBLT displays the finished message and then press the ESC button. Pressing the ESC button during the volume calibration leaves the HBLT with no volume correction table.

To check the volume calibration, cap the HBLT outlet and run Pressure Manager and execute a ramp test that ramps up slowly to the maximum psi and back down to zero. Make sure the volume is set to Volume Total. The resulting volume trace (blue line) should appear flat at zero PSI with a variation less than +/- 0.1 cc.

Touch the "DONE" button when you are finished purging the machine. **Do not allow air to be pushed or pulled into the machine.**

See the Volume Correction Procedure Appendix for more detailed instructions.

Select Output Format

This menu allows the operator to select the items and data rate that the HBLT sends out the serial port during remote operation with streaming mode enabled. There are five options for items transmitted.

Pressure Manager sets these options via the serial port. However, Pressure Manager does not restore the previous options. Use these options when not using Pressure Manager.

This option is not available when using the Scan Mode or the Output Test Result Messages Options.

1. Machine state followed by a colon. The states are:

    a.   R = Refill state (after a burst or leak is resumed).
    b.   U = Ramp up.
    c.   u = Ramp up paused by operator.
    d.   M = Maintain.
    e.   m = Maintain paused by operator.

f.   W = Dwell.

g.   w = Dwell paused by operator.

h.   D = Ramp down.

i.   d = Ramp down paused by operator.

j.   L = Last ramp down.

k.   l = Last ramp down paused by operator.

l.   1 = Burst during ramp up.

m.   2 = Burst during maintain or dwell.

n.   3 = Leak during dwell.

o.   4 = Leak dip during dwell.

p.   5 = Burst during ramp down.

q.   6 = Burst during last ramp down.

r.   7 = Burst during bottom maintain.

s.   B = Bottom maintain.

t.   b = Bottom maintain paused by operator.

u.   Z = Last record of test.

w.   f = filling product.

x.   8 = Wait for Start

y.   9 = Wait for OK

2. Sequence number of data followed by a comma. This also corresponds to the time frequency count.

3. Current Pressure followed by a comma.

4. Peak Pressure followed by a comma.

5. One of four volume options followed by a comma. If this option is selected, the operator has a choice of encoder counts from start of test, encoder counts since last data item, volume in milliliters since beginning of test or volume in milliliters since last data item.

6. If there is a Smart Manifold attached, the open ports may appear on some records.

The HBLT removes the last comma on the string.

The data output rate is also selectable. Choices are 100, 50, 20, 10, 5, 2,1 samples per second. If the CPS (characters per second) based on characters to be sent and the serial port baud rate is such that overrun is likely to occur, a warning window is displayed.

The user has the option of including a headings record. This allows headings for charts and tables in spreadsheets.

To get to the screens, do the following steps:

1. Touch the "Engineering menu button" on the main menu.

2. Touch "System configuration button" on engineering menu.

3. Touch PAGE button to get second page of system configuration menu.

4. Touch "Select remote output" button on second page of system configuration menu.

5. You are now at the Output Format Menu. The first five options are the fields, in order of appearance that may be selected. A YES or NO button is displayed depending upon the current state of that field. To change a state, touch the corresponding button. A confirming message with a YES/NO response is displayed. Make your choice. The volume field is a special case. If this field is selected, another menu appears so that you may choose volume units of encoder count total, encoder count increment, volume in milliliters total, or volume in milliliters increment. Touch the button next to the units desired. A YES/NO window appears to confirm. When you have selected the units you want, touch the ESC button to return to previous menu.

6. Touch PAGE to view the second page of the Output Format menu. Here you may select the data rate or optional column headings.

7. Touch the button for Set the data rate and a new screen appears with the values of 100, 50, 20, 10, 5, 2, or 1. Touch one of the rates to select.

8. Touch the Output column-heading button to select column headings. A YES/NO window confirms your choice. Only headings for the columns you requested on page one is output.

Selecting and Running a Test

"Run a test" is the second option shown on the **Main Menu**. This will permit you to recall previously specified test profiles, and run them. Test results will be sent to the printer, if attached. On-screen prompts and buttons make selecting, running, and viewing results of tests simple. Name and Lot Code information are entered by on-screen keyboard, which includes alphanumeric, some punctuation, backspace and erase (clear) keys.

To prepare for testing, attach an item (product) to be tested to the pressure outlet (on the front of the *HBLT*).

Touch the menu button next to "Run a test" on the **Main Menu**.

The next prompt asks for "Operator Name." This is optional, meant to identify who ran the test on its report, if printed. Touch the "OK" button in the lower right-hand corner once this information has been entered. The HBLT skips this screen if the Skip test start screen is set to YES.

The next screen prompts you to enter a "Lot code." This is optional information that will appear on printed test reports. Touch the "OK" button once entered. The HBLT skips this screen if the Skip test start screen is set to YES.

A menu of currently stored tests will then appear. Ten test names fit onto the display; up to forty tests may be defined. Undefined tests are listed as "(undefined)". Touch the PAGE button to switch between the screens of test names.

Touch the menu button next to the name of the test to be run.

A new screen appears, showing the information about the test selected. The HBLT skips this screen if the Skip test start screen is set to YES.

Touch the OK button if the information displayed corresponds to the test intended to run. Touch the ESC button if you decide not to run this test.

If OK was pressed, the machine will ready itself. When this action is complete, the test screen will appear (saying BURST-LEAK TESTER READY at the top). In the event that hydraulic pressure exists at the outlet at the onset of the test, the system will attempt to depressurize. Part of this function may include "burping," (clicking noises) as the inlet valve switches on and off in an attempt to equalize pressure between the *HBLT* cylinder and the atmosphere. Compliant products, in particular, can cause this kind of activity.

When the outlet pressure has been equalized, the *HBLT* will put up a wait message while its cylinder refills with water, it will then be ready to go, showing a START button. Pressing START will either begin the test, or start the *Fill* function, depending on the test's *Fill speed* setting.

In the event that the test has a *Fill speed* specified, the words "Press to fill" will appear beside the START button. Pressing START will then pump water slowly into the product being tested until 8 PSI of backpressure exists, and then the Cylinder will refill itself. This refilling may again cause "burping" as mentioned above (especially with compliant products). The words "Press to fill" will be erased, and the word "START" will appear on the screen. Pressing START will then commence testing.

Tests run to completion unless a fault (burst or leak) is detected. During the test, the screen displays what state the machine is in, what cycle it is on, and the current and target pressures. The only other way to interrupt a test is to either press the on-screen STOP button or to open the safety door (assuming that a safety door switch is enabled). After the test is stopped, you may resume the test by touching the Resume button, end the test by touching the OK button, or cancel testing and return to the main menu by touching the ESC button. Resuming refills the cylinder, re-pressurizes the system depending on the state the test was stopped in, and then continues with the test.

The results of each test are sent to the printer port at the end of each test. The printout includes:

HBLT1000   Version 2.60   Kernel 1.50
HBLT name: s/n 901 (optional)

Test name: specified test name (Test Type)
Product: specified product name
Operator: operator name lot:
       lot name or number
Start at: date, time
<snap gage data appears here if enabled>
<Smart Manifold reports status here>
End at: date, time
Result: If no burst or leak occurs: "No failure"   If a
burst or leak occurs: time elapsed, burst cycle   number,
burst pressure, and maximum pressure attained.

If the engineering option "Print the test settings" is set to "Yes", the HBLT prints the test settings between the version line and test name line.

In order for results to be printed, a printer must be connected, turned on, on-line and ready *before* the test begins. This is optional. The *HBLT* will run tests with or without a printer connected.

If there is a Smart Manifold attached, one of the following lines appears before or below each set of results:

>>>> The following results are for port ##. <<<<

>>>> The above results are for port ##. <<<<

There may be multiple lines for a set of results. See Appendix H for more information about Smart Manifold operation.

Test Definition and Management

Definition of Terms
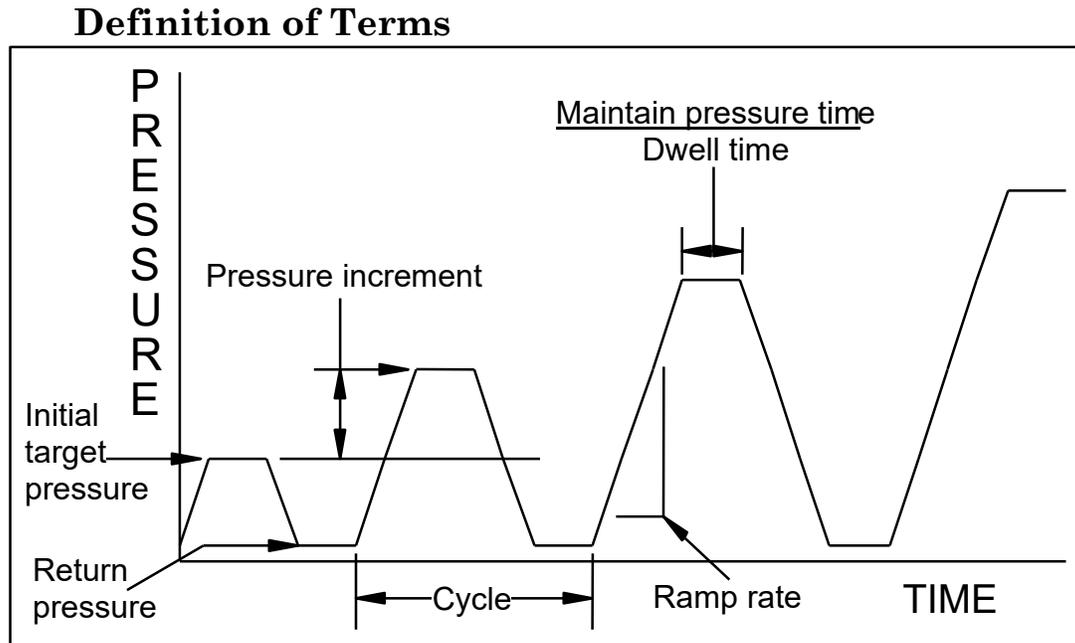
Figure 1 - Illustration of terms.

Burping: This is the process of opening and closing the *HBLT* water inlet in order to equalize pressure between the hydraulic cylinder and the atmosphere. Burping causes the *HBLT* to make clicking sounds, and can repeat several times before pressure equalizes. *Compliant* products in particular can cause a lot of burping when starting a test because of their elastic nature.

Burst Rate: This is the pressure drop rate expressed in *Pressure Units* per second. A burst will be reported during *Ramp Up* or *Dwell Time* and optionally during *Ramp Down* when pressure drops at a rate that equals or exceeds this Burst Rate. Burst Rates must be higher than the *Leak Rate* specified for the same test. There are two burst rates. The first, up burst rate, is active during ramp up and during maintain/dwell. The second, down burst rate, is active during ramp down and bottom maintain.

Compliance: This is the tendency of a product (some plastics and rubber, mostly) to stretch or grow under pressure. Compliant products **seem** to be leaking, whereas in reality they are growing in size to accommodate a larger volume of water. Long *Maintain Times* are recommended for testing compliant products, as well as generous *Leak Rate* settings. Typically, compliant products can only be practically tested for burst conditions.

Cycle: A Cycle is a pressurization and corresponding depressurization of an item under test.

Cycle Repeat: This is the number of times the *HBLT* will repeat a *cycle* (with its specific programmed *Target* and *Return Pressures*) before proceeding to the next programmed Target Pressure.

Down Rate: The HBLT uses this speed to remove pressure during the *Ramp Down* part of a testing *cycle*. The speed is expressed in terms of *Pressure Units* per second.

Dwell Time: This is the maximum amount of time, in seconds, for which an item under test will be pressurized at the *Target Pressure*. Dwell Time begins when the *Target Pressure* is first attained. Dwell Time includes within it the *Maintain Time.*

Fast Ramp: This is pressurization method that can be applied to any test type, intended to maximize pressurization stress at the cost of target pressure achievement accuracy. The hydraulic pressurizing system runs at maximum possible speed throughout most of the upward pressurization *cycle.*

Fill Speed: This is the rate at which water is pumped into a product before a test begins. Each test contains its own fill speed, specified in terms of cubic centimeters per second. Select from 4.00 to .01 cc/sec in .01 cc/sec increments for 1000 PSI or less HBLTs. Select from 2.00 to 0.1 cc/sec in .01 cc/sec increments for 2000 PSI or greater HBLTs. When this is enabled for a particular test (e.g., reads some value other than NO FILL), water is pumped through the outlet at this rate until a back pressure of 8 PSI is achieved, then the test waits to begin its programmed pressure cycle(s).

The HBLT LH25 and HBLT LH100 models (the low pressure/high volume models)

HBLT: Hydraulic Burst and Leak Tester.

Initial Pressure: This is the first (and lowest target) programmed pressure the *HBLT* will achieve during a test.

Leak Dip: This is the pressure drop in absolute pressure from the end of the maintain portion of the dwell cycle. A leak dip will be reported during the *Dwell Time* of test when the *Dwell Time* exceeds the *Maintain Time*. Leak Dips during this period are defined as an absolute pressure drop. See also *Burst Rate* and *Leak Rate.*

Leak Rate: This is the pressure drop rate for leak detection expressed in *Pressure Units* per second. A leak will be reported during the *Dwell Time* of a test when the *Dwell Time* exceeds the *Maintain Time*. Leaks during this period are defined as pressure drops at a rate that equals or exceeds the Leak Rate. See also *Burst Rate.*

Maintain Time: This is a period of time (seconds) during the *Dwell Time* when the *HBLT* actively maintains the *Target Pressure* in the product under test. This means that any pressure drops that occur due to *compliance*

or (small) leaks will be compensated for by further pressurization. Maintain Time begins concurrently with *Dwell Time*. Bursts may be detected during the Maintain Time, **but leaks are not**. Maintain Time may be set anywhere from Zero (which cancels any pressure maintenance) to the total amount of *Dwell Time* (which cancels leak detection).

Maximum Pressure: The highest pressure achieved via two or more *cycles* in a test such as the **Staircase** or **Incremental** modes.

Pressure Manager: Optional PC-compatible (Windows) software that allows you to edit, store, recall, print, and run complex *HBLT* tests that may take several hundred steps. Pressure Manager is an integrated editing and testing application that makes the *HBLT* act as a "slave" to the PC.

Pressure Increment: This is the amount of additional pressure added to the *Target Pressure* of the previous *cycle* to obtain the *Target Pressure* for the next *cycle*. This is used in Staircase and Incremental modes (see the section on **Pressurization Modes**).

Pressure Units: The *HBLT* works with four different engineering units: Pounds per Square Inch (PSI), atmospheres (ATM), kilopascals (KPA), and bars (BAR). Pressure units are selected when a test is defined, and apply to almost all data displayed or printed by that test (including via *remote control*). Once pressure units have been selected, they cannot be changed when editing a test.

Purge: The process of emptying air out of fluid pathways. There is an option on the **Main Menu** to perform this function. Also see *Fill*.

Exhaust Purge speed: The rate at which water is pumped through the outlet during the *Purge* function. This is one of the System Configuration settings in the Engineering Menu.

Intake Purge speed: The rate at which water is drawn from the inlet during the *Purge* function. This is one of the System Configuration settings in the Engineering Menu.

Ramp Rate: This is the rate at which the *HBLT* achieves pressure, expressed in *Pressure Units* per second. There are two ramp rates specified in a given test. These are called *Up Rate* and *Down Rate*.

Ramp Down: The part of a *cycle* in which pressure decreases. Also see *Up Rate*.

Ramp Up: The part of a *cycle* in which pressure increases. Also see *Down Rate, Ramp Rate*.

Repeat Cycle: A test setting that controls how many times a particular *cycle* will repeat until the next step.

Return Pressure: This is the programmed pressure that the *HBLT* will depressurize to at the end of a given *cycle.* This may be set to *VACUUM* or other negative pressures. For Custom tests, the return pressure can be set to NO_RETURN. This allows the definition of a test with pressure goals that execute without returning to the return pressure. This gives more flexibility to test designers. See the parameter tables for the lowest pressure.

Target Pressure: This is the programmed pressure that the *HBLT* will achieve during a given *cycle.*

Total Cycles: This is the computed total number of pressurization/depressurization *cycles* performed during a test, taking into account *Repeat Cycles* and how many steps may be required to achieve *Maximum Pressure.*

Up Rate: The speed at which pressure is applied during a test *cycle.* This is expressed in terms of *Pressure Units* per second. See also *Down Rate, Ramp Rate.*

Vacuum: Any state of negative pressure, typically a small number of *Pressure Units* below zero. A severe vacuum (many *Pressure Units* below zero) usually cannot be achieved by the *HBLT*.

Pressurization Modes, or "Types of Tests"

Linear Ramp
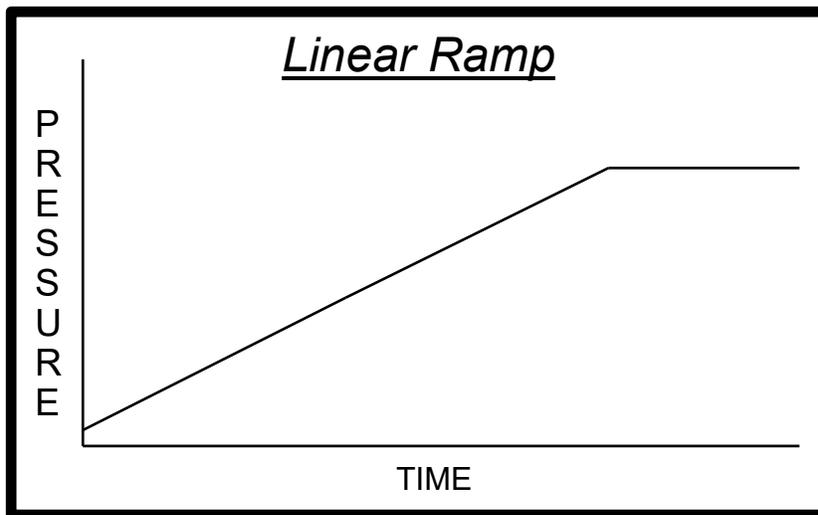
Figure 2 - Linear ramp profile.

Continuously increasing pressure is applied to a product until it reaches its *Target Pressure*, then stays at that pressure for the *Dwell Time,* or until a burst or leak is detected.

Staircase

Figure 3 - Staircase profile.

Pressure increases to programmed *Target Pressure* and remains for the *Dwell Time*. If no burst or leak occurs, pressure is then increased by the *Pressure Increment* amount. The test continues until a burst or leak is detected or until *Maximum Pressure* is achieved.

Fatigue
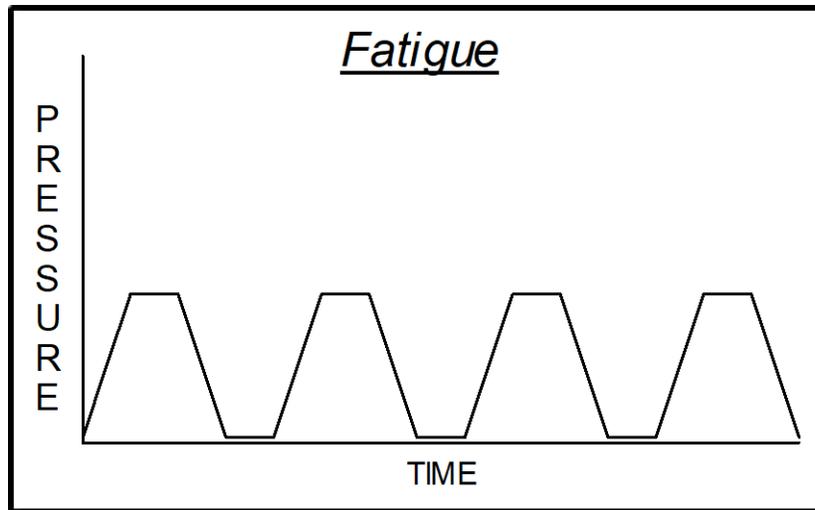
Figure 4 - Fatigue profile.

The Fatigue mode repeats a single defined pressurization *cycle*. Pressure increases to a programmed *Target Pressure*. Product will remain at pressure for the specified *Dwell Time*, and then de-pressurized to the *Return Pressure*. This repeats for the *Repeat Cycles* defined for the test.

Incremental
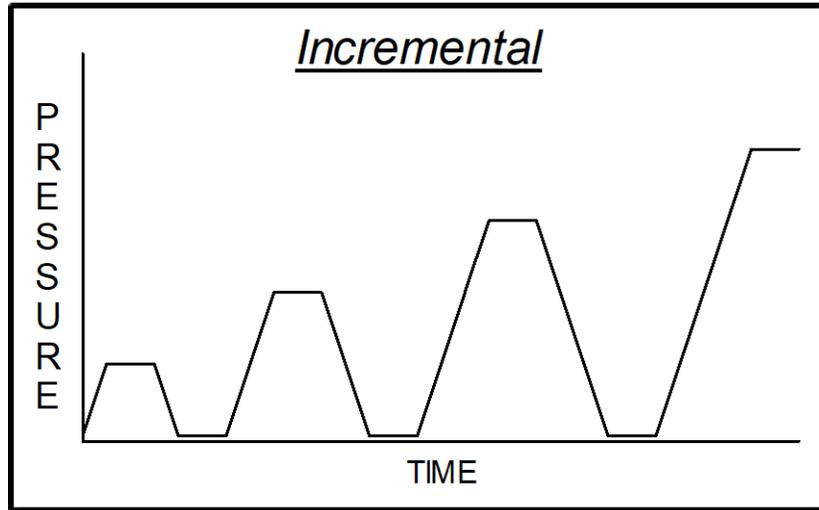
Figure 5 - Incremental profile.

Pressure increases to programmed *Target Pressure* and stays there for the specified *Dwell Time.* If no burst or leak occurs, the pressure is decreased to the specified *Return Pressure* level. This repeats a specified *Repeat Cycle* number of times. Once the *Repeat Cycles* complete, a new *Target Pressure* is computed by increasing the previous pressure by the *Pressure Increment* amount. The test continues like this until a burst or leak, or the *Maximum Pressure* is achieved.

Custom
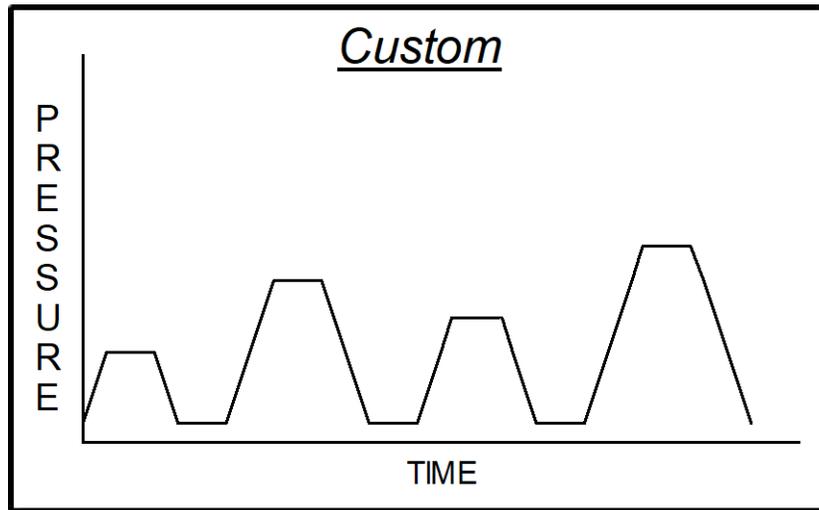
Figure 6 - Custom profile.

This is a custom pressurization profile. It works like Incremental mode, except that each successive *Target Pressure* is defined individually. Up to 100 successive Target Pressures can be defined for a given test. These custom target pressures need bear no relationship to each other; one target may be greater than, less than, or equal to any of its neighboring targets.

If the Return Pressure setting is NO RETURN, the pressure goals do not drop to the return pressure. Each goal starts from the current pressure and ramps up or down to the next pressure goal.

Group

The group test allows the combination of up to ten of the previous test types. All tests must have the same pressure units. If used with a Smart Manifold attached, all tests must have the same Smart Manifold mode (single, sequential, or parallel). Group tests cannot run other group tests.

If the Force group start engineering option is set to YES, the operator must press the Start button to start each test in the group. Otherwise, the HBLT waits for the Start button only for the first test.

If using Pressure Manager, click the Start button on the screen to start each test. Presently, Pressure Manager can run a group test, but cannot create or edit a group test.

Editing Buttons

When creating or editing test information, most of the data entry screens feature a number of editing buttons along the bottom row. These are editing buttons.

ESC

The ESC (escape) button appears on screens enabling you to abort the process of entering or selecting information. It is also used to close menus or submenus and return to a previous level of selection.

BACK

The BACK button is used to step backwards in a multi-step procedure, such as entering or editing test information. Pressing the BACK button permits you to step backwards and change a setting you just entered (and the setting previous to that one, and so on).

Arrow Buttons

When entering numeric values, a right-pointing arrow button appears. When entering alphanumeric information, a left-pointing arrow button appears. These are "backspace" keys, used to erase the last digit (or character) just entered.

SPACE

The SPACE button inserts a blank (space) when typing in alphanumeric information (i.e., test name, product ID, operator name, and so forth).

CLEAR

The CLEAR button erases all alphanumeric information entered on a given screen, or sets a numeric entry to zero.

OK

The OK button acts as an "enter" key, accepting the presently displayed setting.

Compliance Setting

When defining a test, a prompt appears asking for product compliance, offering choices from 1 to 10. Controlled pressurization requires special "tuning" in order to achieve goals accurately. The means by which pressure is achieved when a product stretches under pressure differs from when a product does not stretch. Valves usually are tested best at a Compliance Setting of 1; Catheters at 2; Tubing at 3; bags at 4; and latex at 5-10.

Certain products may be manufactured to be less compliant than their component materials may suggest. Irradiated plastics usually increase in rigidity (decrease in compliance), for example.

Highly compliant products (those best fit for settings 4 through 10) consume large volumes of water before showing any pressure at the sensor. When *Fill speed* is enabled for a test, it will attempt to pressurize a product to approximately eight PSI before starting the actual test. Some very compliant products can burst at less than eight PSI (as the sensor sees it), since the actual weight of water inflating the product can apply much more than eight PSI to its sides, seams, etc.

Highly compliant products may need special test considerations, e.g., testing a product encased in a rugged, constrictive enclosure that prevents it from consuming more than a fixed volume of water. Of course, once inside a constrictive enclosure, the product will not experience the same stresses that it would see in normal use.

If using a Smart Manifold, the HBLT uses adaptive compliance to adjust the compliance value for a varying number of ports when using the parallel mode. During test creation, the HBLT prompts for single port compliance, multiple port compliance and manifold count. The HBLT uses these values to compute adaptive compliance values depending on the number of active ports during the progression of the test.

See appendix L for assistance on selecting the correct compliance setting values.

"Fast Ramp" Pressurization

Each of the five test types (Linear Ramp, Staircase, Fatigue,

Incremental, Custom) ask for an "Up Rate." Most non-destructive tests use a controlled pressurization rate that is entered on this screen in terms of engineering units per second (PSI/sec, kPa/sec, Atm/sec, or Bars/sec).

The "Up Rate" screen features a "FAST" button, which when pressed, changes the requested Up Rate to "FAST RAMP". Any test created with a FAST RAMP Up Rate will pressurize as fast as possible within the limitations of the unit. The effective rate in this case can be as fast as 1000 PSI per second, more in some cases, depending on model.

FAST RAMP is intended for destructive testing. Target pressures are not achieved accurately during FAST RAMP testing. FAST RAMP pressurization is very much like trying to move a car between two points using a stop/go switch as opposed to an accelerator and brake.

A side effect of FAST RAMP pressurization is pressure backlash. If a product is brought to a target pressure and does not fail, the rapid stopping of the pressurization process causes a kind of "hiccup" in the pressure curve, which the tester may interpret as a mild burst. It is recommended that the *Burst Rate* be set to higher values for FAST RAMP tests.

FAST RAMP pressurization consists of two phases: full power pressurization and controlled target acquisition. Full power pressurization starts immediately and runs for as long as it can without running risk of going over pressure. Then a controlled ramp rate decelerates to goal.

Defining a New Test

Select "Edit test information" from the Engineering Menu.

Select "New" on the Test Editing Menu.

Select the type of test (see definitions above).

Enter the information requested at the prompts. Each type of test uses a different number of settings. The *HBLT* prompts you to enter each of the settings, displaying minimum and maximum allowable values each time. If you enter a value that is out of range for a test, you will be prompted to correct the value. If an incorrect value is entered there is no need to quit. It is easy to go back and change values by "Editing" a test (see below). The test will be saved automatically when all parameters have been entered.

If there is a Smart Manifold attached, the HBLT prompts for settings unique to Smart Manifold operation. See Appendix H for details on the Smart Manifold settings.

Once a test has been created, a button appears on screen that enables you to "Quick Start" it. This button appears with the language **Run Test "MYPROC"** where "MYPROC" is the name of the test recently created.

Editing an Existing Test

Select "Edit test information" from the Engineering menu. Note that all test settings **except** for the "Type of test," its name, and the *Pressure Units* may be edited.

Select "Edit" on the Test Editing Menu.

Touch the menu button next to the name of the test to be changed.

Press OK.

Each of the settings, beginning with "Product ID," will be presented, just as when entering a new test. You may change any of these. Simply touch the "OK" button on screens that do not require changes. The new values are automatically saved after the last screen has been (optionally) edited.

If any settings change, the *HBLT* will ask what to do with these changes. You may choose to save the changes into the original test, updating it; save the edited test under a new name; or discard the changes.

Once a test has been edited, a button appears on screen to enable the "Quick Start" function. This button appears with the language **Run Test "MYPROC"** where "MYPROC" is the name of the test recently edited.

Deleting a Test

Select "Edit test information" from the Engineering menu.

Select "Delete" on the Test Editing Menu.

Touch the menu button next to the name of the test to be deleted.

Review the information about the test selected and touch OK if this is the test intended to delete.

Touch YES to confirm deletion of the test.

Printing a Test

Ensure that a printer is connected to the *HBLT*, and that it is turned on and paper is loaded.

Select "Edit test information" from the Engineering menu.

Select "Print" on the Test Editing Menu.

Touch the menu button next to the name of the test to print. The test parameters will be immediately printed.

Importing a Test

This feature allows you to send information that defines a given test from one similar *HBLT* instrument to another. Similar means identical pressure model and identical application versions.

Using a Crescent Design customized serial cable; connect two *HBLT* instruments together via their serial ports (located on their back panels).

Next, go to the *HBLT* instrument that is to **receive** test information and select "Import" from the Test Editing Menu.

Go to the *HBLT* instrument that is to **send** test information and select "Export" from the Test Editing Menu. (Follow the instructions under "Exporting a Test".)

Data transfer usually takes only one second. If you attempt to import a test with the same name as an existing test, you will be prompted as to whether to overwrite an existing test. If you attempt to import a test and the test memory is already full, you will be prompted to delete an existing test or to abandon the import. If information is not received within three minutes, the "Import" screen will automatically time-out (returns to a menu).

Once a test has been successfully imported, a button appears on screen that enables you to "Quick Start" it. This button appears with the language **Run Test "MYPROC"** where "MYPROC" is the name of the test recently received.

Exporting a Test

Select "Export" from the Test Editing Menu.

Touch the menu button next to the name of the test you'd like to export. The data for that test is automatically sent out the serial port in ASCII form. The data is formatted to be intelligible by another *HBLT* instrument, and may not be obvious to the operator.

It is possible to use a "terminal program" to record exported tests, edit, and later upload them into *HBLT* using ASCII data transfer. Any unacceptable settings will be brought to your attention, as well as related error messages should an imported test have problems.

Exporting to the TestScan Program

Select "Export TestScan" from the Test Editing Menu.

Touch the menu button next to the name of the test you'd like to export. The data for that test is automatically sent out the serial port in ASCII form. The data is formatted as input to the TestScan PC program.

Changing the engineering password

Tests and other **Engineering Menu** items may be protected with a password. When a password is applied, access is restricted. To enter or change a password, press the "Change password" button on the **Edit Test Information** screen off the **Engineering Menu**. If an existing password is in place, you must enter the previous password before proceeding. If you

choose to change the password, you must enter it twice, the second time for confirmation. If the confirming entry matches the initial entry, the new password will take effect and further attempts to access certain functions will require passwords.

When entering the password, the HBLT displays asterisks instead of the entered characters. This feature helps secure the password.

To disable the password, go to "Change Password" and enter a blank password by pressing "Clear" then "OK." Confirm this, and the password will be deleted.

The calibration function is now protected by its own password. Read the section on calibration for instructions on setting that password.

Preventive Maintenance

Except for the touch screen display, no special external cleaning of the *HBLT* instrument is necessary. If general cleaning is needed, use a damp cloth to clean the exterior surfaces.

Touch Screen

It is important that only a soft damp cloth be used to clean the touch screen on the *HBLT*. Nothing sharp or potentially abrasive should be used. Do not use paper towels to clean the screen, as they can be abrasive to the touch screen surface.

Water Filter

The water filter should be replaced every 3 months. Follow these steps to change out the water filter:

1. Remove the power cord from the back of the *HBLT*.
2. Remove the eight screws that hold the cover on.
3. Carefully, remove the cover of the instrument.
4. Locate the water filter near the inlet port.
5. Release the hose clamps, or slide the collars back on push-toconnect connections.
6. Remove the hose from the filter and replace the filter with a new one. Make sure that the direction arrow points to the tubing connected to the valve.
7. Replace the hose clamps or insert into the push-to-connect fitting.
8. Replace the cover and replace the screws.
9. Attach the power cord.

10. Turn on the instrument and purge it thoroughly.

Fault conditions

Internal fans in the HBLT run when needed to keep certain components cool. You may hear the fan cycling on and off while a test is running. This is normal.

Overtemperature

Temperature sensors inside the *HBLT* allow the computer to alert you in the case of over-temperature conditions. An error message will appear on the display if either the servomotor or electronics get too hot. In order to clear an over-temperature error, you must turn off the *HBLT* and turn it back on again.

Motor Stalled

The *HBLT* automatically adjusts for hard-to-pressurize conditions (such as *compliant* products). In the event that the *HBLT* cannot effect pressure increases after 5 seconds of effort, it will assume that its motor has stopped working and will display a "Motor stalled" message. In order to clear this error, turn off the *HBLT* and after a moment, turn it back on again. Check to make sure that the product undergoing testing is properly attached to the outlet and that water flow is closed off.

If this message persists, contact CDI for service.

Overpressure

If the pressure exceeds a safe limit, the *HBLT* displays an over pressure error message. This typically cannot happen under normal test circumstances, unless some outside force is applying extreme pressure back into the *HBLT*. Another possible cause of overpressure is incorrect calibration. Always insure the *HBLT* is correctly calibrated.

If the Overpressure signal occurs during calibration, the HBLT displays an alert message instructing the operator to release the pressure. Loosen the gauge allowing the pressure to drop. The HBLT then sets the offset and scale back to factory default values and returns to the start of calibration screen to restart calibration.

Appendix A. Serial Remote Control

Serial Remote Control is an option found on the second page of the **Configuration Menu**, "Enable remote control" and "Select Remote Output". When set to YES, this option will permit remote operation of the tester as if an operator were pressing buttons on its touch screen. The baud rate at which remote operations commence is whatever rate is set in the **Configuration Menu** (page 6), "Set the baud rate". Available baud rates are 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400.

Selecting a test

The tester's **Main Menu** offers an option for "Run a test." An operator must use the touch screen to choose this option, enter their Operator ID and Lot Code information, and then select the test to run. (After selecting a test, the screen shows test information, and the operator must press OK to confirm the test selection.) See also the remote command code "r" for a remote-control method of selecting tests.

Remote Control Features

The main test screen (which shows "BURST-LEAK TESTER READY" at the top) may be controlled either by an operator or by characters coming in the serial channel. The following describe characters and their function. NOTE: In the descriptions below, <cr> stands for an ASCII carriage return, code 13 decimal; <lf> stands for an ASCII linefeed, code 10 decimal. Examples in quotes use the quotes to delimit the message; the quote characters themselves are not part of any message.

ESC (ASCII code 27 decimal) Return to main menu. Once the main menu is displayed, no further serial input is accepted until an operator selects another test as described above. If a test is already in progress or there is no ESC button currently being displayed, this command is ignored.

*   (ASCII code 42 decimal) HBLT RESET command. This command cancels a test during the fill operation or the test execution. The HBLT returns to the main menu after resetting.

?   (ASCII code 63 decimal) status query. During most test states, this command causes the tester to echo back a message formatted like "=XXX,YYY<cr>" where XXX is the current pressure reading (in applicable test units), and YYY the peak pressure reading (again in test units). Example: "=20,200<cr>" and "=1130,1200<cr>". This command is ignored when in streaming mode. See description of command character D (below) for details on streaming.

!   (ASCII code 33 decimal) status query. During most test states, this command causes the tester to echo back a message formatted like "=XXX,YYY,ZZZ.Z<cr>" where XXX is the current pressure reading (in applicable test units), YYY the peak pressure reading (again in test units), and ZZZ.Z is the time in tenths of seconds into the current step. Example: "=20,200,2.2<cr>" and "=1130,1200,3.1<cr>". This command is ignored when in streaming mode. See description of command character D (below) for details on streaming.

C   (ASCII code 67 decimal) Streaming mode CANCEL. This is a software function that has no on-screen button equivalent. See description of command character D (below) for details on streaming.

D   (ASCII code 68 decimal) Streaming mode ENABLE. This is a software function that has no on-screen button equivalent. Streaming mode causes a continuous flow of data to be sent by the HBLT during test operation. See the description of the : (colon) response code for details on the data packets.

G   (ASCII code 71 decimal) GO button. Tester will behave as if the onscreen GO button had been pressed. The GO button in question is the button that appears on-screen after initial power-up of the HBLT.

K   (ASCII code 75 decimal) OK button. Tester will behave as if the onscreen OK button had been pressed. If a test is not in progress or the OK button is not currently being displayed, this command is ignored.

l   (lower case, ASCII code 108 decimal) Lot number string. Tester will behave as if a string were typed in response to the lot number request. Type up to 14 characters followed by a carriage return or linefeed. This command must follow the "r" command.

o   (lower case, ASCII code 111 decimal) Operator string id. Tester will behave as if a string were typed in response to the operator id request. Type up to 14 characters followed by a carriage return or linefeed. This command must follow the "r" command.

R   (ASCII code 82 decimal) START button. Tester will behave as if the onscreen START button had been pressed. If a test is already in progress or there is no START button currently being displayed, this command is ignored.

r   (lower case, ASCII code 114 decimal) execute process command. The lower-case r must be immediately followed by the exact (spaces, punctuation, and case-sensitive) test name and then a carriage return

(ASCII code 13 decimal). If this test name matches one of the tests in the HBLT memory, it will be loaded and made ready. The system should typically respond with an F (waiting to start). A response of "?" followed by the test name happens when no match is found. A nonresponse (within one or two seconds) would indicate that the HBLT was busy running a test or in another mode (purge or engineering menus, for example) and cannot accept run commands. The test name need not be terminated with a carriage return if its length is exactly ten characters long. NOTE: Most tests contain no lower-case characters. Example: "rMY TEST<cr>".

The "r" command resets the operator id string and lot number string to null. Use the "l" and "o" commands to set the lot number and operator id respectively after you issue the "r" command.

S   (ASCII code 83 decimal) STOP button. Tester will behave as if the onscreen STOP button had been pressed. If a test is not in progress or the STOP button is not currently being displayed, this command is ignored.

X   (ASCII code 88 decimal) exports currently loaded process. When the HBLT is waiting for the START button, sending an X causes the HBLT to export the process presently being run via the serial channel exactly as if it had been EXPORTed via the Engineering Menu. Note that decimal points are omitted. See Appendix B for units description.

Y   (ASCII code 89 decimal) redirects the parallel port output to the serial port. Pressure Manager uses this command to redirect reports to the Windows application.

y   (ASCII code 121 decimal) restores the parallel port output back to the original port.

Z   (ASCII code 90 decimal) resume a test stopped by S command, burst, or leak. If a burst or leak stopped the test, the cylinder is refilled. If stopped in a pressurized state, the HBLT is re-pressurized.

Response codes

The tester will send various codes indicating test status by itself when a test is in progress (or just stopping). The following are the codes and their meanings:

= (ASCII code 61 decimal) status report, responding to remote query. This response code is followed immediately by XXX,YYY<cr> where XXX is the current pressure (in test units), and YYY the peak pressure (in test units).

~ (ASCII code 126 decimal) status report, responding to remote query "!" command. This response code is followed immediately by XXX,YYY,ZZ.Z<cr> where XXX is the current pressure (in test units), YYY the peak pressure (in test units), and ZZ.Z is the time in tenths of seconds into the current step.

: (ASCII code 58 decimal) streaming data report. This character is followed by a sequence of numbers separated by commas. Depending on the options selected during Select Remote Output, the numbers include a sequence number, the current pressure, the maximum pressure, and the volume. The pressures are reported using the engineering units specified for the test. The volume can be the total volume, the incremental volume, the total encoder counts, or the incremental encoder counts. Example data responses would be (without quotes): ":50,-5<cr>" and ":-5,100<cr>".

? (ASCII code 63 decimal) remote test name rejected. This character is followed by the test name (up to 10 characters long) and a <lf><cr> sequence. This is always in response to a remote command "r" followed by a test name that does not match any in the HBLT memory. Since test names are punctuation-, case- and space-sensitive, common errors can be having an unintentional space (or other character) follow the "r" command, or in sending a lower-case test name when most all tests contain no lower case.

B (ASCII code 66 decimal) maintain cycle starting. This character is transmitted before any applicable pressure maintenance during a test. The HBLT does not emit this character when streaming mode is active.

DA (ASCII codes 68 and 65 decimal, respectively) test aborted by operator (safety door open, RESET via remote control or front panel). This response code is followed immediately by XXX<cr> where XXX is the peak pressure (in test units). Example: "DA1200<cr>".

DB (ASCII codes 68 and 66 decimal, respectively) test aborted, up ramp burst condition. This response code is followed immediately by XXX,YYY,ZZZ,VVV<cr> where XXX is the burst pressure (in test units), YYY the peak pressure (in test units), ZZZ is the time elapsed since the pressure started ramping up in the current cycle, and VVV is the event volume in cc or cc/sec. Example: "DB360,500,4.2,2.1<cr>". (Burst at 360 units, peak 500, 4.2 seconds,2.1cc.) The HBLT emits this

message when an up ramp or dwell burst occurs. However, during streaming data mode, the message is displayed after the test completes.

If using a Smart Manifold, the HBLT appends a comma and the port number to the message. Example: "DB360,500,4.2,2.1,4<cr>".

DC   (ASCII codes 68 and 67 decimal, respectively) test aborted, down ramp burst condition. This response code is followed immediately by XXX,YYY,ZZZ,VVV<cr> where XXX is the burst pressure (in test units), YYY the peak pressure (in test units), ZZZ is the time elapsed since the pressure started ramping down in the current cycle, and VVV is the event volume in cc or cc/sec. Example: "DC360,500,4.2,2.1<cr>". (Burst at 360 units, peak 500, 4.2 seconds, 2.1cc.) The HBLT emits this message when a down ramp or bottom maintain burst occurs. However, during streaming data mode, the message is displayed after the test completes.

If using a Smart Manifold, the HBLT appends a comma and the port number to the message. Example: "DC360,500,4.2,2.1,4<cr>".

DD   (ASCII codes 68 and 68 decimal, respectively) test aborted, leak dip condition. This response code is followed immediately by XXX,YYY,ZZZ,VVV<cr> where XXX is the leak pressure (in test units), YYY the peak pressure (in test units), ZZZ is the time elapsed since the pressure started ramping up in the current cycle, and VVV is the event volume in cc or cc/sec. Example: "DD360,500,4.2,2.1<cr>". (Burst at 360 units, peak 500, 4.2 seconds, 2.1cc.) The HBLT emits this message when a leak dip occurs. However, during streaming data mode, the message is displayed after the test completes.

If using a Smart Manifold, the HBLT appends a comma and the port number to the message. Example: "DD360,500,4.2,2.1,4<cr>".

DK   (ASCII codes 68 and 75 decimal, respectively) test completed, no errors. This response code is followed immediately by XXX,YYY<cr> where XXX is the peak pressure (in test units), and YYY is the time elapsed since the pressure started ramping up in the current cycle. Example: "DK1130,8.1<cr>". (Peak at 1130 units, 8.1 seconds).

DL   (ASCII codes 68 and 76 decimal, respectively) test aborted, leak condition. This response code is followed immediately by XXX,YYY,ZZZ,VVV<cr> where XXX is the leak pressure (in test units), YYY the peak pressure (in test units), ZZZ is the time in tenths of seconds into the current step, and VVV is the event volume in cc or cc/sec. Example: "DL25,29,7.2,2.1<cr>". The HBLT emits this message when a leak occurs. However, during streaming data mode, the message is displayed after the test completes.

If using a Smart Manifold, the HBLT appends a comma and the port number to the message. Example: "DL360,500,4.2,2.1,4<cr>".

DT   (ASCII codes 68 and 84 decimal, respectively) is the current target pressure in the current pressure units. Example: "DT100<cr>".

DY   (ASCII codes 68 and 89 decimal, respectively) is the current test cycle. Example "DT0,3<cr>". The first number is the Smart Manifold port (a zero represents non Smart Manifold reporting). The second number is the cycle.

DZ   (ASCII codes 68 and 90 decimal, respectively) test not run due to lack of calibration. Calibrating the HBLT clears this condition. Example: "DZ:0,0,0,0<cr>".

F   (ASCII code 70 decimal) waiting for start button. This character is transmitted after a test is prepared and ready to run, and also after 8 PSI of backpressure is detected during the *Fill* pre-testing process. The latter only occurs when the *Fill speed* setting is enabled.

M   (ASCII code 77 decimal) maintain cycle ending. This character is transmitted after any applicable pressure maintenance during a test. If a test's "Maintain pressure time" setting is zero, this character is transmitted each time the hydraulic pressure reaches its (next) goal. If a test has a non-zero "Maintain pressure time," then this character is sent after the *Maintain Time* expires. However, the HBLT does not emit this character when streaming mode is active.

[(ASCII code 91 decimal) starts a quoted text string when transmitting redirected parallel port output out the serial port.

]   (ASCII code 93 decimal) ends a quoted text string when transmitting redirected parallel port output out the serial port.

^   (ASCII code 126 decimal) quotes a single character when transmitting redirected parallel port output out the serial port.

Appendix B. Model Parameters

25 PSI Model Parameters	PSI	ATM	BAR	kPa
Up Ramp Rate, minimum per second	1.00	0.068	0.069	6.89
Up Ramp Rate, maximum per second	50.00	3.403	3.447	327.67
Up Ramp Rate, default	5.00	0.340	0.345	34.47
Down Ramp Rate, minimum per second	1.00	0.068	0.069	6.89
Down Ramp Rate, maximum per second	50.00	3.403	3.447	327.67
Down Ramp Rate, default	5.00	0.340	0.345	34.47
Initial Pressure, minimum	1.00	0.068	0.069	6.89
Initial Pressure, maximum	25.00	1.701	1.724	172.37
Initial Pressure, default	1.00	0.068	0.069	6.89
Target Pressure, minimum	0.10	0.007	0.007	0.69
Target Pressure, maximum	25.00	1.701	1.724	172.37
Target Pressure, default	10.00	0.681	0.689	68.95
Return Pressure, minimum	-12.00	-.817	-.827	-82.74
Return Pressure, maximum[1]	25.00	1.701	1.724	172.37
Return Pressure, default	0.00	0.000	0.000	0.00
Increment Pressure, minimum step	0.01	0.001	0.001	0.07
Increment Pressure, maximum step	25.00	1.701	1.724	172.37
Increment Pressure, default	5.00	0.340	0.345	34.47
Maximum Test Pressure, minimum[2]	0.05	0.003	0.003	0.34
Maximum Test Pressure, maximum	25.00	1.701	1.724	172.37
Maximum Test Pressure, default	10.00	0.681	0.689	68.95
Leak Rate, minimum per second	1.00	0.068	0.069	6.89
Leak Rate, maximum per second	50.00	3.403	3.447	327.67
Leak Rate, default per second	5.00	0.340	0.345	34.47
Up Burst Rate, minimum per second[3,5]	5.00	0.340	0.345	34.47
Up Burst Rate, maximum per second	200.00	13.610	13.790	327.67
Up Burst Rate, default per second	25.00	1.701	1.724	172.37
Down Burst Rate, minimum per second[3]	5.00	0.340	0.345	34.47
Down Burst Rate, maximum per second	200.00	13.610	13.790	327.67
Down Burst Rate, default per second	0.00	0.000	0.000	0.00

Leak Dip, minimum	0.01	0.001	0.001	0.07
Leak Dip, maximum	25.00	1.701	1.724	172.37
Leak Dip, default	0.00	0.000	0.000	0.00

Table 4 - HBLT models 25 and LH 25 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

100 PSI Model Parameters	PSI	ATM	BAR	kPa
Up Ramp Rate, minimum per second	1.0	0.07	0.07	6.9
Up Ramp Rate, maximum per second	50.0	3.40	3.45	344.7
Up Ramp Rate, default	50.0	3.40	3.45	344.7
Down Ramp Rate, minimum per second	1.0	0.07	0.07	6.9
Down Ramp Rate, maximum per second	50.0	3.40	3.45	344.7
Down Ramp Rate, default	50.0	3.40	3.45	344.7
Initial Pressure, minimum	1.0	0.07	0.07	6.9
Initial Pressure, maximum	100.0	6.81	6.89	689.5
Initial Pressure, default	10.0	0.68	0.69	68.9
Target Pressure, minimum	1.0	0.07	0.07	6.9
Target Pressure, maximum	100.0	6.81	6.89	689.5
Target Pressure, default	50.0	3.40	3.45	344.7
Return Pressure, minimum	-12.0	-0.82	-0.83	-82.7
Return Pressure, maximum[1]	100.0	6.81	6.89	689.5
Return Pressure, default	0.0	0.00	0.00	0.0
Increment Pressure, minimum step	0.1	0.01	0.01	0.7
Increment Pressure, maximum step	100.0	6.81	6.89	689.5
Increment Pressure, default	5.0	0.34	0.34	34.5
Maximum Test Pressure, minimum[2]	1.0	0.07	0.07	6.9
Maximum Test Pressure, maximum	100.0	6.81	6.89	689.5
Maximum Test Pressure, default	100.0	6.81	6.89	689.5
Leak Rate, minimum per second	1.0	0.07	0.07	6.9
Leak Rate, maximum per second	50.0	3.40	3.45	344.7
Leak Rate, default per second	5.0	0.34	0.34	34.5
Up Burst Rate, minimum per second[3,5]	5.0	0.34	0.34	34.5

Up Burst Rate, maximum per second	500.0	34.02	34.48	3276.7
Up Burst Rate, default per second	25.0	1.70	1.72	172.4
Down Burst Rate, minimum per second[3]	5.0	0.34	0.34	34.5
Down Burst Rate, maximum per second	500.0	34.02	34.48	3276.7
Down Burst Rate, default per second	0.0	0.00	0.00	0.0
Leak Dip, minimum	0.1	0.01	0.01	0.7
Leak Dip, maximum	100.0	6.81	6.89	689.5
Leak Dip, default	0.0	0.00	0.00	0.0

Table 5 - HBLT models 100 and LH 100test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

250 PSI Model Parameters	PSI	ATM	BAR	KPa
Up Ramp Rate, minimum per second	1.0	0.07	0.07	7
Up Ramp Rate, maximum per second	125.0	8.51	8.62	862
Up Ramp Rate, default	125.0	8.51	8.62	862
Down Ramp Rate, minimum per second	1.0	0.07	0.07	7
Down Ramp Rate, maximum per second	125.0	8.51	8.62	862
Down Ramp Rate, default	125.0	8.51	8.62	862
Initial Pressure, minimum	1.0	0.07	0.07	7
Initial Pressure, maximum	250.0	17.01	17.24	1724
Initial Pressure, default	25.0	1.70	1.72	172
Target Pressure, minimum	2.5	0.17	0.17	17
Target Pressure, maximum	250.0	17.01	17.24	1724
Target Pressure, default	100.0	6.81	6.89	689
Return Pressure, minimum	-12.0	-0.82	-0.83	-83
Return Pressure, maximum[1]	250.0	17.01	17.24	1724
Return Pressure, default	0.0	0.00	0.00	0
Increment Pressure, minimum step	0.1	0.01	0.01	1
Increment Pressure, maximum step	250.0	17.01	17.24	1724
Increment Pressure, default	10.0	0.68	0.69	69
Maximum Test Pressure, minimum[2]	2.5	0.17	0.17	17
Maximum Test Pressure, maximum	250.0	17.01	17.24	1724
Maximum Test Pressure, default	250.0	17.01	17.24	1724
Leak Rate, minimum per second	1.0	0.07	0.07	7
Leak Rate, maximum per second	50.0	3.40	3.45	345
Leak Rate, default per second	5.0	0.34	0.34	34
Up Burst Rate, minimum per second[3,5]	5.0	0.34	0.34	34
Up Burst Rate, maximum per second	500.0	34.02	34.48	3448
Up Burst Rate, default per second	25.0	1.70	1.72	172

Table

Down Burst Rate, minimum per second[3]	5.0	0.34	0.34	34
Down Burst Rate, maximum per second	500.0	34.02	34.48	3448
Down Burst Rate, default per second	0.0	0.00	0.00	0
Leak Dip, minimum	0.1	0.01	.001	1
Leak Dip, maximum	250.0	17.01	17.24	1724
Leak Dip, default	0.0	0.00	0.00	0

6 - HBLT model 250 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

500 PSI Model Parameters	PSI	ATM	BAR	KPa
Up Ramp Rate, minimum per second	1.0	0.07	0.07	7
Up Ramp Rate, maximum per second	250.0	17.01	17.24	1724
Up Ramp Rate, default	250.0	17.01	17.24	1724
Down Ramp Rate, minimum per second	1.0	0.7	0.7	7
Down Ramp Rate, maximum per second	250.0	17.01	17.24	1724
Down Ramp Rate, default	250.0	17.01	17.24	1724
Initial Pressure, minimum	5.0	0.34	0.34	34
Initial Pressure, maximum	500.0	34.03	34.47	3447
Initial Pressure, default	25.0	1.70	1.72	172
Target Pressure, minimum	5.0	0.34	0.34	34
Target Pressure, maximum	500.0	34.03	34.47	3447
Target Pressure, default	100.0	6.81	6.89	689
Return Pressure, minimum	-12.0	-0.82	-0.83	-83
Return Pressure, maximum[1]	500.0	34.03	34.47	3447
Return Pressure, default	0.0	0.00	0.00	0
Increment Pressure, minimum step	0.5	0.03	0.03	3
Increment Pressure, maximum step	500.0	34.03	34.47	3447
Increment Pressure, default	10.0	0.68	0.69	69
Maximum Test Pressure, minimum[2]	5.0	0.34	0.34	34
Maximum Test Pressure, maximum	500.0	34.03	34.47	3447
Maximum Test Pressure, default	500.0	34.03	34.47	3447

Leak Rate, minimum per second	1.0	0.07	0.07	7
Leak Rate, maximum per second	50.0	3.40	3.45	345
Leak Rate, default per second	5.0	0.34	0.34	34
Up Burst Rate, minimum per second[3,5]	10.0	0.68	0.69	69
Up Burst Rate, maximum per second	500.0	34.03	34.47	3447
Up Burst Rate, default per second	25.0	1.70	1.72	172
Down Burst Rate, minimum per second[3]	10.0	0.68	0.69	69
Down Burst Rate, maximum per second	500.0	34.03	34.47	3447
Down Burst Rate, default per second	0.0	0.00	0.00	0
Leak Dip, minimum	0.5	0.03	0.03	3
Leak Dip, maximum	500.0	34.03	34.47	3447
Leak Dip, default	0.0	0.00	0.00	0

Table 7 - HBLT model 500 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

1000 PSI Model Parameters	PSI	ATM	BAR	kPa
Up Ramp Rate, minimum per second	10	0.7	0.7	69
Up Ramp Rate, maximum per second	500	34.0	34.5	3447
Up Ramp Rate, default	250	17.0	17.2	1724
Down Ramp Rate, minimum per second	10	0.7	0.7	69
Down Ramp Rate, maximum per second	500	34.0	34.5	3447
Down Ramp Rate, default	250	17.0	17.2	1724
Initial Pressure, minimum	5	0.3	0.3	34
Initial Pressure, maximum	1000	68.1	68.9	6895
Initial Pressure, default	100	6.8	6.9	689
Target Pressure, minimum	10	0.7	0.7	69
Target Pressure, maximum	1000	68.1	68.9	6895
Target Pressure, default	250	17.0	17.2	1724

Table

Return Pressure, minimum	-5	-0.3	-0.3	-34
Return Pressure, maximum[1]	1000	68.1	68.9	6895
Return Pressure, default	0	0.0	0.0	0
Increment Pressure, minimum step	1	0.1	0.1	7
Increment Pressure, maximum step	1000	68.1	68.9	6895
Increment Pressure, default	25	1.7	1.7	172
Maximum Test Pressure, minimum[2]	5	0.3	0.3	34
Maximum Test Pressure, maximum	1000	68.1	68.9	6895
Maximum Test Pressure, default	500	34.0	34.5	3447
Leak Rate, minimum per second	5	0.3	0.3	34
Leak Rate, maximum per second	50	3.4	3.4	345
Leak Rate, default per second	10	0.7	0.7	69
Up Burst Rate, minimum per second[3,5]	20	1.4	1.4	138
Up Burst Rate, maximum per second	1000	68.1	68.9	6895
Up Burst Rate, default per second	50	3.4	3.4	345
Down Burst Rate, minimum per second[3]	20	1.4	1.4	138
Down Burst Rate, maximum per second	1000	68.1	68.9	6895
Down Burst Rate, default per second	0	0.0	0.0	0
Leak Dip, minimum	1	0.1	0.1	7
Leak Dip, maximum	1000	68.1	68.9	6895
Leak Dip, default	0	0.0	0.0	0

8 - HBLT model 1000 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

2000 PSI Model Parameters	PSI	ATM	BAR	Kpa
Up Ramp Rate, minimum per second	10	0.7	0.7	69
Up Ramp Rate, maximum per second	1000	68.1	68.9	6895
Up Ramp Rate, default	250	17.0	17.2	1724
Down Ramp Rate, minimum per second	10	0.7	0.7	69
Down Ramp Rate, maximum per second	1000	68.1	68.9	6895
Down Ramp Rate, default	250	17.0	17.2	1724
Initial Pressure, minimum	10	0.7	0.7	69
Initial Pressure, maximum	2000	136.1	137.9	13790
Initial Pressure, default	100	6.8	6.9	689
Target Pressure, minimum	20	1.4	1.4	138
Target Pressure, maximum	2000	136.1	137.9	13790
Target Pressure, default	250	17.0	17.2	1724
Return Pressure, minimum	-5	-0.3	-0.3	-34
Return Pressure, maximum[1]	2000	136.1	137.9	13790
Return Pressure, default	0	0.0	0.0	0
Increment Pressure, minimum step	2	0.1	0.1	14
Increment Pressure, maximum step	2000	136.1	137.9	13790
Increment Pressure, default	25	1.7	1.7	172
Maximum Test Pressure, minimum[2]	10	0.7	0.7	69
Maximum Test Pressure, maximum	2000	136.1	137.9	13790
Maximum Test Pressure, default	500	34.0	34.5	3447
Leak Rate, minimum per second	10	0.7	0.7	69
Leak Rate, maximum per second	100	6.8	6.9	689
Leak Rate, default per second	10	0.7	0.7	69
Up Burst Rate, minimum per second[3,5]	40	2.7	2.8	276
Up Burst Rate, maximum per second	2000	136.1	137.9	13790
Up Burst Rate, default per second	50	3.4	3.4	345

Table

Down Burst Rate, minimum per second[3]	40	2.7	2.8	276
Down Burst Rate, maximum per second	2000	136.1	137.9	13790
Down Burst Rate, default per second	0	0.0	0.0	0
Leak Dip, minimum	1	0.1	0.1	7
Leak Dip, maximum	2000	136.1	137.9	13790
Leak Dip, default	0	0.0	0.0	0

9 - HBLT model 2000 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

3000 PSI Model Parameters	PSI	ATM	BAR	KPa
Up Ramp Rate, minimum per second	10	0.7	0.7	69
Up Ramp Rate, maximum per second	1000	68.1	68.9	6895
Up Ramp Rate, default	250	17.0	17.2	1724
Down Ramp Rate, minimum per second	10	0.7	0.7	69
Down Ramp Rate, maximum per second	1000	68.1	68.9	6895
Down Ramp Rate, default	250	17.0	17.2	1724
Initial Pressure, minimum	10	0.7	0.7	69
Initial Pressure, maximum	3000	204.2	206.8	20684
Initial Pressure, default	100	6.8	6.9	689
Target Pressure, minimum	20	1.4	1.4	138
Target Pressure, maximum	3000	204.2	206.8	20684
Target Pressure, default	250	17.0	17.2	1724
Return Pressure, minimum	-5	-0.3	-0.3	-34
Return Pressure, maximum[1]	3000	204.2	206.8	20684
Return Pressure, default	0	0.0	0.0	0
Increment Pressure, minimum step	2	0.1	0.1	14
Increment Pressure, maximum step	3000	204.2	206.8	20684
Increment Pressure, default	25	1.7	1.7	172
Maximum Test Pressure, minimum[2]	10	0.7	0.7	69
Maximum Test Pressure, maximum	3000	204.2	206.8	20684
Maximum Test Pressure, default	500	34.0	34.5	3447
Leak Rate, minimum per second	10	0.7	0.7	69

Leak Rate, maximum per second	100	6.8	6.9	689
Leak Rate, default per second	10	0.7	0.7	69
Up Burst Rate, minimum per second[3,5]	40	2.7	2.8	276
Up Burst Rate, maximum per second	3000	204.2	206.8	20684
Up Burst Rate, default per second	50	3.4	3.4	345
Down Burst Rate, minimum per second[3]	40	2.7	2.8	276
Down Burst Rate, maximum per second	3000	204.2	206.8	20684
Down Burst Rate, default per second	0	0.0	0.0	0
Leak Dip, minimum	1	0.1	0.1	7
Leak Dip, maximum	3000	204.2	206.8	20684
Leak Dip, default	0	0.0	0.0	0

10 - HBLT model 3000 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

5000 PSI Model Parameters	**PSI**	**ATM**	**BAR**	**KPa**
Up Ramp Rate, minimum per second	10	0.7	0.7	69
Up Ramp Rate, maximum per second	1000	68.1	68.9	6895
Up Ramp Rate, default	250	17.0	17.2	1724
Down Ramp Rate, minimum per second	10	0.7	0.7	69
Down Ramp Rate, maximum per second	1000	68.1	68.9	6895
Down Ramp Rate, default	250	17.0	17.2	1724
Initial Pressure, minimum	10	0.7	0.7	69
Initial Pressure, maximum	5000	340.3	344.7	32767
Initial Pressure, default	100	6.8	6.9	689
Target Pressure, minimum	20	1.4	1.4	138
Target Pressure, maximum	5000	340.3	344.7	32767
Target Pressure, default	250	17.0	17.2	1724
Return Pressure, minimum	-5	-0.3	-0.3	-34

Table

Return Pressure, maximum[1]	5000	340.3	344.7	32767
Return Pressure, default	0	0.0	0.0	0
Increment Pressure, minimum step	2	0.1	0.1	14
Increment Pressure, maximum step	5000	340.3	344.7	32767
Increment Pressure, default	25	1.7	1.7	172
Maximum Test Pressure, minimum[2]	10	0.7	0.7	69
Maximum Test Pressure, maximum	5000	340.3	344.7	32767
Maximum Test Pressure, default	500	34.0	34.5	3447
Leak Rate, minimum per second	10	0.7	0.7	69
Leak Rate, maximum per second	100	6.8	6.9	689
Leak Rate, default per second	10	0.7	0.7	69
Up Burst Rate, minimum per second[3,5]	40	2.7	2.8	276
Up Burst Rate, maximum per second	5000	340.3	344.7	32767
Up Burst Rate, default per second	50	3.4	3.4	345
Down Burst Rate, minimum per second[3]	40	2.7	2.8	276
Down Burst Rate, maximum per second	5000	340.3	344.7	32767
Down Burst Rate, default per second	0	0.0	0.0	0
Leak Dip, minimum	1	0.1	0.1	7
Leak Dip, maximum	5000	340.3	344.7	32767
Leak Dip, default	0	0.0	0.0	0

Table 11 - HBLT model 5000 test settings minimum, defaults and maximums.

See the notes at the end of this appendix.

Notes:

1. This value is upper bounded by the initial pressure setting −1.

2. This value is lower bounded by the initial pressure setting.

3. This value is lower bounded by the leak rate setting + 15 PSI.

4. Items with gray backgrounds exceed the bound of their data types. These values are lower than the maximum machine pressure.

5. Set the leak rate to zero to obtain the minimum up burst settings that are below 15 PSI when using Pressure Manager scripts. The minimum for HBLT tests is still 15 PSI or higher.

Appendix C. Special note about ramp rates

Under certain conditions, the *HBLT* may not be able to make a pressure jump at the requested ramp rate. This typically occurs when small jumps are requested, particularly at low pressures. An example would be going from zero to 25 PSI at 250 PSI per second. Theoretically, this should take 1/10 of a second. In practice, the motor has to begin decelerating almost as soon as it starts accelerating.

To manage this, the *HBLT* program applies rules to bound the actual rates used internally to achievable values. This is generally invisible to a user.

It is important to realize that what the *HBLT* does is attempt to accelerate to the operating ramp rate, and then decelerate to zero speed at the target pressure. As a result, the time to achieve a given pressure will not be the pressure change divided by the ramp rate. It will always be a longer time. The smaller the pressure jump, the greater the exaggeration will be.

Appendix D. Option jumpers

On the main circuit board containing the HBLT electronics and logic are six option "jumpers" that define what model, pressure, and features that apply to the specific model HBLT you have. There are no jumpers intended for customer use; they are for factory use only and should not be changed or removed.

Appendix E. Downloading

Downloading is the process of programming the *HBLT* with a new "application," or software that permits operation (running and defining tests and so forth). Usually, downloading is invoked by requesting it via the **System Configuration** menu. In the event that the re-programmable memory circuits inside the *HBLT* lose their information, a message will be displayed similar to: "NO APPLICATION PRESENT - Please begin downloading new application."

Downloading requires that a computer (usually a PC compatible) be attached to the serial port and a special application run on the PC that downloads application data into the *HBLT*.

When downloading is invoked via the **System Configuration** menu, the screen indicates that it is waiting for download data to begin. This screen also features a STOP button that you may use to abort the downloading before it begins and large numerals counting down minutes and seconds. The minutes and seconds indicate how much time remains before the download request is automatically canceled (usually starting from five minutes).

Once downloading begins, the screen will show a Download ID and Received ID. These both should read BLT (for standard software versions). Below this information will be a Record Addr, short for record address. This displays hexadecimal numbers that count up as the application data comes into the system. At the bottom of the screen will be status messages. The normal status should read, "Receiving data."

Download Status Messages

The following is a list of status messages and their meanings, that may appear on the bottom of the downloading screen. All messages are informational; the downloader automatically makes whatever corrections and retries if it can. After a number of consecutive errors occur, the process will abort and the screen will indicate the problem and/or prompt to begin downloading again.

Address err

The application data was received with an improper programming address. The system will automatically progress to another status message if correct data does not come in within a certain amount of time.

Character timeout

A generous amount of time has elapsed since any data was received. If this message lingers, it may suggest a poor connection between the *HBLT*

and the PC compatible performing the transfer. After successive failures to communicate, the system will progress to show an abort message.

Data/CRC err

The application data was received with improper formatting or checksum. The system will automatically progress to another status message if correct data does not come in within a certain amount of time.

Download aborted

The download process had too many problems in receiving data, including the lack of data. Several attempts have been made to recover and retry without success. Usually an "OK" button appears on screen. After pressing OK, the download will start over from the beginning.

Download succeeded

The application has been received, initialized, and is about to be launched. The application's main "greeting screen" should appear almost instantly.

Erasing database

The application has been received and the end-of-data message was correct. The application is being invoked with the express purpose of erasing any process database information left over from the previous version. This is done because process data structure differs from version to version. The system will automatically progress to another status message.

Erasing unused EEPROM

The download process received all application data without error. Unused memory locations are being erased for safety. The system should progress beyond this step in a matter of seconds.

Last block err

The end-of-data message was formatted improperly. The system will automatically progress to another status message almost instantly.

NO APPLICATION PRESENT

This message indicates that the application memory contains no data or, whatever data it once contained lost integrity. You must begin running the download program (on a PC compatible) before the *HBLT* can function.

Receiving data

Application data is presently being received and programmed. When things are functioning smoothly, the new application will be ready to run in a matter of minutes.

Receiving last block

The application data has been completely received and the end-of-data message is being checked for validity. The system will automatically progress to another status message almost instantly.

Title record err

The HBLT received the initial data, but that data does not correspond with the expected values. Typically the screen will show Download: BLT and next to Received ID: will be something other than BLT. What appears next to Received ID: may be useful information for diagnosing problems if this occurs frequently. The system will automatically progress to another status message if the correct initial data does not come in within a certain amount of time.

Waiting for record

Application data is received in bursts of information known as records. A certain minimum amount of time has elapsed without a subsequent record coming in. The system will automatically progress to another status message if another record does not come in within a certain amount of time.

Waiting for start

This indicates that the initial data has yet to come in. Typically the screen will show Download ID: BLT and Received ID: shows a blank. The system will automatically progress to another status message if the initial data does not come in within a certain amount of time.

Write failed

The memory circuits inside the *HBLT* did not program and verify properly. The system will automatically progress to another status message if subsequent retries fail.

Appendix F. Hardware Troubleshooting

If the *HBLT* will not operate when the power switch is turned on, the most likely fault is the line cord pulling out of the wall plug or the IEC receptacle on the back of the machine.

If the machine still won't work, check the fuse. To gain access to it, remove the line cord from the back of the machine and pry out the fuse carrier below it. There are two fuses, a two-amp fuse for use in 230-volt locations, and a four-amp fuse for use with 115 volts. Both are 5 x 20millimeter "SLO-BLO" types. Do not use an ordinary fast-acting fuse, as the start-up surge will blow it within a few power cycles.

⚠ WARNING! When replacing the fuse carrier, observe the markings to be certain you are installing it for the correct line voltage.

Below are shown a list of messages displayed by the *HBLT* under conditions in which operation is interrupted. These messages are displayed on a special screen indicating "ERROR! ERROR! ERROR!" at the top and bottom.

In some circumstances mentioned below, you must take steps to correct the fault condition, turn the *HBLT* off, and then on again. If you have successfully corrected the error condition, you will be allowed to proceed.

Message	Explanation
Pressure limit exceeded.	The hydraulic pressure exceeded operational limits. Remove pressure from the system manually by venting the outlet. Excessive pressure can damage the pressure transducer. One cause of this problem is miscalibration. If it reoccurs soon after a calibration, contact Crescent Design for assistance.
The motor is overheating.	The motor that generates hydraulic pressure has overheated. Turn off the machine and contact Crescent Design for assistance.
Motor stalled.	Five seconds elapsed without any motor motion. Check for proper connection of the encoder connector. Switch off the HBLT and after a few moments, switch on again and retry. Contact Crescent Design for assistance.
The motor driver is too hot.	The circuits that power the motor that generates hydraulic pressure have overheated. Continued operation would risk damage. Let the system cool for five minutes with the power off. If the problem re-appears, contact Crescent Design.

Can't configure machine.	Option switches or internal setup is incorrect. Contact Crescent Design for assistance in solving this problem.
Ver mismatch x.xx/y.yy	The Kernel version y.yy is incompatible with the Application version x.xx. Contact Crescent Design for assistance in solving this problem.
Transducer not installed.	The pressure transducer is disconnected or malfunctioning. Contact Crescent Design for assistance in solving this problem.
Unknown press config (xxx)	The pressure limit xxx (in PSI) is unknown to the software. This can also be caused by improper option settings or setup. Contact Crescent Design for assistance in solving this problem.
Invalid exhaust/intake limits.	Both the intake limit switch and the exhaust limit switch are on at the same time. Contact Crescent Design for assistance in solving this problem.
Error code #xxx	An internal software error xxx was detected. Contact Crescent Design for assistance in solving this problem.

Table 12 - Warning messages.

If the HBLT has erratic pressure readings, see Appendix J for environmental considerations that can affect the pressure transducer.

Appendix G. Alert Messages

The HBLT displays Alert messages to inform the operator of recoverable program error conditions and recoverable machine error states. After reading the message, press the **OK** button to continue operation.

Each Alert message described below includes the full alert text and a description of the cause and resolution of the alert.

Alert

```
*** IMPORT TIMEOUT ***
No data was received
in the time allowed.
```

The HBLT displays this alert message when the import test text fails to arrive within 3 minutes if initiating the import. The long time allows the user to begin the export process from another HBLT. After

closing the alert message, begin a new import attempt without distractions.

Alert

```
0.5 cc/sec will be
used for the fill
rate after vacuum.
```

The HBLT displays this alert message when there is a vacuum setting and the test fill rate is 0 cc/sec. Setting the fill rate to a non-zero value disables this alert. The HBLT displays this alert for both Pressure Manager and non Pressure Manager opertion.

Alert

```
A fill timeout has
occurred. Please call
for service.
```

The HBLT displays this alert message when the fill operation times out without encountering a limit switch. The timeout value varies depending on the cylinder volume. If this alert repeats, contact Crescent Design, Inc. for service. Either the HBLT needs adjustment or there is a faulty component.

Alert

```
A purge timeout has
occurred. Please call
for service.
```

The HBLT displays this alert message when the purge operation times out without encountering a limit switch. The timeout value varies depending on the cylinder volume. If this alert repeats, contact Crescent Design, Inc. for service. Either the HBLT needs adjustment or there is a faulty component.

Alert

> **An intake timeout has
> occurred. Please call
> for service.**

The HBLT displays this alert message when the refill operation times out without encountering a limit switch. The timeout value varies depending on the cylinder volume. If this alert repeats, contact Crescent Design, Inc. for service. Either the HBLT needs adjustment or there is a faulty component.

Alert

> **At intake limit.
> Check for leaks.**

The HBLT displays this alert message when the intake limit switch turns on during a test. This can occur if the product leaks, is very compliant is compliant and large. The cylinder does not have enough volume. If the product leaked during an up ramp, try lowering the burst rate parameter to detect the leak. If the compliance is a problem, try constraining the product to limit its compliance.

If the HBLT itself is leaking, contact Crescent Design, Inc. for service.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!IN" alert to the remote software.

This alert flashes so that the operator can see any displayed results before pressing the OK button.

Alert

> **Calibration expired on
> <date>
> Please recalibrate.**

The HBLT displays this alert message when the user-defined calibration expires. Contact your metrology group/vendor to recalibrate the HBLT. The HBLT resets the expiration date upon successful calibration.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!CE" or "!CX" alert to the remote software.

> **Calibration expires in
> <99> days. Schedule
> recalibrate now.**

Alert

The HBLT displays this alert message when the warning period defined by the calibration occurs. This is only a warning. The HBLT will function after closing the alert panel. Contact your metrology group/vendor to schedule calibration. This message appears each time the HBLT powers up until the next calibration. The HBLT resets the expiration date upon successful calibration and this warning ceases to appear.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!CW" alert to the remote software.

Alert

```
Calibration warning
days not defined.
Set days first.
```

The HBLT displays this alert message when the user selects warn at power on or warn before test options without first setting the warning days. After closing the alert message, set the calibration warning days before selecting the warning location.

Alert

```
Cannot add a group
test type.
```

The HBLT displays this alert message when the user attempts to add a group test to a group test. The HBLT does not allow nested groups.

Alert

```
Cannot build volume
correction table. HBLT
not calibrated.
```

The HBLT displays this alert message when the user selects Volume Correction from the purge type selection screen. The HBLT is not properly calibrated. First, calibrate the HBLT. Then build the volume correction table.

```
Cannot create a
group test with no
tests.
```

The HBLT displays this alert message when the user presses the OK button on the Select Group Names screen with no selected tests. Add

Alert

at least one test before pressing the OK button or press the ESC button to cancel the new or edited test.

Alert

**Cannot mix pressure
units in a group test.**

The HBLT displays this alert message when the user attempts to add run a group test whose tests have different pressure units. Edit the referenced tests to make all the pressure units the same.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!GU" alert to the remote software.

Alert

**Cannot mix Smart
Manifold modes in a
group test.**

The HBLT displays this alert message when the user attempts to add or run a group test whose tests have different Smart Manifold modes. Edit the referenced tests to make all the Smart Manifold modes the same.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!GE" alert to the remote software.

Alert

**Cannot run a group
test without any tests
selected.**

The HBLT displays this alert message when the user attempts to run a group test whose tests no longer exist. Recreate the referenced tests or delete this group test and create another.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!GX" alert to the remote software.

**Check Sum Error Select
another test.**

Alert

> The HBLT displays this alert message when the user selects a test that has a checksum error. If this alert persists, contact Crescent Design, Inc for service.

Alert

> **Check Sum Error.**
> **Will continue delete.**

> The HBLT displays this alert message when the check sums do not match while deleting a test. If this alert persists, contact Crescent Design, Inc. for service.

Alert

> **Clear the calibration**
> **password before**
> **changing this option.**

> The HBLT displays this alert message while changing from dual password to single password mode. The user must clear the calibration password before the HBLT allows the change to single password mode.

Alert

> **Confirming entry did**
> **not match initial**
> **entry. Try again.**

> The HBLT displays this alert message when entering the confirmation to a new password. After closing the alert panel, enter the correct password.

Alert

> **Enable the dual**
> **password option first.**

> The HBLT displays this alert message when the operator attempts to set the calibration password before enabling the dual password option on the engineering configuration screen.

Alert

> **Failed to find a**
> **group test.**

> The HBLT displays this alert message when the HBLT fails to find a test listed in a group test. Compare the tests referenced in the group test to the available tests. Then, either remove the offending reference from the group or create a new test with the referenced name.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!GT" alert to the remote software.

Alert

`Failed to find a test in a group.`

The HBLT displays this alert message when the HBLT fails to find a test listed in a group test while printing a test's settings. Compare the tests referenced in the group test to the available tests. Then, either remove the offending reference from the group or create a new test with the referenced name.

Alert

`Failed to print a test. Check the printer.`

The HBLT displays this alert message when the HBLT fails to print a test settings. Check the printer for correct operation. Check the printer cable for proper connection.

Alert

`Found a nested group test.`

The HBLT displays this alert message when the HBLT finds a group test referenced in a group test The HBLT does not support nested groups.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!GN" alert to the remote software.

Alert

`Found a nested group test during print test.`

The HBLT displays this alert message when the HBLT finds a group test referenced in a group test The HBLT does not support nested groups.

`Import data had errors and therefor cannot be saved.`

Alert

The HBLT displays this alert message when an import error occurs. If the transfer is between two HBLT's, insure both HBLT's are the same version. If the transfer is between an HBLT and Pressure Manager, insure that the HBLT version is 1.81 or later. If the transfer is between an HBLT and a PC, check the text file on the PC for correctness. If this problem persists, contact Crescent Design, Inc. for service.

Alert

```
IMPORT ERROR
PRESSUNIT=<val>
PSI/ATM/KPA/BAR
```

The HBLT displays this alert message when it receives an invalid parameter to a PRESSUNIT= record during remote import mode. If this alert repeats, contact Crescent Design, Inc. for service.

Alert

```
IMPORT ERROR
TESTTYPE=<val>
RAM/STA/FAT/INC/CUS
```

The HBLT displays this alert message when it receives an invalid parameter to a TESTTYPE= record during remote import mode. If this alert repeats, contact Crescent Design, Inc. for service.

Alert

```
IMPORT ERROR <val> at
least one item out of
range
```

The HBLT displays this alert message when it receives an incorrectly formatted creation or update date during remote import mode. If this alert repeats, contact Crescent Design, Inc. for service.

```
IMPORT ERROR <var>
undefined or
missing
```

The HBLT displays this alert message when a required variable is missing in an imported test. The most likely cause is an invalid test variable record. If the transfer is between two HBLT's, insure that both HBLT's have the same application version. If the transfer is between Pressure Manager and an HBLT, insure that the HBLT version is 1.81 or later. If the transfer is between a PROCOMM or

Alert

> similar program and an HBLT, check the format of the test for correctness. Do this by exporting a test to PROCOMM and compare the two tests.
>
> In rare cases, there may be a problem with the serial port. If the problem persists, contact Crescent Design, Inc. for service.

Alert

> **IMPORT ERROR**
> **<var>=<value>**
> **Press units unknown**
>
> The HBLT displays this alert message when importing a test and the PRESSUNIT= record contains an unrecognized unit. If this alert repeats, contact Crescent Design, Inc. for service.

Alert

> **IMPORT ERROR**
> **<var>=<value>**
> **<var> min, <val> max**
>
> The HBLT displays this alert message when importing a test and a record parameter is not within valid bounds. If this alert repeats, contact Crescent Design, Inc. for service.

Alert

> **Imported process**
> **invalid, therefore**
> **cannot be saved.**
>
> The HBLT displays this alert message when an imported test contains invalid parameters. If the transfer is between two HBLT's, insure both HBLT's are the same version. If the transfer is between an HBLT and Pressure Manager, insure that the HBLT version is 1.81 or later. If the transfer is between an HBLT and a PC, check the text file on the PC for correctness. If this problem persists, contact Crescent Design, Inc. for service.
>
> **Invalid Calibration.**
> **Please Recalibrate.**
>
> The HBLT displays this alert message at initialization. Calibrate the HBLT before running tests.

Alert

> **Invalid Calibration.**
> **Please Recalibrate.**

Alert

> **Aborting the test.**

> The HBLT displays this alert message when attempting to run a test and the HBLT is not calibrated. Calibrating the HBLT clears this problem.

> If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "DZ:0,0,0,0" alert to the remote software.

Alert

> **Invalid correction**
> **table size. Software**
> **error.**

> The HBLT displays this alert message at start of volume correction process. This is a software error that has no workaround. Contact Crescent Design for more information.

Alert

> **Invalid test type,**
> **aborting to main menu.**

> The HBLT displays this alert message when attempting to run a test and the process type is not one of the valid types. This occurs only if there is a programming error or there is a memory fault. If this alert repeats, contact Crescent Design, Inc. for service.

Alert

> **Invalid test name.**
> **Please enter a valid**
> **test name.**

> The HBLT displays this alert message when the operator enters an invalid (blank) test name. Enter a valid test name or press the ESC key to cancel the process.

> **No pressure unit was**
> **present, so the test**
> **will not be saved.**

> The HBLT displays this alert message when an imported test does not contain a PRESSUNIT= record or that record is invalid. If the transfer is between HBLT's, check the serial connections and try again. If the transfer is between a PC and HBLT, verify that the text file on the HBLT contains the PRESSUNIT = record and that the record is

Alert

>correctly formatted. If this problem persists, contact Crescent Design, Inc. for service.

Alert

>**Processes found with**
>**bad checksums will be**
>**erased.**

>The HBLT displays this alert message at initialization if there are any bad checksums.

Alert

>**System Overpressure!**
>**Please verify that the**
>**outlet is clear.**

>The HBLT displays this alert message when the pressure is too high. This usually means that the outlet is blocked, capped, or the operator did not pull the syringe soon enough. Insure the outlet is clear and attempt the purge again.

Alert

>**That number exceeds a**
>**maximum of <val>**
>**Please re-enter.**

>The HBLT displays this alert message when entering a test parameter. After closing the alert message, enter a value within the bounds.

Alert

>**That number is below a**
>**minimum of <val>**
>**Please re-enter.**

>The HBLT displays this alert message when entering a test parameter.
>After closing the alert message, enter a value within the bounds.

>**That password is**
>**incorrect. Please**
>**try again.**

>The HBLT displays this alert message when the password the user enters is incorrect. After closing the alert message, enter the correct password.

Alert

Alert

That test name is already used. Please select another one.

The HBLT displays this alert message when selecting a test name for a new test. After closing the alert message, select a new unique name.

Alert

The Calibration values are not reliable. Please recalibrate.

The HBLT displays this alert message during initialization when it finds calibration values outside of valid bounds. Contact your metrology group/vendor to recalibrate the HBLT. If the problem persists after calibration, contact Crescent Design, Inc. for service.

Alert

The cylinder is out of water. Check for leaks or a starved inlet.

The HBLT displays this alert message when the actuator reaches the exhaust limit switch during a test. This can occur if the product leaks, is very compliant, or is compliant and large. The cylinder does not have enough volume to reach the target pressure and maintain. If the product leaked during an up ramp, try lowering the burst rate parameter to detect the leak. If the compliance is a problem, try constraining the product to limit its compliance.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!EX" alert to the remote software.

If the HBLT itself is leaking, contact Crescent Design, Inc. for service.

This alert flashes so that the operator can see any displayed results before pressing the OK button.

The group is full. Cannot add a test.

The HBLT displays this alert message when the operator press the ADD button while defining a group test with the maximum number of tests already defined. The maximum number of group tests is ten.

Alert

Alert

**The import file has no
process type and will
not be saved.**

The HBLT displays this alert message when an imported test does not contain a TESTTYPE= record or that record is invalid. If the transfer is between HBLT's, check the serial connections and try again. If the transfer is between a PC and HBLT, verify that the text file on the HBLT contains the TESTTYPE = record and that the record is correctly formatted. If this problem persists, contact Crescent Design, Inc. for service.

Alert

**The imported test has
no name and will not
be saved.**

The HBLT displays this alert message when an imported test does not contain a TESTNAME= record or that record is invalid. If the transfer is between HBLT's, check the serial connections and try again. If the transfer is between a PC and HBLT, verify that the text file on the HBLT contains the TESTNAME= record and that the record is correctly formatted. If this problem persists, contact Crescent Design, Inc. for service.

Alert

**The safety door is
open. Aborting the
test.**

The HBLT displays this alert message when the operator opens the safety door during a test.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!SD" alert to the remote software.

This alert flashes so that the operator can see any displayed results before pressing the OK button.

**The streaming mode CPS
is greater than the
serial port CPS.**

Alert

The HBLT displays this alert message when the operator selects
streaming mode options and baud rates that result in more Character
Per Second (CPS) than the serial transmission can handle. For
instance, if the operator selected a baud rate of 1200 (approximately
120 characters per second) and a streaming mode of 100 data points
per second (100*length of streaming message), the HBLT would not be
able to send the data without dropping many characters.

To prevent this from happening, always use 38400 (the maximum)
baud rate for the serial port. If a slower baud rate is essential, select a
streaming data rate below 100 that does not cause this alert message.

Alert

**The test record
contains an unknown
test type.**

The HBLT displays this alert message when beginning test execution
and the test type is not one of the predefined types. This message is a
program diagnostic. If this alert appears, contact Crescent Design, Inc.
for service.

Alert

**There are no more free
test memories. You
must delete one.**

The HBLT displays this alert message when the operator attempts to
save a new test when there is no "Undefined" test position. To save the
test, the operator must first cancel the current operation. Then select
and delete a test. Finally, perform the original operation again.

Alert

**Volume correction not
completed. Volume will
be output as zero.**

The HBLT displays this alert message when the operator attempts to
enable remote mode. Since the remote mode and Pressure Manager
operation use the volume-reporting feature, the volume correction
must be done to provide the correction. Otherwise the HBLT reports
the volume as 0.00 cc.

**Warning!
A burst occurred.
Aborting calibration.**

Alert

The HBLT displays this alert message when a burst event occurred during calibration.

Alert Warning! Burst
event during
pressurize.

The HBLT displays this alert message when a burst event occurred during calibration.

Alert Warning! Exhaust
limit during
pressurize.

The HBLT displays this alert message when the piston activates the exhaust limit switch during calibration.

Alert

Warning!
Over pressure error.
Release the pressure.

The HBLT displays this alert message when the pressure exceed the limits of the pressure transducer. Normally the error condition results in a more sever message requiring the restart of the HBLT. But, since this is calibration, the HBLT does the following:

1. Stops the motor.

2. Resets the calibration offset and scale to factory defaults.

3. Displays this message.

4. Returns to the beginning calibration screen.

Alert

Warning!
Pressure is too low.
Check outlet.

The HBLT displays this alert message when the applied pressure at the outlet is too low. After closing the alert message, apply more pressure and complete calibration.

Warning!
Pressure at outlet is
too low.

Alert

The HBLT displays this alert message when the pressure at the open outlet is too low. The transducer may be faulty. If this alert message persists, contact Crescent Design, Inc. for service.

Alert Warning!

Refill cylinder failed during pressurize.

The HBLT displays this alert message when a refill cylinder process failed during calibration.

Alert Warning! System error during pressurize.

The HBLT displays this alert message when a system error occurs during calibration.

Alert Warning! Timeout occurred during pressurize.

The HBLT displays this alert message when a piston motion timeout occurred during calibration.

Alert

Warning! You must press an arrow to complete calibration.

The HBLT displays this alert message when the user presses OK without first pressing an arrow button (i.e. bypassing calibration). After closing the alert message, correctly calibrate the HBLT before pressing the OK button.

Alert

You can't select an undefined test. Please try another.

The HBLT displays this alert message when the operator presses a button labeled Undefined when selecting a test for execution. Select only defined tests on these panels.

You must calibrate the HBLT before use.

Alert

> The HBLT displays this alert message when it discovers that the calibration is invalid after the user presses ESC on the Calibration screen. After closing the alert message, calibrate the machine before use.

Alert

> **You must choose a**
> **unique name for this**
> **test. Try again.**

> The HBLT displays this alert message when saving an edited test with a new name that is not unique. After closing the alert message, enter a new unique test name.

Alert

> **You must define**
> **expiration days before**
> **warning days.**

> The HBLT displays this alert message when the user attempts to set the calibration warning days before the calibration expiration days. After closing the alert message, set the calibration expiration days before setting the calibration warning days.

Appendix H. Smart Manifold

Introduction

The Smart Manifold is an expander that allows testing of up to ten products at a time. The HBLT communicates with the Smart Manifold and conducts tests singly, sequentially or in parallel. The Smart Manifold has ten channels available on the front panel. Each channel consists of a touch panel button, a channel select LED, a channel under test LED, a channel results LED, an outlet fitting and a valve (located inside the expander).

The Smart Manifold also has eight digital inputs and eight digital outputs. The Pressure Manager Protocol version 1.23 has commands to read and write to these outputs.

Installation

The Smart Manifold design allows the HBLT to stack on top the Smart Manifold. This saves space on the work area. To install the Smart Manifold, follow these instructions:

1. Place the smart manifold on the work surface.

2. Place the HBLT on top of the Smart Manifold aligning the HBLT feet with the pads on top of the Smart Manifold.

3. Connect the HBLT outlet to the Smart Manifold inlet using the provided tubing set.

4. Connect the communications cable between the HBLT and the Smart Manifold. The DB15 end connects to the HBLT expander connector found on the HBLT back panel. The RJ45 connect plugs into a receptacle on the Smart Manifold rear panel.

5. Connect the power cord to the HBLT.

6. Connect the power supply to the Smart Manifold. The power plugs into J1. You should see the green LED on the back panel light indicating power connected. You should also see the orange LED light on the upper right corner of the front panel.

7. Turn on the HBLT. On the first screen, verify that the version is 2.00 or greater and that the kernel version is 1.40 or greater. Verify that the blue LED indicating correct communications is lighted.

8. Attach a printer to the HBLT. The HBLT prints the test results on the printer.

Diagnostics

The Smart Manifold diagnostics allows the operator to check for correct expander operation. Form the Main Menu, press Engineering menu. Then, press System configuration. Then press the Page button once. Then, press the Diagnostics button. Finally, press the Expander tests button.

To test each channel, press the touch panel button repeatedly. The first press turns on the channel select LED. The second press turns off the channel select LED and turns on the channel under test LED. The third press turns off the channel under test LED and turn on the channel done LED. The fourth press turns off the channel done LED and turns on the valve (which makes a click sound). The fifth press turns off the valve and leaves all LEDs off.

To test each output port, toggle each input on/off. The HBLT toggles the corresponding output on/off in sync with the input.

Purging the Smart Manifold

Purging the Smart Manifold is very similar to purging the HBLT. When starting the purge, the HBLT selects the far right channel. This allows the most complete purge of the manifold. Press the other channel buttons during the exhaust strokes to purge each channel. Each internal valve and the outlet plumbing need purging.

Use a syringe to assist the purge. This is more important on the Smart Manifold than the HBLT. The manifold and valves increase the surface area and number of crevices that hold onto bubbles with surface tension. The syringe vacuum enlarges the bubbles allowing the purge flow to dislodge and sweep the bubbles out of the Smart Manifold.

Calibration with the Smart Manifold

Calibrating the Smart Manifold is similar to calibrating the HBLT. When starting the calibration, the HBLT select the far left channel. Perform the calibration as described previously in this manual.

Purge the Smart Manifold completely before calibration. Excessive trapped air can cause failure to calibrate when using the self-pressurization method.

Volume Correction with the Smart Manifold

Volume correction with a Smart Manifold attached is similar to the HBLT volume correction method. The HBLT turns off all channels while performing the volume correction. When prompted, open and close valves to allow the pressure to equalize at zero PSI.

Purge the Smart Manifold completely before running the volume correction. Trapped air can affect the volume correction results.

Smart Manifold Hunt Settings

When in parallel mode, the Smart Manifold hunts for burst or leaking ports using two methods. For bursts, the HBLT finds the burst port by delivering water to each active port in turn until either reaching the cutoff PSI or reaching the timeout. If the reaching the cutoff PSI occurs first, the Smart Manifold concludes that the product on that port did not burst. If the reaching the timeout occurs first, the Smart Manifold concludes that the product on that port did burst. For leaks, the HBLT finds the leaking port by performing the last pressure ramp, dwell, and down ramp to each active port in turn. If a leak of the same type (leak rate or leak dip) occurs, the HBLT reports the original event conditions. If a different leak type occurs or a burst occurs, the HBLT reports the new event conditions.

To accommodate differing products and test regimens, the HBLT has three test options to set the flow rate in cc/sec, the cutoff PSI in PSI, and the timeout in seconds. They appear in a test set to parallel mode.

The Find Port Rate should be set as high as possible without creating a backpressure on a burst product that would reach the cutoff PSI. Remember that balloons with small lumens restrict the flow rate.

The Find Cutoff should be set as low as possible without causing false triggers.

The Find Port Timeout should be set to allow enough time to completely fill a single product and then pressurize the product to the cutoff PSI.

Experiment to determine the correct settings for a particular product. If available, user Pressure Manager and a script to plot the results of a script that delivers a volume to the port with a product attached. For a particular delivery rate, the plot shows the time to get to a given cutoff pressure. Also test with a burst product to confirm that the settings do not detect a burst product as an un-burst product.

Smart Manifold Test Settings.

When defining a test with a Smart Manifold attached, the HBLT presents the Smart Manifold test options. Use these settings to adjust the HBLT to match the product properties.

Smart Manifold mode select

This option appears if there is a Smart Manifold attached to the HBLT. Use this option to change the Smart Manifold mode to single,

sequential or parallel. The default mode is single. If the selected mode is Parallel, the HBLT prompts for the following settings.

Find Port Rate

This option sets the Smart Manifold port hunt delivery rate in cc/sec. The screen displays the maximum and minimum setting for the HBLT model. The HBLT displays this option only with a Smart Manifold attached.

Find Port Timeout

This option sets the Smart Manifold port hunt timeout seconds. The value ranges from 3 to 300 seconds with a default of ten seconds. The HBLT displays this option only with a Smart Manifold attached.

Find Cutoff

This option sets the Smart Manifold port hunt cutoff PSI. The value ranges from 1 to 100 PSI with a default of 10 PSI. The HBLT displays this option only with a Smart Manifold attached.

Multiple Port Compliance

This option sets the Smart Manifold multiple port compliance value. This value ranges from the single port compliance value to ten. The HBLT displays this option only with a Smart Manifold attached. See appendix L for assistance on selecting the correct Multiple Port Compliance setting value.

Smart Manifold Count

This option sets the Smart Manifold count that describes the number of ports used with the Multiple Port compliance value. The HBLT displays this option only with a Smart Manifold attached. See appendix L for assistance on selecting the correct Smart Manifold Count setting value.

Smart Manifold Operation

To test product with the Smart Manifold, follow these instructions:

1. Make sure the HBLT is at the Main menu.

2. Attach product to the ports.

3. Press the button for each channel with product attached.

4. Press the Run a test button on the HBLT screen. Follow normal test start operations.

5. Press the Start button.

If the Smart Manifold is set to single mode, the HBLT performs the test and then stops. Find the test results on the screen and the printer.

If the Smart Manifold is set to sequential mode, the HBLT performs the test on each selected port from left to right. Find the test results on the printer and by pressing the results button on the final test screen.

If the Smart Manifold is set to parallel mode, the HBLT performs the test on all selected ports. If there are no errors, the test completes. If there are errors, the HBLT searches for the ports with burst product. The test-done LED flashes on burst ports. The HBLT then finishes the test on the remaining ports. Find the test results on the printer and by pressing the results button on the final test screen.

On exiting the last test screen, the HBLT clears the results. We highly recommend using a printer to save test results.

Smart Manifold Errors

`Alert`

> `Manifold not on.`
> `Turn on manifold`
> `power.`

The HBLT displays this alert message when the Smart Manifold interface reports that the expander is attached but not powered. Check the interface cable and power, and then restart the HBLT.

`Alert`

> `Bad manifold status.`
> `Check the cable.`
> `Check the power.`

The HBLT displays this alert message when the Smart Manifold interface reports that the expander is present but not attached to the expander or not powered. Check the interface cable and power, and then restart the HBLT.

`Alert`

> `Manifold error.`
> `Check the cable.`
> `Check the power.`

The HBLT displays this alert message when the Smart Manifold interface reports that the expander status changed during operation. Check the interface cable and power, and then restart the HBLT.

`Alert`

> `There are no`
> `ports selected.`

The HBLT displays this alert message when an operation, such as running a test, requires the operator to first select ports and there are

no ports selected. Select at least one port and then close the alert message.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!NP" alert to the remote software.

Alert

`There are too many`
`ports selected.`

The HBLT displays this alert message when the operator selects more that one port when running a test using the Smart Manifold single port mode. Select just one port and retry the operation.

If running a test in remote mode or with Pressure Manager, the HBLT does not display this alert but sends the "!NP" alert to the remote software.

Appendix I. Volume Correction Procedure

Introduction

The HBLT uses the volume correction procedure for Pressure Manager and remote operation only. If these features are not used, ignore the volume correction procedure.

The volume correction procedure and volume reporting require careful setup and operation of the HBLT. The following sections describe the processes that give the best results.

Volume Correction

Follow these steps to perform the volume correction:

1. Select a workstation for the HBLT that has a consistent temperature and humidity. Changes in temperature and humidity affect the pressure transducer measurements. Since the volume correction relies on accurate and consistent pressure readings, the temperature and humidity affect the volume reporting.

2. Setup the HBLT at the workstation. If required, setup the Smart Manifold.

3. Attach a zero-displacement valve, such as a ball valve, to the HBLT outlet or to port ten of the Smart Manifold. Insure that the valve is rated for the maximum pressure of the HBLT.

4. Purge the HBLT using the maximum purge rate. Use the engineering configuration screens to change the exhaust and intake purge rates.

5. Use the engineering configuration menus to lower the exhaust and intake purge rates to the following settings:

HBLT model	Exhaust and Intake Purge Rate
HBLT 25	0.5 cc/sec
HBLT LH25	1.0 cc/sec
HBLT 100	0.5 cc/sec
HBLT LH100	1.0 cc/sec
HBLT 250	0.5 cc/sec
HBLT 500	0.5 cc/sec

HBLT 1000	0.5 cc/sec
HBLT 2000	0.3 cc/sec
HBLT 3000	0.2 cc/sec
5000	0.2 cc/sec

Table 13 – Purge rate table for volume correction.

6. Turn on the HBLT and leave it on for 24 hours. This allows the temperature inside the HBLT cabinet to stabilize.

7. Calibrate the HBLT following the instructions in the Calibration Procedure Appendix K.

8. Use a syringe or the Crescent Design Vacuum Purger to purge the HBLT. If using the vacuum purger, vent the purger before removing it from the HBLT outlet. If using a Smart Manifold, open the port valve while venting. Otherwise, any bubbles caused by the vacuum inside the HBLT will contract when exposed to atmospheric pressure pulling air into the HBLT.

9. Use the Volume Correction option on the HBLT purge screen to do the volume correction. Follow the instructions on the HBLT screens for opening and closing the zero-displacement valve. This insures that the volume correction starts at zero PSI.

10. Use the engineering configuration screens to enable the HBLT for remote operation.

Operation for Volume Reporting

Follow these steps to insure the most accuracy for volume reporting:

1. Insure that HBLT reports zero PSI when the outlet is exposed to atmospheric pressure. Do this by starting a HBLT test but not running it. Observe the current pressure. It should be zero PSI.

2. Attach the device to test to the HBLT outlet or the Smart Manifold ports in such a way that they do not increase or decrease the pressure inside the HBLT. The test must start at zero PSI for best results. Using a three-way valve that allows the outlet to open to atmospheric pressure is helpful.

If the HBLT requires calibration, repeat the process in the above section. The volume reporting is dependent on the pressure.

Appendix J. Calibration and Operation Considerations

Operate the HBLT in an environment that has stable temperature and humidity. Variations in temperature or humidity can affect the pressure transducer. Lower temperature and high humidity can cause the transducer zero point to drift excessively. This causes bad HBLT behavior such as excessive burping, incorrect pressure ramps when starting from a vacuum, intake limit alarms, and incorrect volume reporting which is based on pressure.

Normal air conditioned office and clean rooms should be suitable. Spaces that are not air conditioned, especially with exposure to the outside through open doors or windows, present a risky environment for obtaining accurate results.

Appendix K. Calibration Procedure

Calibration

The HBLT requires a simple two-point calibration, which can be completed without opening the machine. The user is guided through this cover-on calibration process by following a series of onscreen prompts using the HBLT itself as the pressure source to achieve the pressure needed for calibration.

The recommended calibration interval is one year. It is essential that metrology complete this entire calibration procedure to correctly calibrate the HBLT. The HBLT operation relies on the zero point being at 0 PSI. Just verifying that the pressures are within tolerance is not acceptable. Metrology must make adjustments to insure correct HBLT operation.

It is now possible to protect calibration with its own password. It was previously protected by use of the engineering password. If selected, this change allows both engineers and calibration staff to have protected access to their respective areas while guarding the other area.

HBLT Front View
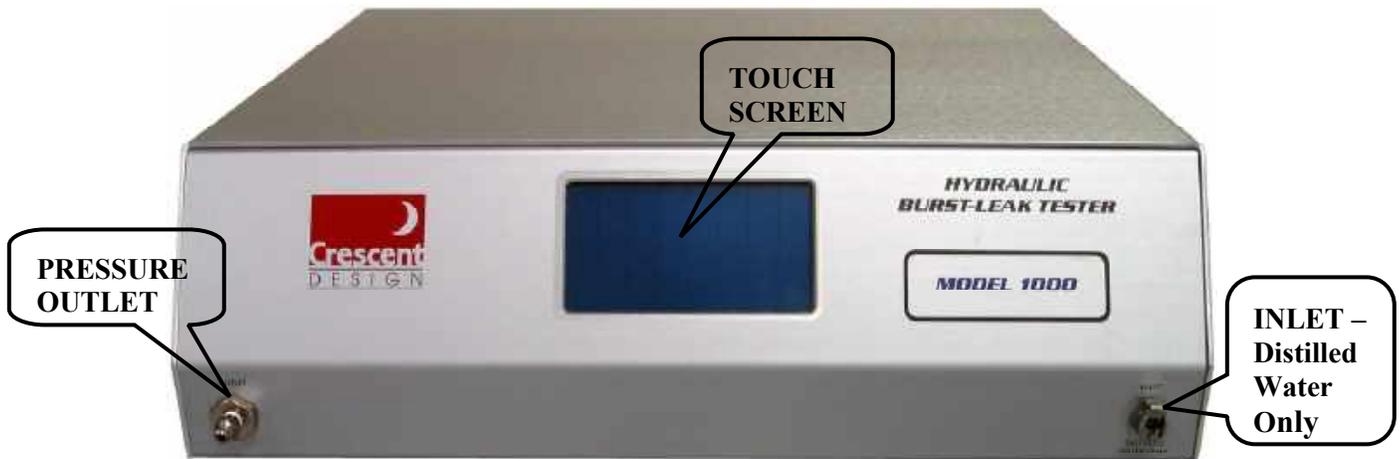
Figure 7 – HBLT components.

Prior to performing calibration, please review the following sections of the HBLT user's manual:

- Set Calibration Expiration

- Set Calibration Warning

This is necessary because performing the initial calibration calculates the expiration date and the warning date.

Perform Calibration

This choice comes up automatically when the HBLT is powered on for the first time, and also may be accessed by completing the following steps:

	Turn On the Power – push the toggle switch located on the back of the machine, exterior right, to the "Up" position.

Figure 8 – HBLT power plug and switch.

	Touch the **GO** button on the Crescent Design screen.

Figure 9 – Startup screen.

CDI HYDRAULIC BURST-LEAK TESTER ⬤ Purge the tester ⬤ Run a test ⬤ Engineering menu	Touch the **Engineering menu** button on the MAIN MENU screen.
Figure 10 –Main menu.	
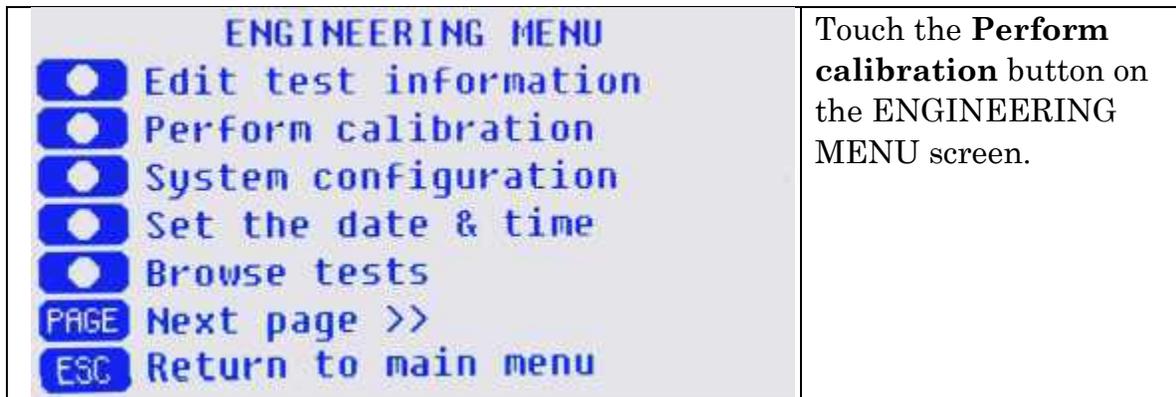
ENGINEERING MENU ⬤ Edit test information ⬤ Perform calibration ⬤ System configuration ⬤ Set the date & time ⬤ Browse tests PAGE Next page >> ESC Return to main menu	Touch the **Perform calibration** button on the ENGINEERING MENU screen.
Figure 11 –Engineering menu.	

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Figure 12 – Calibration options menu.

Touch the **Perform calibration** button on the CALIBRATION screen.
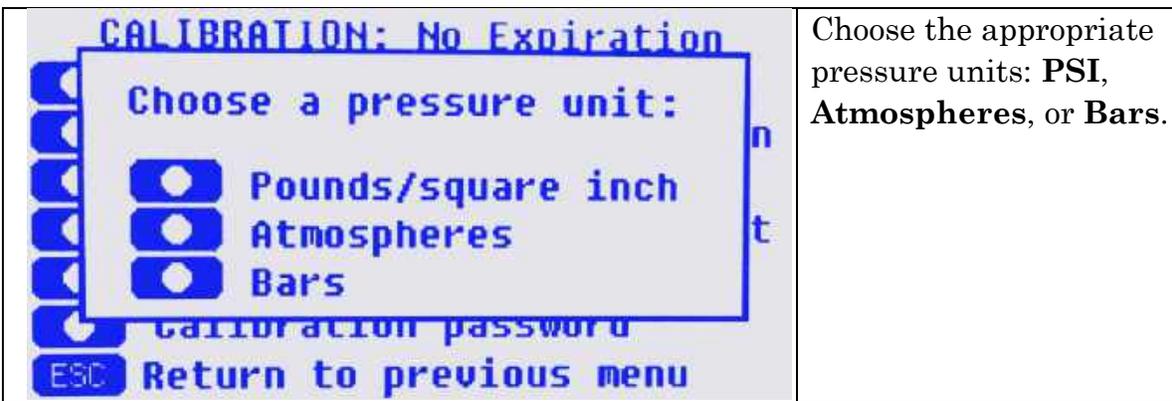
Figure 13 – Pressure units popup menu.

Choose the appropriate pressure units: **PSI**, **Atmospheres**, or **Bars**.
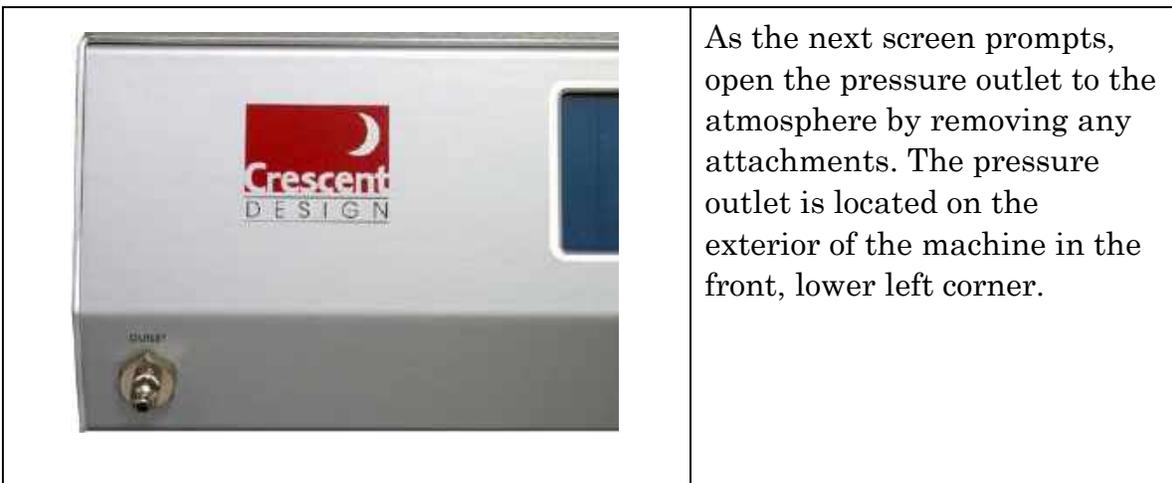
Figure 14 – HBLT outlet port.

As the next screen prompts, open the pressure outlet to the atmosphere by removing any attachments. The pressure outlet is located on the exterior of the machine in the front, lower left corner.

PRESSURE SENSOR CALIBRATION Open the outlet to the atmosphere, then press OK. OK ESC	Press "**OK"** to continue. To abandon calibration without making any changes, press "**ESC**".

Figure 15 – Setting atmospheric value.

PRESSURE SENSOR CALIBRATION Attach the pressure gage and press the Pressurize button. Pressurize ESC	Attach the pressure gage. Then press the Pressurize button and wait as the HBLT generates its own pressure to reach the maximum pressure.

Figure 16 – Pressurizing the HBLT.

PRESSURE SENSOR CALIBRATION Adjust pressure at 800 PSI, then press Pressurize button. 800 PSI Pressurize ESC	Use the UP and DOWN arrows to adjust the pressure setting. Use the large arrows for coarse adjustments and the small arrows for fine adjustments.

Figure 17 – Adjusting pressure at 80% of max pressure.

| | Use the UP and DOWN arrows to adjust the pressure setting. Use the large arrows for coarse adjustments and the small arrows for fine adjustments. |

PRESSURE SENSOR CALIBRATION
Adjust pressure at 1000 PSI,
then press the OK button.
1000 PSI
ESC   OK

Figure 18 – Adjusting pressure at max pressure.

• If the value on external gauge is higher than that shown on the right side of the screen, press the UP arrows to increase the HBLT value until it agrees with the calibrated gauge.

For example: If external gauge reads 1002 PSI and HBLT screen value reads 1000, push UP arrow until both values agree.

If the external gauge reads 998 PSI and the HBLT screen value reads 1000, push DOWN arrow until both values agree.

•   acceptable when the reading on the HBLT screen agrees
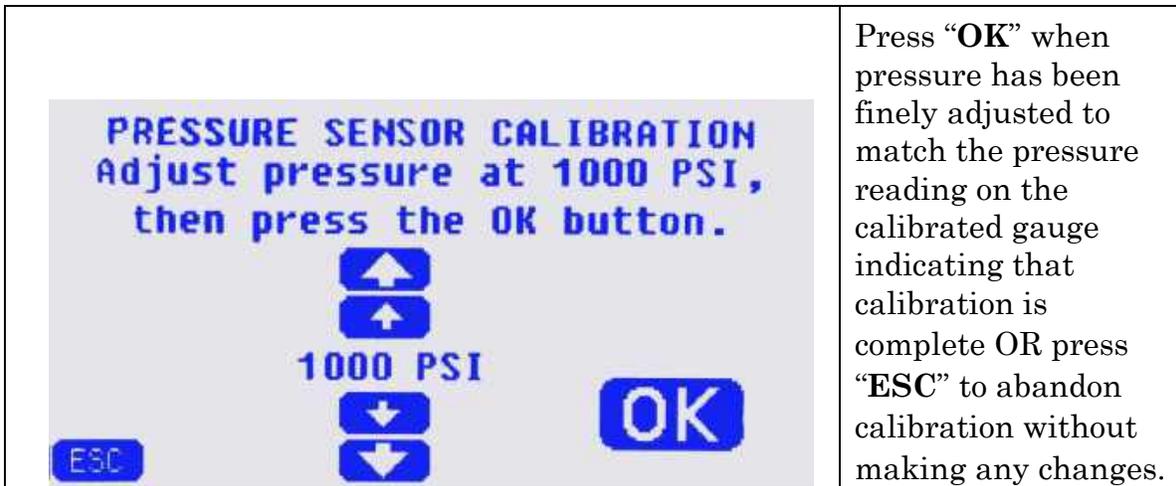   w   ited gauge within the specified accuracy limits of your
                 . See accuracy limits under "specifications". gauge
• If the actual eeds the HBLT maximum, the HBLT displays a warning
   pressure (directs the operator to release the pressure. To release the
                  crack the gauge at the luer fitting ll. The HBLT then sets
                 scale to
   to allow the p s and returns to the beginning of calibration screen.
                   f sure error occurs, either the transducer is damaged or the
• If an overpre essing the down arrows instead of the up arrows to match
   HBLT   ssure and the gauge pressure.

	Press "**OK**" when pressure has been finely adjusted to match the pressure reading on the calibrated gauge indicating that calibration is complete OR press "**ESC**" to abandon calibration without making any changes.
PRESSURE SENSOR CALIBRATION Adjust pressure at 1000 PSI, then press the OK button. 1000 PSI ESC OK	

Figure 19 – Completing the calibration.

NOTE: After pushing arrows, it is normal for both values to change on the external gauge and the HBLT screen. Allow values to settle before making additional adjustments.

When calibration completes, the HBLT saves the new zero and span values in memory. The HBLT uses these critical values to correct the output from the pressure transducer to the corrected pressure. These values remain in force until the next calibration.

If using Pressure Manager, LabGenie, or remote operation, follow the instructions in the Volume Correction Appendix to perform the volume correction procedure. This is necessary because the volume correction is dependent on the reported pressure.

Appendix L. Determining Compliance Settings

What is compliance? Compliance is the deformation or stretching of a product as the internal pressure increases.

Example:
A catheter balloon grows in diameter (complies) as the internal pressure increases.

The HBLT compliance setting is a number scale from 1 to 10 with 1 being the least compliant to 10 being the most compliant. The HBLT uses this setting as a "hint" to the pressure control system about the compliance of the attached product(s). The best compliance setting is found empirically by running tests with the product(s) attached.

Not having the correct compliance setting test causes poor HBLT performance. If the compliance setting is too low, then the HBLT takes longer to acquire the specified pressure ramp and the pressure overshoots the

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target pressure. If the compliance setting is too high, the HBLT has unstable up and/or down ramps.

The compliance setting actually represents the compliance of the entire test setup. This includes the HBLT, the fixture used to attach the product(s), the Smart Manifold (if used), and the product(s) themselves. The following conditions affect the compliance characteristic of the HBLT system:

1. A poorly purged HBLT makes the HBLT appear more compliant at lower pressures.

2. A Smart Manifold makes the HBLT more compliant because of the additional trapped air in the manifold and the compliance of the manifold itself.

3. Any fixture that traps air or is itself made of a compliant material can increase the system compliance. This is especially true when using a custom manifold or the Smart Manifold because each port adds to the total system compliance when used in a parallel fashion.

4. The product itself is compliant. For instance, a small cardiac balloon is less compliant than large periphery balloons. Generally, a larger version of the same product, such as a catheter balloon, made of the same material will have more compliance than the smaller product.

5. Adding products using a custom manifold or the Smart Manifold can increase the compliance significantly when done in a parallel fashion.

Follow these steps to find the compliance value for a single product:

1. Create a simple ramp test with a target pressure of 80% of the expected burst pressure. Use the up ramp rate that you expect to use for your production test. Use the fill setting to insure that the product fills before the up ramp. Make a first guess of the compliance setting starting with a value of two or three.

2. Attach the purged product to the HBLT using the production fixture.

3. Run the test and observe any target pressure overshoot or an unstable pressure ramp.

4. If there is an overshoot, increase the compliance setting value by one and do step three again.

5. If there is no overshoot, decrease the compliance setting value by one and do step three again.

6. If there is an unstable up or down ramp, lower the compliance setting value by one and do step three again.

7. Choose the lowest compliance setting value that produces minimal overshoot and stable up and down pressure ramps.

When using the Smart Manifold in parallel test mode, there is an additional Manifold Compliance setting. Since the number of products under test affects the total system compliance, the HBLT must adjust the compliance value internally as products fail and are removed from the test circuit. In order to do this, the HBLT needs to know the compliance for a single product and for the maximum number of products tested at a time.

Follow these steps to find the Manifold Compliance and Manifold Count settings:

1. Find the compliance for a single product using the method described above. Make sure that the Smart Manifold mode is set to parallel. Use the single port compliance found above for the following tests.

2. Attach a purged product to each of the Smart Manifold ports and select all the ports.

3. To find the maximum number of products that the HBLT can test at a time, do the following steps:

    a. Run the 80% ramp test used above and observe the pressure ramp and the motor speed.

    b. If the HBLT runs out of water, remove one product and repeat step "a".

    c. If the HBLT cannot maintain the pressure ramp because the motor is running at the maximum speed, remove one product and repeat step "a".

    d. If the HBLT maintains the correct pressure ramp without running the motor at the maximum speed and does not run out of water, then the remaining products are the maximum number of concurrently tested products. Use this value for the Manifold Count setting.

4. Attach the Manifold Count number of products to the Smart Manifold and select their correspond ports.

5. Run the test and observe any target pressure overshoot or an unstable pressure ramp.

6. If there is an overshoot, increase the Manifold Compliance setting value by one and do step five again.

7. If there is no overshoot, decrease the Manifold Compliance setting value by one and do step five again.

8. If there is an unstable up or down ramp, lower the Manifold Compliance setting value by one and do step five again.

9. Choose the lowest compliance setting value that produces minimal overshoot and stable up and down ramps for the Manifold Compliance setting.

Do not assume that similar products will have the same compliance settings. This is especially true when using the Smart Manifold in parallel mode because each port adds to the overall system compliance. When introducing a new product to testing with a previous test, confirm that the compliance settings are correct by testing the product and observing the overshoot and the ramp stability.

If possible, use the Pressure Manager application to display the strip chart of the test pressure. Overshoots and instability are shown clearly on the strip chart. If Pressure Manager is not available onsite, request a trial copy. Pressure Manager is able to run tests but not save the data in the trial mode. You can observe the pressure on the strip chart to determine overshoot and ramp stability.

The best method of attaching a product to the HBLT or Smart Manifold is using a fitting that connects directly to the product. Luer fittings are common to many products. This eliminates any fixture from adding to the system compliance. If you must use a special fixture, follow these guidelines:

1. Use rigid stainless steel tubing whenever possible. Avoid using plastic tubing. If plastic is essential for movement, use the shortest and least compliant tubing possible.

2. Design fixtures with the least number of joints and valves. Joints and valves provide places that can trap air, which increases the compliance of the system.

3. Use smaller tubing sizes that allow for the expected flow of water. But, do not use tubing so small that it impedes the flow of the water.

4. Keep the fixture path as short as possible. Longer lengths make purging more difficult which increases system compliance. In addition, longer plastic tubing lengths are more compliant than shorter plastic tubing lengths.

5. All of the above considerations are even more critical when using a custom manifold or the Smart Manifold in a parallel

fashion. The total system compliance increases with each port added to the system.

Appendix M – Vacuum Purge Adapter (VPA)

Introduction

The Vacuum Purge Adapter (VPA) is an accessory used with the HBLT and Smart Manifold to automatically purge catheter balloons prior to testing and to evacuate the water from the balloons after testing.

Installation

Follow these instructions to install the VPA:

1. Place the Smart Manifold on the workstation surface.

2. Use two persons to lift and place the VPA on top of the Smart Manifold taking care to align the feet of the VPA into the foot receptacles on the top of the Smart Manifold.

3. Use two persons to lift and place the HBLT on top of the VPA taking care to align the feet of the HBLT into the foot receptacles on the top of the VPA.

4. Attach the longer stainless steel tubing piece from the HBLT outlet to the Smart Manifold inlet. Insure that the labels on the tubing match their location on the equipment to insure correct vertical alignment. Use two wrenches when tightening or loosening these connections to prevent damage to the equipment due to the bulkhead nut turning. Hold the bulkhead nut in place with one wrench while tightening the other nut with the other wrench.

5. Attach the ten shorter stainless steel tubing pieces to the corresponding Smart Manifold and VPA ports. Use two wrenches when tightening or loosening these connections to prevent damage to the equipment due to the bulkhead nuts turning. Hold the bulkhead nut in place with one wrench while tightening the other nut with the other wrench.

6. Place the aspirator vessel in its holder on the left side of the VPA

7. Plug the aspirator vacuum line connector into the port located on the rear panel upper right corner.

8. Plug the shop air into the push to connect fitting on the rear of the VPA. Insure that the shop air is a minimum of 80 PSI.

9. Set the HBLT power conditioner plug to 120 VAC or 240 VAC depending on the local power source.

10. Plug in the power to the HBLT using the power cord. 11. Plug in the power to the VPA using its power supply.

12. Plug in the power to the Smart Manifold using its power supply.

13. Set the VAC TIMER 1 setting using the numeric buttons that correspond to the numeric position on the timer face. Continue pressing each button until its corresponding position reads its correct value. The settings are seconds and tenth seconds.

14. Set the VAC TIMER 2 setting using the numeric buttons that correspond to the numeric position on the timer face. Continue pressing each button until its corresponding position reads its correct value. The settings are seconds and tenth seconds.

15. Fill the water reservoir with water.

16. Place the water reservoir on the table to the right of the HBLT and plug the tubing into the HBLT inlet port.

Indicators and Controls

Indicators

The VPA uses the following indicators to show the machine state.

Not Ready

The orange Not Ready lamp located on the VPA front panel lower left corner indicates that the VPA is not ready to operate when lighted. Wait until this lamp is off before pressing either vacuum cycle buttons. The lamp turns off after brings the pressure down to the minimum vacuum setting for operation.

VACUUM

The VACUUM gauge located on the VPA front panel left side shows the current vacuum reading.

VACUUM CYCLE 1

The white VACUUM CYCLE 1 button lamp indicates when the vacuum cycle 1 is running.

VACUUM CYCLE 2

The blue VACUUM CYCLE 2 button lamp indicates when the vacuum cycle 2 is running.

Port Clamping Lamps

The green port clamping lamps indicate that the VPA port is clamping the part. This does not mean that the part is sealed. It only indicates that the port is activated.

VAC TIME 1

Located on the rear panel, the VAC TIME 1 timer indicates the vacuum 1 timeout and current time when running.

VAC TIME 2

Located on the rear panel, the VAC TIME 2 timer indicates the vacuum 2 timeout and current time when running.

Controls

The operator uses these controls to run the VPA:

Port Clamping Buttons

Press the green port clamping buttons to clamp the parts onto the VPA ports. Slide the luer tip down onto the clamp and press the button which lights when clamping. To release the part, push the button again and lift the part out of the clamp.

VACUUM CYCLE 1

Press this button to purge the balloons with the time entered into the VAC TIME 1 timer on the rear panel.

VACUUM CYCLE 2

Press this button to purge the balloons with the time entered into the VAC TIME 2 timer on the rear panel.

VAC TIME 1

Use this control to enter the duration time for the vacuum cycle 1 control on the front panel.

VAC TIME 2

Use this control to enter the duration time for the vacuum cycle 2 control on the front panel.

VACUUM

Maintenance personnel use this control to set the vacuum settings.

Operation

Follow these instructions to operate the VPA:

1. Check the HBLT reservoir water level to insure that there is enough water to purge all of the ports.

2. Check the aspirator water level. If necessary follow these steps to empty the aspirator:

   a. Unplug the vacuum lines from the rear of the VPA.

   b. Remove the aspirator from its holder.

   c. Remove the aspirator lid.

     d. Empty the water from the aspirator.

     e. Replace the aspirator lid.

     f. Replace the aspirator into its holder.

     g. Plug the vacuum lines into the connector on the VPA rear panel.

3. Check that the orange Not Ready lamp is off.

4. One at a time, slide each part's luer tip into a clamp and press the green button to clamp the part. There may be one to ten parts mounted at a time.

5. Press the Vacuum Cycle 1 button and wait until the cycle ends and the white lamp turns off. This may be done multiple times if the parts have not fully purged with a single cycle.

6. Start the HBLT test and wait until it ends.

7. Press the Vacuum Cycle 2 button and wait until the cycle ends and the blue lamp turns off. This may be done multiple times if the parts have not fully purged with a single cycle.

8. One at a time, press the green buttons to release a part and lift it out of the clamp.

Trouble Shooting

Use this table to trouble shoot the VPA.

Problem	Cause	Action
The Not Ready lamp remains lighted even though the vacuum has reached operating pressure.	There is not enough shop air pressure to active the startup air switch.	Insure that there is at least 80 PSI of shop air available.
Pressing the white Vacuum Cycle 1 button does not activate the cycle when the Not Ready lamp is off.	The VAC TIMER 1 is set to 0 seconds.	Set VAC TIMER 1 to at least 1 second.
Pressing the blue Vacuum Cycle 2 button does not activate the cycle when the Not Ready lamp is off.	The VAC TIMER 2 is set to 0 seconds.	Set VAC TIMER 2 to at least 1 second.
The VACUUM display is not on.	Check the VPA power.	Plug in the VPA power.

The purge cycles run, but no water arrives in the aspirator container.	The aspirator vacuum lines are not plugged into the receptacle on the rear of the VPA.	Plug the aspirator vacuum lines into the receptacle on the rear of the VPA.
Pressing a green button fails to clamp the part.	There is not enough shop air pressure to active the clamp.	Insure that there is at least 80 PSI of shop air available.
The vacuum pump runs continuously.	The lid on the aspirator is not fully seated.	Tighten the aspirator lid until it seals.

Appendix N. Troubleshooting Guide

This appendix covers basic issues that may arise with the HBLT and provides a guide on how to troubleshoot and resolve those issues.

Problem	Possible Problem	Possible Solution
BURPING The HBLT is experiencing excessive burping (clicking) when trying to run a test.	The 0 pressure point of the HBLT has drifted. If the HBLT is burping (clicking) excessively it is most likely sitting over +/-2PSI when open to atmosphere. Note: *Some burping is common and expected especially if you have a high purge rate set on the HBLT. On average 2 to 4 clicks is fine.*	Since the HBLT has drifted off its zero point you will need to calibrate the HBLT. Please review the Owner's Manual and see our website at www.Crescentdesign.com and go to the "How To" videos section for a demo video on calibrating the HBLT.
PRESSURE OVERSHOOT HBLT overshooting the programmed pressure target.	This can be caused by one or more of these issues: Air in the system (most common) Incorrect compliance setting Up Ramp Rate setting too high	Make sure to purge the HBLT under vacuum every morning or before the start of each shift. Run a total of 3 purge cycles under vacuum. Note: *Always make sure that your parts are prepped and purged of air for best test results.* Lower the compliance setting Lower the Ramp Rate

Problem	Possible Problem	Possible Solution
MOTOR STALLED ERROR When purging the HBLT under vacuum and the "Motor Stalled" error message is displayed.	If the HBLT purges into an open container with nothing attached to the outlet, but the motor stalls when purging under vacuum the HBLT needs to be calibrated. If this error is displayed while running a test please contact Crescent Design.	Calibrate the HBLT. Please review the Owners Manual and go to www.Crescentdesign.com and navigate to "How To" videos section for a demo video on calibrating the HBLT.

Problem	Possible Problem	Possible Solution
MOTOR OVERHEATING ERROR When running a test and the "Motor Overheating" error is displayed.	It is possible to get the actuator motor hot during tests that maintain high pressures for long periods of time or during fatigue tests with a large number of cycles. The motor needs to be turned off to cool down. If this error is displayed while the HBLT is idle please contact Crescent Design.	Turn off the HBLT. Use a rag or towel to put over the luer connection at the outlet and disconnect it to relieve the pressure. Let the HBLT sit while turned off for 30 minutes to let the motor cool.
PRESSURE LIMIT EXCEEDED ERROR When running a test and the "Pressure Limit Exceeded" message is displayed.	The hydraulic pressure exceeded the operational limits of the HBLT. The main cause of this problem is mis-calibration. Target pressure is close to the HBLT limit.	Calibrate the HBLT and run the test again. If the issue persists please contact Crescent Design. Lower the ramp rate.

THE CYLINDER IS OUT OF WATER CHECK FOR LEAKS When running a test the "Cylinder is out of water check for leaks" is displayed.	This message is displayed when the actuator reaches the exhaust limit switch while running a test. This can occur if the product leaks, is very compliant, or is compliant and large. The cylinder does not have enough volume to reach the target pressure and maintain it. Internal HBLT leakage.	If <u>not</u> using a FILL: Check the product for leaks. Pre-fill the product before running the test. Try constraining the product to limit its compliance. Lean HBLT on side and see if any water comes out of enclosure.
A FILL (or PURGE) TIMEOUT HAS OCCURED. PLEASE CALL FOR SERVICE. During the fill sequence the "Fill Timeout" message is displayed.	The HBLT displays this alert message when the fill operation times out without encountering a limit switch. The timeout value varies depending on the cylinder volume. Wrong power module inlet power selection.	Install power module voltage selector for 110-120V.

Problem	Possible Problem	Possible Solution

Problem	Possible Problem	Possible Solution
FALSE BURST REPORTED When running a test and the HBLT declares a burst but the product is intact with no failure or leak.	Tubing loose in Tuohy-Borst which allows the tubing to slip in the fitting causing a sudden drop in pressure. CAUTION: Over tightening the Touhy-Borst fitting can collapse the tubing restricting fluid flow and pressurization of the product under test. An internal HBLT leak.	Change the compression fitting rubber O-ring often. A damaged O-ring will cause connection issues. Use a quality connector such as the Plasti-Mate TuohyBorst made by S4J manufacturing PN# A7530. Mark the balloon stem with a black sharpie right at the connection so you can see if it slips. It may be necessary to use a hypo tube inside the I.D. of the product tube to allow sufficient compression of the fitting without collapsing the fluid path. This will also ensure repeatable product-to-product test results. To check the HBLT for leaks, install a metal cap or ball valve directly to the outlet and run a simple ramp test to the maximum pressure of the HBLT and let it dwell for 60 seconds. If it leaks down more than 10% in 60 seconds please contact Crescent Design.
FALSE BURST AT START OF DOWN RAMP	The **up burst** or **down bu**rst setting is too close to the **down ramp rate** setting.	Increase the down burst rate or decrease the down ramp rate. Ensure that the compliance settings are correct (not too high).
FALSE BURST AT THE BEGINNING OF A TEST	The initial (starting) pressure is negative (below zero) causing the HBLT to detect a downward pressure decay.	Check HBLT calibration and adjust if necessary. Ensure that zero is adjusted close to zero.

Problem	Possible Problem	Possible Solution

| EXHAUST LIMIT ERROR | If this error is displayed it could be one of the following issues:

An HBLT or product leak prevents reaching the target pressure. This allows the HBLT to activate the exhaust limit switch. | To check the HBLT for leaks, install a metal cap or ball valve directly to the outlet and run a simple ramp test to the maximum pressure of the HBLT and let it dwell for 60 seconds. If it leaks down more than 10% in 60 seconds please contact Crescent Design. Inspect the product for pinhole leaks. |
| | The product is too compliant or large for the HBLT to reach the set pressure. | Check maximum volume output of your model HBLT and verify how much volume is needed to test each different product. |

Appendix O. Using the Scan Mode Option

Introduction

The Scan Mode option allows the execution of a single test scanned into the HBLT using a QR code scanner interfaced to the HBLT using the Crescent Design E3-10532 scanner interface. This system, in conjunction with the Test Scan PC software, allows an engineer to do the following:

1. Use the HBLT to create an onboard test.
2. Export the test to the TestScan program.
3. Use the Test Scan program to create the QR code image for inclusion on testing documentation.
4. Use the QR code scanner to read the QR code test.
5. Execute the test and only that test on the product.
6. The operator may execute that test many times until exiting the testing mode. To continue testing after exiting the test mode, rescan the QR coded test.

This option disables the Enable remote control option and sets the serial port baud rate to 9600 baud. The baud rate is fixed at 9600 baud while this option is enabled.

When using this option, the Select Remote Output option is not available.

Hardware Setup

The scan mode hardware consists of a Symbol Technologies DS9208 QR scanner and a Crescent Design E3-10532 scanner interface along with provided cables. Follow these instructions to install this hardware:

1. Plug the E3-10532 9 pin DB9S pigtail cable into the HBLT DB9P connector on the HBLT rear panel and secure with the thumb screws.

2. Plug the cable provided with the Symbol QR scanner into the scanner base. Only one connector fits.

3. Plug the other end of the scanner cable into the E3-10532 connector labeled SCANNER.

4. Plug the small power cable provided with the E3-10532 interface into the scanner cable and then into the port labeled 5V. This provides power to the QR scanner.

5. On the end of the E3-10532 interface label Data Out, plug the QR scanner power supply into the port labeled 5V followed by plugging the power supply into the wall outlet.

6. If sending test settings to the Test Scan program or using the Output Test Result Messages option, plug a DB9 cable into the port labeled Data Out.

Software Configuration

Using the Engineering menu / System configuration screens, press the page button to find the Scan Mode option. Press the option button and answer YES to using the option. This automatically sets the serial port baud rate to 9600 and disables remote operation.

Enabling the Remote Mode option to use Pressure Manager or LabGenie disables the Scan Mode option.

Creating a Scan Mode test.

There is only a single test in Scan Mode. If there were other tests defined before selecting Scan Mode, they are still in memory but they are not available to run or edit. The single scan mode test is displayed to the Engineer as the only test available and is saved in the 40th test position. The engineer can create, edit, or delete a test followed by running the test from the edit test screen for development purposes. The operator cannot run a test except by scanning a QR coded test image.

Creating a QR Code Image

Follow these instructions to create a QR code image used to enter a test into the HBLT:

1. Install the TestScan program onto a PC. See the TestScan documentation.
2. Connect the PC to the E3-10532 interface using the Data Out port. Use a USB-toserial adapters if needed.
3. Start the Test Scan program.
4. On the HBLT, open the Test Edit Menu screen
5. On the PC, click the Start Test Acquisition button. Wait for the available COM ports to be identified and an Acquisition Status of "Ready – Export Test" to be displayed.
6. On the HBLT, press the Export TestScan button then select the test to be exported
7. On the PC, ensure that the Acquisition Status is a green SUCCESSFUL image.
8. Review the test material for correctness. Special Note: the HBLT does not show decimal points in parameters. They are implied by the HBLT. So, on an HBLT 100, a target pressure of 1000 is actually 100.0.
9. To save the QR image, click the Save TestScan Code to File button.
10. Import the file created into documents to be used to specify the associated test.
11. Close the TestScan program.
12. Remove the serial cable.
13. If using Output Test Result Messages, replace that serial cable.

Running a Test

Follow these steps to run an HBLT test using Scan Mode:

1. Acquire the materials to test including the document that has the QR code.
2. Attach product(s) to the HBLT or Smart Manifold.
3. From the Main Menu screen, press the Run a test button.
4. When the operator screen appears, either scan a code (QR or bar code) to fill in the operator name or use the HBLT keypad to enter the operator name.
5. Press the OK button.
6. When the lot code screen appears, either scan a code (QR or bar code) to fill in the lot code or use the HBLT keypad to enter the lot code.
7. Press the OK button.
8. When the SCAN TEST screen appears, scan the test QR code on the test document.
9. Review the test information for correctness.
10. Ensure that the check code on the document matches the check code displayed on the HBLT screen. If the check codes do not match, rescan the QR code using the BACK button. It the check codes match, press the OK button.
11. Run the test as usual.
12. Remove the tested product.
13. If the there are more products to test, attach another product and press the OK button. Repeat until finished testing all of the product.
14. Press the ESC button to exit the testing mode.

Appendix P. Using the Output Test Result Messages Option.

Introduction

The Output Test Result Messages option allows the transmission of the test results via RS-232 to a remote data collection computer. This option is mutually exclusive with Remote Mode as both options require the use of the HBLT serial port. So, this option does not work with Pressure Manager or LabGenie programs.

This option disables the Enable remote control option and sets the serial port baud rate to 9600 baud. The baud rate is fixed at 9600 baud while this option is enabled.

The Output Test Result Messages option can be selected with the Scan Mode option selected.

When using this option, the Select Remote Output option is not available.

Hardware Setup

There are two ways to connect the RS-232 cable to the HBLT. The first is to just connect the cable to the HBLT RS-232 port. The second is when using the E3-10532 scanner interface. See Appendix O for instructions on installing the interface. Then plug the serial cable to the data collection computer into the port labeled Data Out.

Software Configuration

Using the Engineering menu / System configuration screens, press the page button to find the Output Test Result Messages option. Press the option button and answer YES to using the option. This automatically sets the serial port baud rate to 9600 and disables remote operation.

Enabling the Remote Mode option to use Pressure Manager or LabGenie disables the Output Test Result Messages option.

If using the E3-10532 scanner interface, see Appendix O for configuration information.

Running a Test

With this mode enabled, the HBLT sends test results to the remote data collector at the completion of each test.

Format of the Result Message

The results message will be a comma-delimited message with several fields. The last field will be followed by a carriage return instead of a comma. The fields will be:

> Lot code,
>
> Operator,
>
> Test name (recipe),
>
> Asset ID,
>
> Date & Time test ended, (see below)
>
> Port Number (0 if no Smart Manifold),
>
> Test end status, (see below)
>
> Test end value 1,
>
> Test end value 2 <CR><LF>

Date and time will be encoded as YY:MM:DATE:HH:MM. For example, a test ending on May 21, 2020, at 3:17 in the afternoon would encode as:

> 20:05:21:15:17

Test End Status will contain a number that indicates how the test ended. In addition, it will specify the information contained in "Test end value 1" and "Test end value 2".

Value	Meaning	End Val 1	End Val 2
0	No Failure	Highest Pressure	0
1	Up Burst	Press at Burst	Cycle at burst
2	Maintain Burst	Press at Burst	Cycle at burst
3	Dwell Burst	Press at Burst	Cycle at burst
4	Down Burst	Press at Burst	Cycle at burst
5	Rate Leak	Press at leak	Cycle at leak
6	Dip Leak	Press at leak	Cycle at leak
7	Manual Abort	Highest Pressure	Cycle at abort
101	Motor Stall	0	0
102	Motor Overtemp	0	0
103	Pressure Fault	0	0
104	Limit Switch	0	0

105	Timeout Fault	0	0
106	Drive Overtemp	0	0
107	Safety Door	0	0
108	Other HBLT Fail	0	0