

BBR3

Bending Beam Rheometer 3



This manual contains important operating and safety information. Carefully read and understand the contents of this manual prior to the operation of this equipment.

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For assistance with set-up or operation, contact the ATS service department. Please have this manual and product serial number available when you call.

Telephone: +1-724-283-1212.

Manual Contents

A. Introduction	1
A.1 Unpacking	1
A.2 Standard Users and Passwords.....	1
A.3 Warranty Information	1
A.4 After Sale Support.....	1
B. Safety	3
B.1 For Owners, Operators, and Maintenance	3
B.2 Cautions & Warnings.....	3
C. System Overview	6
C.1 Equipment Parts	6
Front of Unit.....	6
Back of Unit	7
Load Frame.....	8
Tank Interior	9
Gage Kit	10
C.2 General Product Description.....	11
Major Components	11
Accessory Items	11
Product Specifications.....	12
Environmental Conditions.....	13
Load Frame.....	13
Specimen Support.....	14
Air Bearing.....	15
Linear Variable Differential Transformer (LVDT)	15
Load Cell	15
Resistance Temperature Detector (RTD)	15
Computer Control System Software.....	15
Mechanical Refrigeration Unit (Chiller)	16
Accessories	16
Specimen Molds	16
Confidence Beam.....	16

Non-Compliant Beams.....	17
Step Disk	17
Load Cell Calibration Weights	17
Controls.....	18
Internal Controls	18
Data Instruments	19
Basic Unit Controls	20

D. Installation21

D.1 Recommended Tools.....	21
Installation.....	21
Operation	21
D.2 Unpacking the BBR3.....	21
D.3 Assembling the Load Nose.....	22
D.4 Connecting Equipment.....	25

E. Operation28

E.1 Filling the Bath.....	28
E.2 Power Up the BBR3	28
E.3 Overview of Touchscreen and Menu	29
E.4 Editing Users and Permissions	29
E.5 Standardization Process	32
E.6 Verification Process.....	36
E.7 Test Setup.....	40
Test Name	41
Test Date	41
Saving Test Parameters.....	41
Copying a Test.....	41
Creating a New Test	42
Deleting a Test	42
Adding Report Images	42
Adding a Test Company	43
Standard or Data Report	43
Deflection Plot and Load Plot	43
Bath Values.....	44
Specimen Values.....	44

Test Times	44
E.8 Run Test	44
Load Setup	45
Start Test.....	46
Run Crack Sealant Test	47
View Test	48
E.9 Diagnostics.....	49
Analog Inputs AI1, AI2, and AI3	49
Analog Outputs AO1 and AO2	49
Digital Inputs 1, 2, 3, and 4	50
Digital Outputs 1 and 2	50
Digital Outputs 3 and 4	50
Cool PID Values	50
F. Troubleshooting.....	52
F.1 Preface.....	52
F.2 Load Shaft Stuck or Stalled During Verification or Standardization	52
G. Maintenance	55
G.1 Cleaning the BBR3	55
G.2 Changing the BBR3 Fluid Bath	55
APPENDIX A: Warranty	56
APPENDIX B: Wiring Diagram.....	57
APPENDIX C: Image Glossary.....	59

A. Introduction

A.1 Unpacking

Retain all cartons and packing materials until the unit is operated and found to be in good condition. If damage has occurred during shipping, notify Applied Test Systems (ATS) and the carrier immediately. If it is necessary to file a damage claim, retain the packing materials for inspection by the carrier.

A.2 Standard Users and Passwords

Every BBR3 is programmed with three standard user settings. Each setting has a corresponding password and set of user restrictions. Please refer to the table below to login and operate your new equipment.

User Name	Password	Permissions
Administrator	admin	Basic Standardization Diagnostics User Edit
Operator	oper	Basic Standardization
Default		Basic

A.3 Warranty Information

All new ATS systems are shipped with a warranty. Units have a warranty against defective parts and workmanship for one full year from the date of shipment. Please see APPENDIX A of this manual for complete details on the warranty.

A.4 After Sale Support

If there are any questions concerning the operation of the unit or software, contact the ATS

Service Department at +1-724-283-1212.

Before calling, please obtain the software revision number and the serial number from the unit's data tag. A sample data tag is illustrated below, and can be completed with the unit's information for easy reference. Please be prepared to give a complete description of the problem to the ATS Service Department.



The image shows a rectangular data tag with a thick black border. On the left side, there is a stylized logo consisting of the letters 'A', 'T', and 'S' in a bold, italicized font. To the right of the logo is a table with four rows and two columns. The first row contains the text 'NO.' in the left column and a blank space in the right column. The second row contains 'AMP' in the left column and 'VAC' in the right column. The third row contains 'PH' in the left column and 'HZ' in the right column. The fourth row is entirely blank. Below the table is a large, empty rectangular box for additional information.

NO.	
AMP	VAC
PH	HZ

Figure A.1 - ATS Sample Data Tag

B. Safety

B.1 For Owners, Operators, and Maintenance

All ATS equipment is designed to be operated with the highest level of safety. This manual uses note, caution, and warning symbols throughout to draw your attention to important operational and safety information.

Read and understand all instructions and safety precautions listed in this manual before installing or operating your unit. If you have any questions regarding operation of the unit or instructions in this manual, contact the ATS Service Department at +1-724-283- 1212.

Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, personal injury or death.

B.2 Cautions & Warnings



Read and understand all instructions and safety precautions listed in this manual before installing or operating your unit. If you have any questions regarding operation of the unit or instructions in this manual, contact our Service Department.



Thoroughly understand the safety features and operation of the equipment. This manual will provide operators with safety concerns and general procedures. Be familiar with correct operating principals and use good judgment. Also refer to the appropriate manuals for system component safety instruction manuals.



Use caution when working with liquids at low temperatures. Protect skin by wearing protective clothing, and follow safety, operation, and maintenance procedures described in the appropriate instruction manuals.



Obey all national and local electric code requirements.



Handle the BBR3 carefully. Avoid dropping and jarring the BBR3. Damage to machine may result.



Dangerous high voltages present. Do not attempt to open the enclosure or gain access to areas where you are not instructed to do so. Refer servicing to qualified service personnel only.



Injury to the operator could occur if operational procedures are not followed. Follow all steps or procedures as instructed and refer to accompanying documents.



Flammable vapors may be emitted from bath. Operate fluid bath in a well ventilated area . Do not smoke or use an open flame near the bath. Refer to fluid manufacturer's documentation for more detailed information specific to safety precautions for the bath fluid being used.



Do not submerge hand and arm in extremely cold test bath. Do not attempt to pull the drain plug when the fluid bath level is high and temperature is extremely cold. Extremely cold fluid may cause frost bite.



Use caution when handling air hoses during operation or when performing maintenance as contents will be under pressure.



Handle load cell with care. The load cell will be damaged if the load frame is put on it's side with the load nose attached, or if the load nose is over tightened.



Handle the refrigeration hose with care. The refrigeration hose may be damaged if it is twisted or pulled, especially when the unit is cold. Do not move the refrigeration unit unless it has been turned off for at least 8 hours and has reached room temperature.



Prevent damage to the cooling unit. Never operate the cooling unit if the ambient temperature is higher than 25 degrees C.



The cooling unit should be placed in a well- ventilated area, on a stand at least six inches above the floor and not on the same surface as the BBR3.



Carefully place the calibration weights on the load cell's weight pan. If the Linear Variable Differential Transducer (LVDT) shaft is bumped, it may become inaccurate or even permanently damaged.



Avoid damage to the Confidence Beam. Do not leave a load on the confidence beam for an extended period of time. This may cause the beam to bend and could result in inaccurate readings for future tests.



Before energizing the electrical power to the bending beam rheometer, turn off all power switches and place all controls in an OFF or neutral position. Check that your power source is of the appropriate voltage and is surge-protected. Use appropriate power adapters based upon your region.



FLAMMABLE CHEMICALS may be located within enclosure. Exposure may result in severe injury. Refer to maintenance manual before servicing.

C. System Overview

C.1 Equipment Parts

Front of Unit

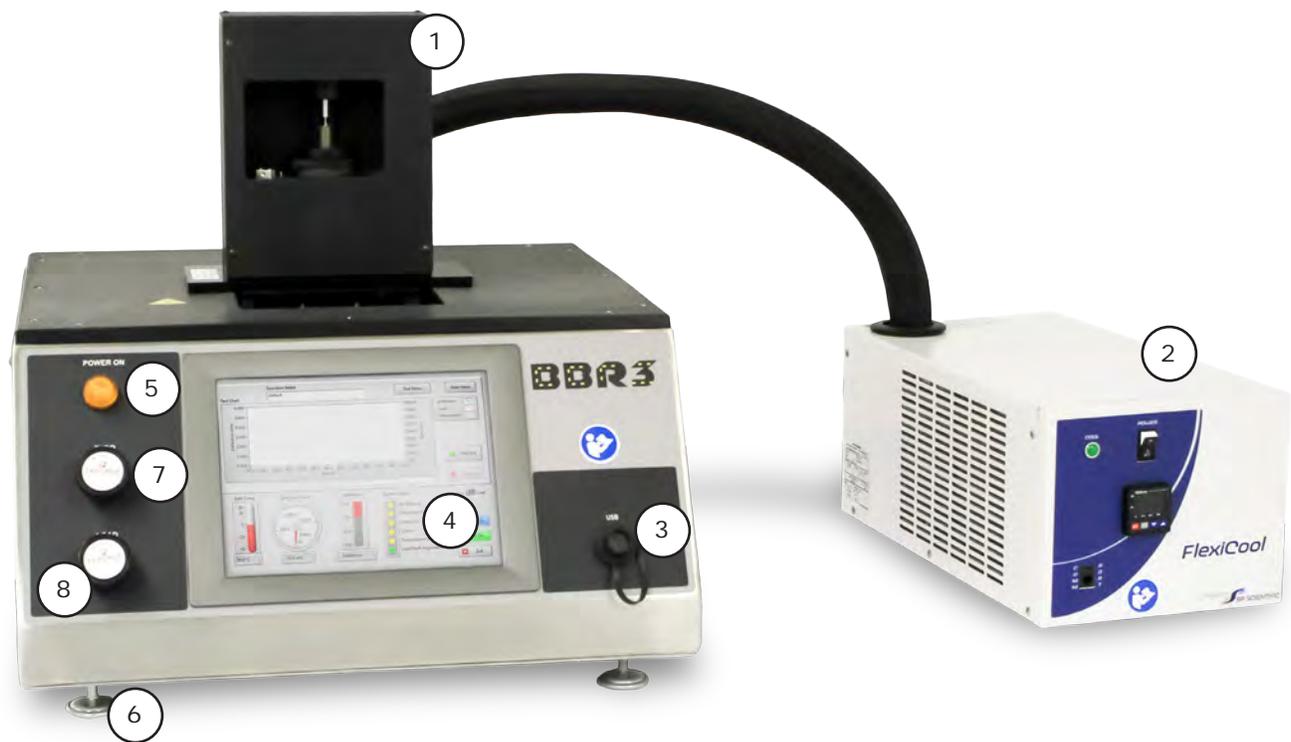


Figure C.1 - Front of BBR3 Unit

- | | |
|-------------------------|-------------------|
| 1. Load Frame | 6. Leveling Feet |
| 2. Chiller | 7. ZERO Regulator |
| 3. USB Port | 8. LOAD Regulator |
| 4. Touch Screen Monitor | |
| 5. Power Indicator | |

Back of Unit

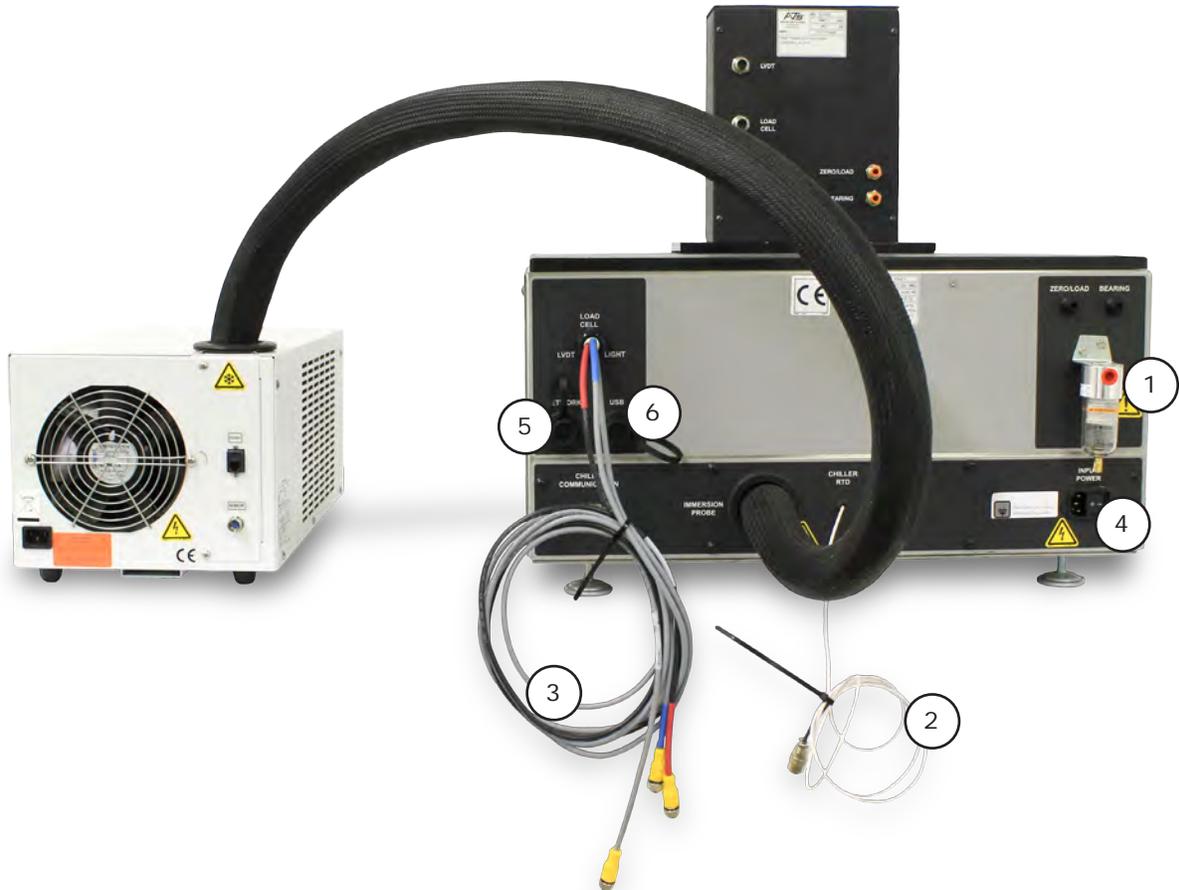


Figure C.2 - Back of BBR3 Unit

- | | |
|---------------------------|---------------------|
| 1. Air Connector | 5. Network/Ethernet |
| 2. Connects to Chiller | 6. USB Connection |
| 3. Connects to Load Frame | |
| 4. Unit Power | |

Load Frame

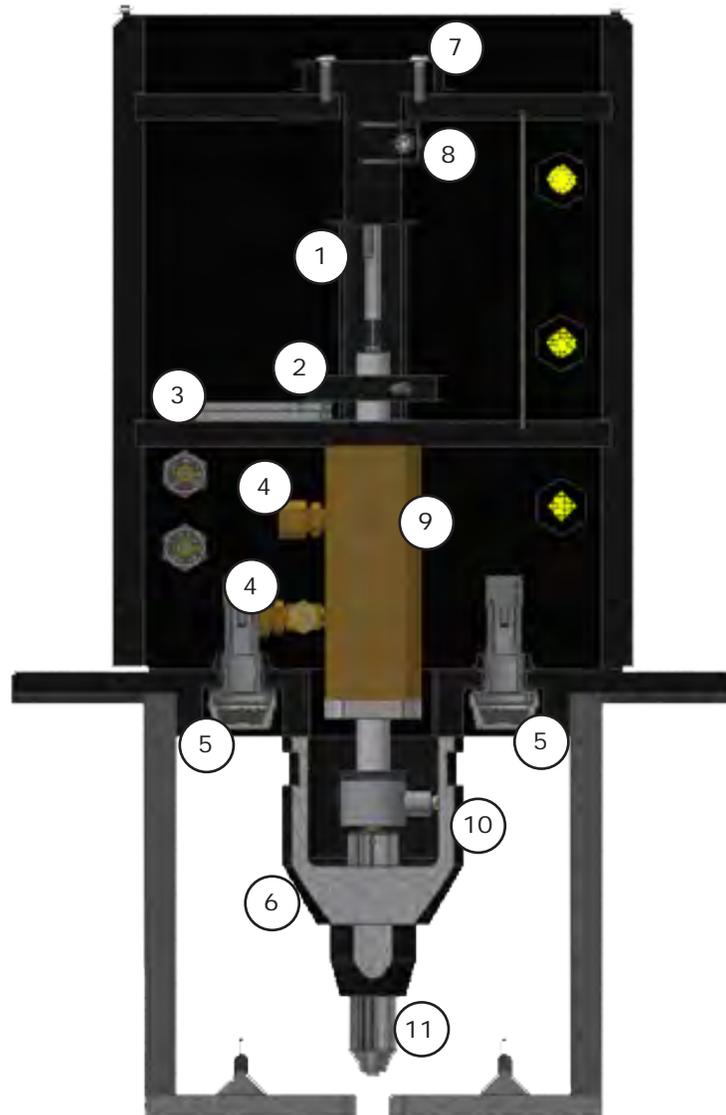


Figure C.3 - Load Frame

- | | |
|-------------------------------|-----------------|
| 1. LVDT Shaft | 7. LVDT Housing |
| 2. Weight Pan | 8. LVDT |
| 3. Gaging Disk | 9. Air Bearing |
| 4. Bearing Air Supply/Control | 10. Load Cell |
| 5. Lamps | 11. Load Nose |
| 6. Shroud | |

Tank Interior

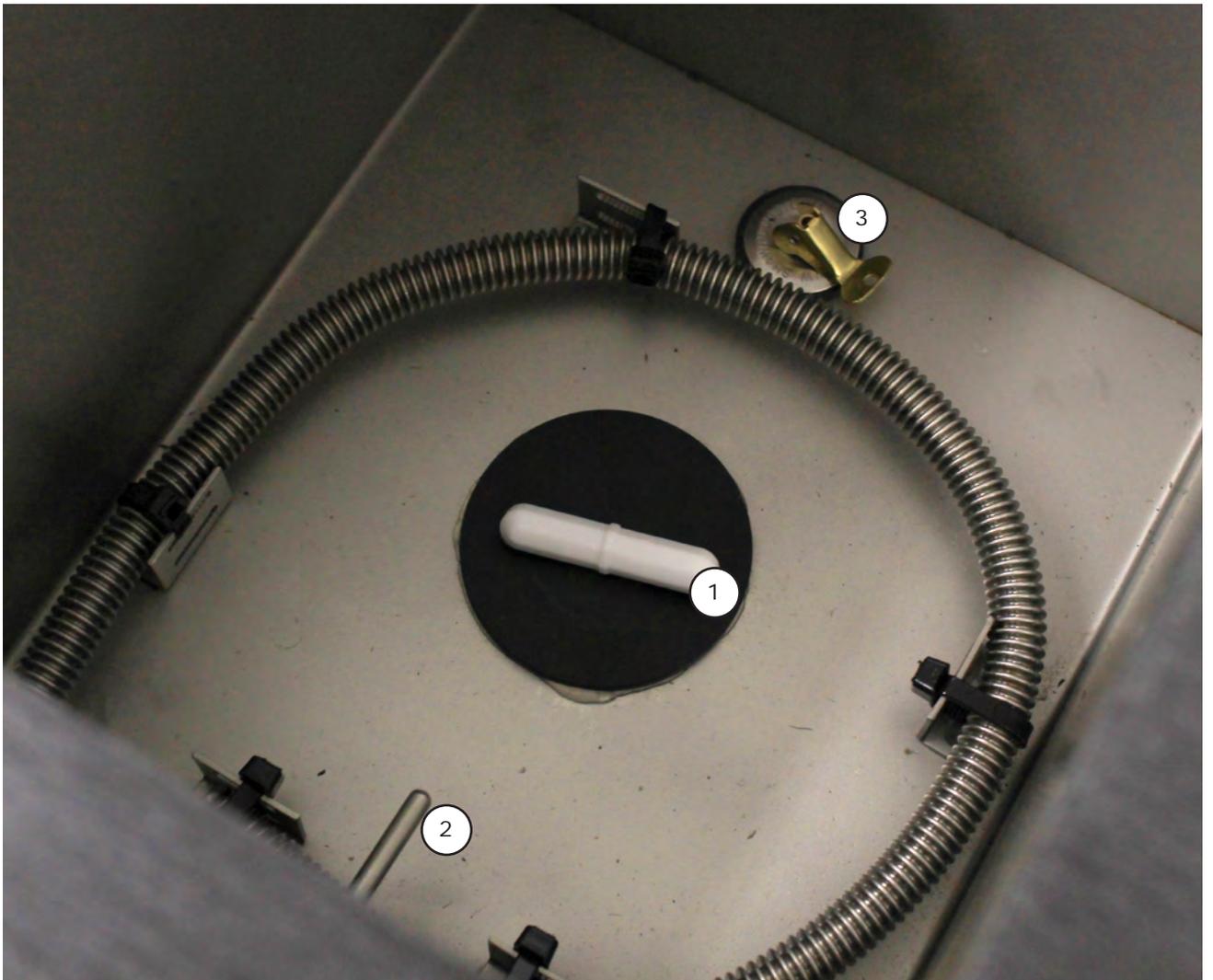


Figure C.4 - Tank Interior

1. Spinner
2. RTD

3. Drain

Gage Kit

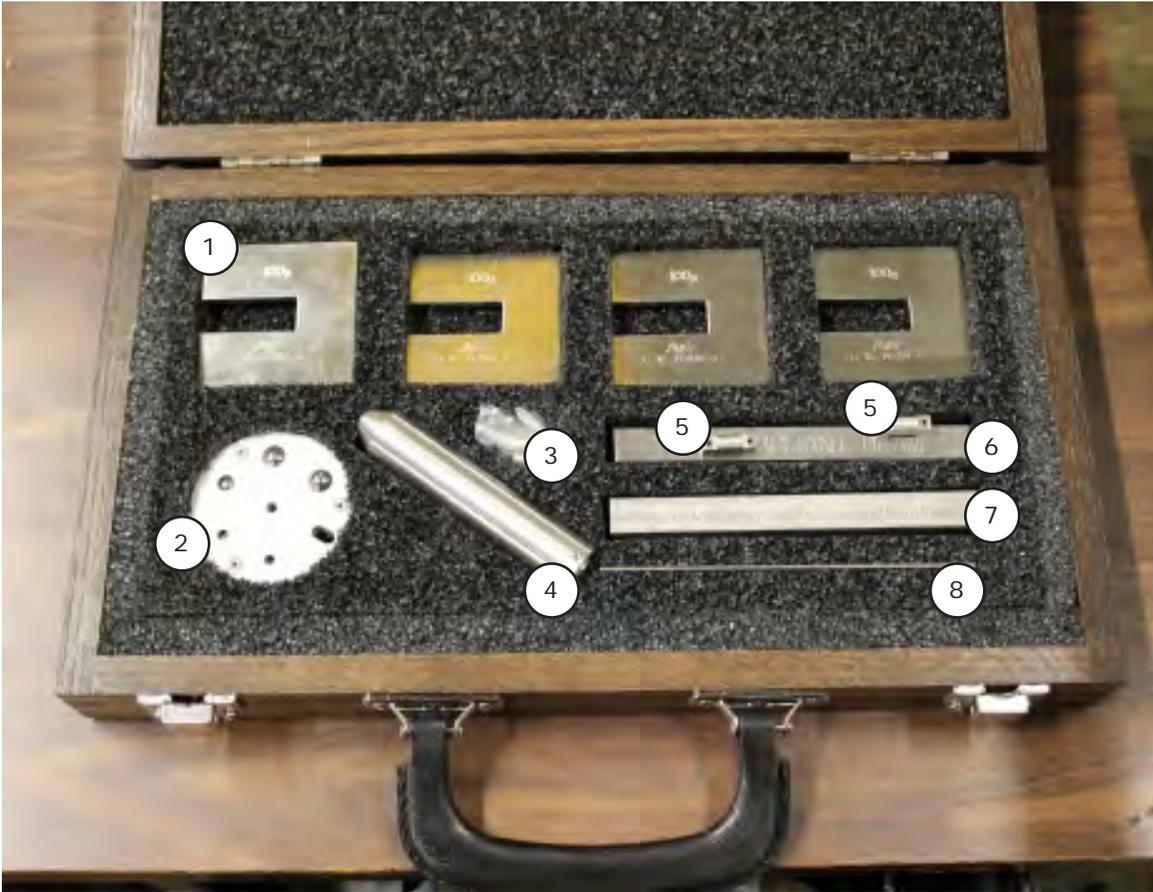


Figure C.5 - Gage Kit

- | | |
|-----------------|--|
| 1. 100g Weights | 5. Anvil Adapters |
| 2. Step Disk | 6. Non-Compliant Beam |
| 3. 2g Weights | 7. Crack Sealant (CS) Non-Compliant Beam |
| 4. Load Nose | 8. Confidence Beam |

C.2 General Product Description

ATS's Bending Beam Rheometer 3 (BBR3) is designed to provide a state-of-the-art means for testing the flexural creep stiffness properties of asphalt binders in a temperature range from -40°C to ambient. This testing is in accordance with the Strategic Highway Research Program (SHRP) Test Method B-002, AASHTO Designation T313, AASHTO TP 87, BS EN14771, and ASTM D 6648 specifications. The BBR3's design does not allow for it to perform any additional functions other than the intended functions specified in this manual.

The BBR3 is a fully integrated, modularized system consisting of the following:

Major Components

- Base unit
- Load frame assembly BBR3 software
- Mechanical refrigeration unit

Accessory Items

- Specimen Molds (5 molds)
- Confidence Beam
- Non-Compliant Beam
- Crack Sealant (CS) Non-Compliant Beam
- Step Disk
- Load Cell Calibration Weights (4) 100-gram and (2) 2-gram
- Crack Sealant Specimen Molds

The BBR3 test control function and data acquisition is operated by a Windows®-based computer inside the machine. During testing, the software controls the BBR3 load function, displays and records the load, deflection, and temperature data received from the unit. When tests are not being performed, the software permits access to test information including graphs, raw data tables, and test analysis.

Product Specifications

Load Frame Construction	Integral stainless steel, frictionless construction
Loading Shaft Point	In-line stainless steel with blunt point
Test Load	Variable test range from 0 to 4,000 mN standard. System. Maintains required test load within +/- 5mN throughout test cycle.
Test Cycle Times	Cycle times for pre-load, recovery, and test load are completely operator-adjustable.
Load Cell	500 g (temperature-compensated)
Mechanical Overload Protection	Standard
Test Weights	Calibrated and traceable to NIST
BBR3 Weight	Base = 83 lbs , Load frame = 15 lbs
Chiller Weight	50 lbs (23 Kg)
BBR3 Size/Dimensions	H=23.5" x W=24" x D=26.5"
Rating	IP20 Enclosure rating
Sample Supports	3mm (.118") radius stainless steel spaced 4.00in (101.6mm) apart
LVDT Displacement Transducer	6.35mm (0.25in) calibrated range to provide 2µm resolution throughout testing and verification range.
Data Display	Large on-screen display of load, displacement, and bath temperature provides ease of setup and operation. Real time displacement, loading, and temperature graphs are displayed during the test cycle and can be re-plotted and re-scaled as needed for easy viewing.

Chiller	Included (non-CFC refrigerant)
Tank Liquid Volume	1.5 Gallons (5.5 Liters)
Operating Temperature	Ambient to -40°F (-40°C)
Temperature Measurement	Platinum RTD
Power Requirements	120 VAC, 60Hz or 230 VAC, 50/60 Hz 2 AMP power rating
Air Pressure	60 PSI inlet pressure (414 kpa) @ Class 3 Quality max particle of 5um

Environmental Conditions

The BBR3 is designed for use in an industry/laboratory setting in an indoor and dry environment. The Base Unit should be placed on a clean, stable work surface with the connecting mechanical refrigeration unit nearby. The mechanical refrigeration unit should be placed 6 inches above the floor and in an area that will not constitute a tripping hazard.

Load Frame

The load frame is an independent three-point loading device designed to apply a load of up to 4000 mN. The load frame may be operated in the supplied fluid bath, or it may be used in ambient conditions. The load frame is designed with space-saving design, rigid construction, and corrosion resistance.

The load frame is constructed of stainless steel plates and durable high-strength PVC uprights that are designed to be dimensionally stable and provide accurate force control. The load frame consists of an integral free-floating loading shaft within an air bearing to permit specimen loads in the range of 0 to 4000 mN. The air bearing also provides reliable and rapid loading with an accuracy of ± 5 mN.

The load frame is constructed with a horizontal shelf that extends across the top of the base unit to provide supports to suspend the lower portion of the load frame in the fluid bath. The upper part of the load frame is covered by an access panel that permits the user to easily view the top of the loading shaft. This panel also provides access to the weight pan for easy calibration of the load cell and the Linear Variable Differential Transformer

(LVDT). Two low voltage, sealed lamps are mounted in the base of the load frame in order to illuminate the specimen in the fluid bath.

The load frame is made up of an LVDT shaft, weight pan, air bearing, load shaft, load cell, and adapter. A metal plate cover is mounted to the front of the load frame and serves to protect the load cell from splashing fluid and minimize the effect of fluid movement on the load nose.

Specimen Support

The bottom half of the load frame consists of an anvil with two metal supports designed for alignment of the specimen. These specimen supports have a 3 mm contact radius and are fixed 102 mm apart from each other. They are designed to align samples that are approximately 127.00 mm x 12.70 mm x 6.35 mm.

Resting on each of the anvil's specimen supports are two anvil adapters (see Figure C.7). During crack sealant testing these anvil adapters need to be removed by lifting STRAIGHT UP on the adapter and pulling it off of the guide pin. The load frame should be removed from the bath and allowed to warm to room temperature before removing the anvil adapters.



Figure C.6 - Load Frame without Anvil Adapters

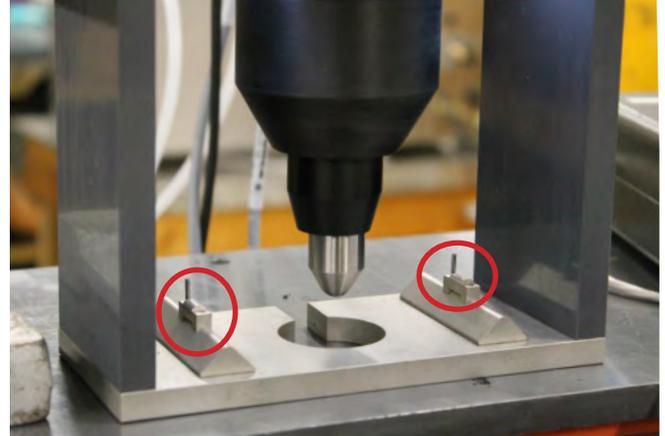


Figure C.7 - Load Frame with Anvil Adapters

The specimen supports and lower portion of the load frame are designed to be submerged in the constant-temperature fluid bath during the test. The fluid in the bath provides a buoyant force that counterbalances the weight of the specimen.

Air Bearing

The BBR3 incorporates an air bearing to provide frictionless loading performance. The air bearing control system requires a constant 60 – 65 psi (414 – 448 kPa) minimum clean and dry air supply, @ Class 3 Quality max particle of 5µm. The air pressure to the air bearing is controlled by a set of high-precision air regulators located on the front panel of the base unit.

Linear Variable Differential Transformer (LVDT)

The LVDT is calibrated at between 0 and 6 mm and is mounted in the upper section of the load frame assembly. A free-floating core rod is attached directly to the load shaft. It measures the displacement of the specimen as the test load is applied.

Load Cell

The load cell is a precision strain gauge-type, with 500 gram (4903 mN) force capacity. It is constructed of stainless steel to prevent corrosion or damage by the fluid during test procedures.



CAUTION: The load cell can be easily damaged, especially from side loading and excessive torque. Use caution while handling the test frame when the loading shaft is attached. Remove loading shaft before laying load frame on its side, especially before shipping.

Resistance Temperature Detector (RTD)

The RTD is a platinum measuring device that measures the cooling fluid bath temperature, is attached to the chiller, and relays the information to the computer control system software. It is mounted in the BBR3 bath directly under the test specimen supports.

Computer Control System Software

The computer control system software provides user control of the BBR3 system in a Windows® environment with touchscreen access. The software provides pull-down

menus, button selections, and data entry text boxes for easy updates and access to information.

The base unit contains an integrated personal computer, designed to efficiently run the software. During operation, the software collects and records the data from the various sensors on the load frame. During tests, the software controls specimen loading and unloading. The software is organized so all the information required to conduct a particular test is stored internally.

Mechanical Refrigeration Unit (Chiller)

The refrigeration unit (chiller) is an immersion cooler designed to act as a cooling source for sub ambient work in liquid baths. It maintains the cooling fluid at a constant temperature using the unit's temperature controller and the magnetic stirrer located in the bath. The single stage refrigeration system is equipped with one compressor. A hose carries refrigerant through the cooling probe located in the bath.

Refer to the separate manufacturer's literature for more detailed information regarding safety, operation, and maintenance of the refrigeration unit.



WARNING: Refrigeration unit (chiller) will cause the test bath to be extremely cold. Do not submerge hand or arm in extremely cold test bath. Do not attempt to pull the drain plug when the test bath level is high and the temperature is extremely cold. Extremely cold fluid may cause frostbite.

Accessories

Specimen Molds

A specimen mold is used to create specimens. Each mold consists of five aluminum bars of various sizes, three mylar strips, and two holding rings. Five of these molds are supplied with the BBR3.

Confidence Beam

The confidence beam is a thin stainless steel beam of a known stiffness. This beam is

placed on the specimen supports of the load frame during the confidence check.

Non-Compliant Beams

The BBR3 comes with a Non-Compliant Beam and a Crack Sealant Non-Compliant Beam. The Non-Compliant Beam is a length of stainless steel that has the same dimensions as a specimen. This beam is placed on the specimen supports when verifying and calibrating the load cell and when performing the compliance test.

The Crack Sealant Non-Compliant Beam is the thicker of the two beams, and is used only for Crack Sealant tests.

Step Disk

The step disk is used during LVDT standardization and verification. It has five positions containing high precision balls. The calibration positions include a zero gaging and four subsequent steps which decrease in increments of 1, 3, 5, and 6 mm. These steps are labeled on the disk using the letters A (1 mm), B (3mm), C (5mm), and D (6mm). This provides the 6mm test range required by both ASTM and AASHTO Specifications.



Figure C.8 - BBR3 Step Disk

Load Cell Calibration Weights

Four 100 gram and two 2 gram load cell calibration weights are supplied with the BBR3. These weights are placed on the load frame weight pan during load cell verification. The weights are also used to calibrate the load cell and ensure system compliance.

Controls

Internal Controls

Five Internal Controls are located inside the LEFT panel of the BBR3 base unit, when viewed from the front (Figure C.9). These controls are factory set.

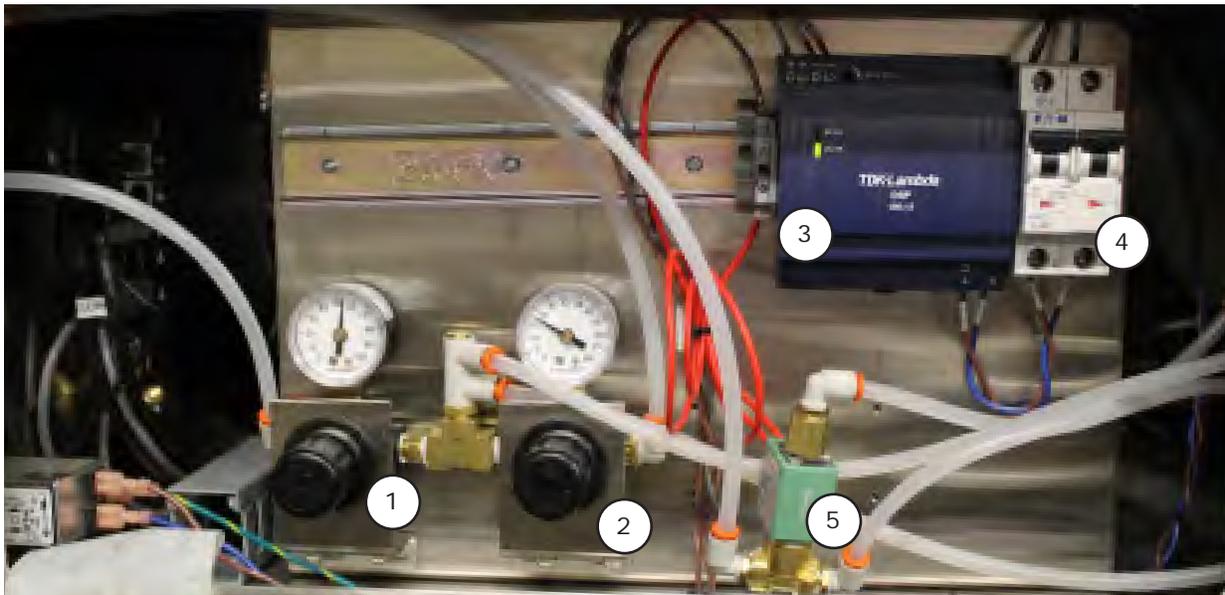


Figure C.9 - Internal Controls

1. **LINE PRESSURE REGULATOR** - The line pressure regulator is positioned on the LEFT inside the panel. This pressure is set at 60 psi.
2. **BEARING PRESSURE REGULATOR** - The bearing pressure regulator is located to the RIGHT of the line pressure regulator, and the bearing pressure is set at 15 to 20 psi. Verify the settings if necessary.
3. **DC POWER SUPPLY** - This supplies DC Power necessary to operate the computer, touch screen display, and other operating systems of the BBR3. A Green LED on the module indicates that the power output from the power supply is in the desired range.
4. **AMP CIRCUIT BREAKER** - Provides over current protection for the electronics of the BBR3. The circuit breaker handle should be in the UP position to allow current to flow to the BBR3.

5. **LOAD CONTROL SOLENOID VALVE** - Switches control of the air flow to the load frame air bearing between the Zero and Load Control Valves on the front of the BBR3 during set-up and testing.

Data Instruments

The Data Instruments box and Signal Conditioner Modules, along with the 3 Solid State Relays, are all located on the RIGHT side of the BBR3 base unit as viewed from the front (see Figure C.10).

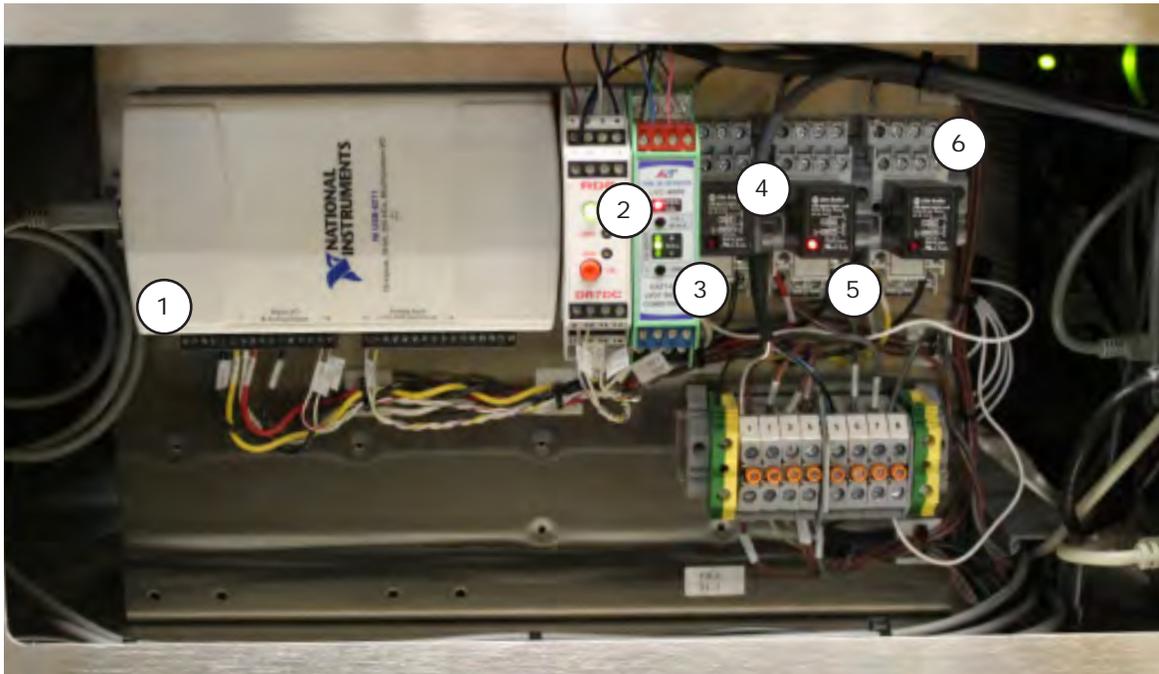


Figure C.10 - Data Instruments

1. **DATA ACQUISITION BOX** - Digitizes the amplified voltages from the Load Cell and Signal Conditioner Modules and sends that information to the PC. Also receives command signals from the BBR3 Computer and sends those signals to the Solid State Relays to operate the stirrer motor, bath heater, and load control solenoid valve.
2. **LOAD CELL SIGNAL CONDITIONER MODULE** - Receives and conditions the output of the Load Cell, and supplies an amplified voltage output to the Data Acquisition Box.
3. **LVDT SIGNAL CONDITIONER MODULE** - Receives and conditions the output of the LVDT Displacement Sensor, and supplies an amplified voltage output to the Data Acquisition

Box.

- 4 - 6. DC VOLT SOLID STATE RELAYS - Used to control the functions of the Bath Heater (4), Stirrer Motor (5), and Load Control Solenoid Valve (6). These modules are identical and interchangeable.

Basic Unit Controls



Figure C.11 - Basic Unit Controls

1. POWER INDICATOR - Orange light indicates Power is ON.
2. ZERO REGULATOR - Provides the means of lifting the loading shaft and permits the operator to adjust the air pressure to provide a zero or preload on the specimen.
3. LOAD REGULATOR - Permits the operator to adjust the air pressure to provide a test load on the specimen
4. TOUCH SCREEN - Operator interface that allows for all setup and running of tests, all machine parameter entries, and standardization.
5. USB PORT - Provides access for data downloads and software updates. Users may also attach a mouse and or keyboard if desired.

D. Installation

D.1 Recommended Tools

The following tools are recommended for use during installation and operation of Bending Beam Rheometer.

Installation

- 9/16" Open Ended Wrench
- Set of Hexagonal Wrenches
- Flat Bladed Screw Driver

Operation

- Metal tongs for the placement and removal of the specimen from the fluid bath.
- Protective eye wear and gloves for use during testing.

D.2 Unpacking the BBR3

To unpack and prepare the BBR3 for operation, complete the following steps.



CAUTION: Use care when moving the base unit. The refrigeration unit is attached, and the refrigeration hose may be damaged if it is twisted or pulled, especially when the unit is cold.

1. Remove the base unit and the refrigeration unit from the box, and place them on a sturdy work surface.



WARNING: Position the BBR3 in a well-ventilated area. Consider that flammable vapors may be emitted from the bath during operation. Refer to fluid manufacturer's MSDS documentation for further information.

2. Remove the load frame assembly and place it on a sturdy work surface near the base unit.

3. Remove any packing materials from the unit. The following items should also be located and set aside:
 - Case containing the step disk, a non-compliant test beam, a crack sealant non-compliant beam, a confidence check beam, two anvil adapters, the load nose, and a six-piece weight set.
 - Plastic bag containing specimen mold pieces.
 - Plastic bag containing crack sealant specimen mold pieces.
4. Inspect the base, the refrigeration unit, and the load frame for any obvious damage that may have occurred during shipment.



NOTE: If damage is found or suspected, notify the shipper and contact ATS immediately.

D.3 Assembling the Load Nose

Assemble the loading shaft to the load frame assembly.

1. There are four screws securing the shroud to the load frame (Figure D.1). Loosen the back two screws slightly, and completely remove the front two screws. This should allow you to remove the shroud from the frame.

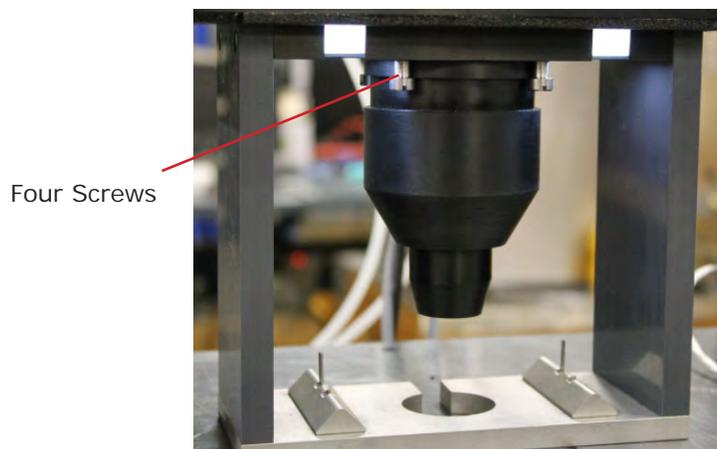


Figure D.1 - Load frame screw location

2. Remove the foam from inside of the load shroud (Figure D.2, p. 23). Unscrew the lower portion of the load shroud from the upper portion (Figure D.3, p. 23). Set the lower portion

aside.

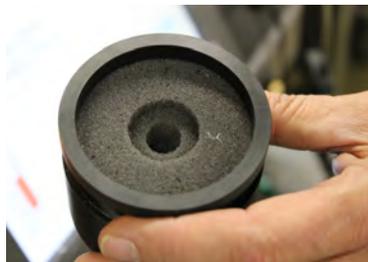


Figure D.2 - Foam Inside Load Shroud



Figure D.3 - Unscrew the Lower Portion of the Load Shroud

3. Retrieve the load nose from the BBR3 gauge kit. Place the load nose in the upper portion of the load shroud.
4. Position the shroud and load nose at the base of the load frame. Lift the load nose and carefully screw it on to the threaded stud in the bottom of the load cell until it is finger tight. When complete, secure the load nose in place by tightening the set screw on the side of the load nose (see Figure D.4 and D.5).



Figure D.4 - Set Screw Location on Load Nose



Figure D.5 - Tightening the Set Screw



WARNING: Do not over tighten the load nose, or damage to the load cell may occur.

5. Once the load nose is secured, lift the upper portion of the shroud around it. Use the back two screws to guide it into place before tightening them and carefully screwing in the front two screws. See Figure D.6, p. 24.



CAUTION: Do not over tighten the loading shaft on the load cell, or the load

cell may become damaged. The load cell is extremely sensitive to this twisting movement.



CAUTION: The load cell can be easily damaged, especially from side loading and excessive torque. **DO NOT** place Load Frame on its side once the Load Nose is in place. Improper handling will result in irreversible Load Cell damage.

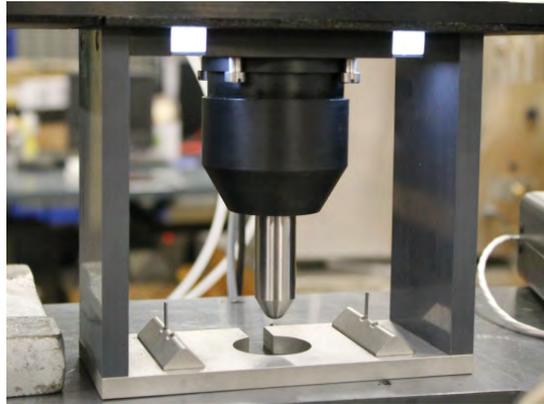


Figure D.6 - Load Nose with upper portion of Shroud attached to Load Cell

6. To re-attach the lower portion of the load shroud, place the lower portion of the shroud on a flat surface. **CAREFULLY** lift the load frame, and position it so that the load nose is directly above the lower portion of the shroud (Figure D.7). Lift the lower portion of the shroud up and gently screw it in to the upper portion (Figure D.8).

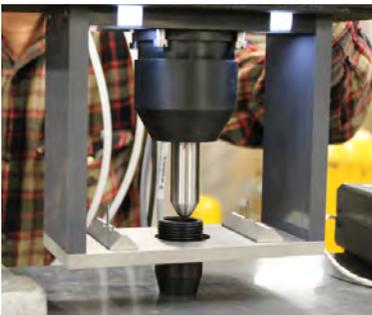


Figure D.7 - Attaching lower portion of Load Shroud



Figure D.8 - Attaching lower portion of Load Shroud

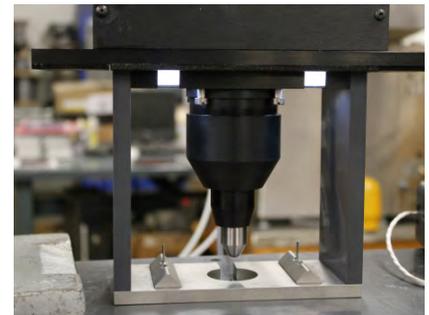


Figure D.9 - Attached Load Nose with Shroud

D.4 Connecting Equipment

The following hoses and cables are shipped with the BBR3. Use them for connecting the BBR3 equipment:

- Zero/Load hose
- Air bearing hose
- Four color-coded electrical cables (integral to base)
- Refrigeration control cable
- Main electrical power cable(s)

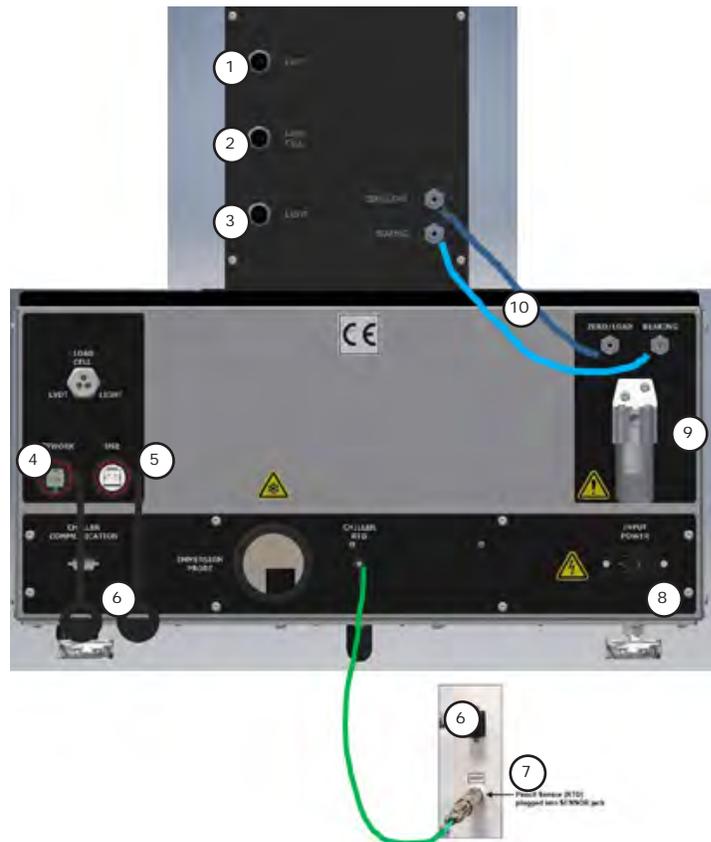


Figure D.10 - Connecting the BBR3

- | | |
|----------------------|-------------------------------|
| 1. LVDT hook up | 6. Chiller Communication Port |
| 2. Load Cell hook up | 7. Back of Chiller Unit |
| 3. Light hook up | 8. AC Power Plug |
| 4. Network/Ethernet | 9. Compressed Air |
| 5. USB Connection | 10. Air Bearing Lines |

Load frame hook ups pre-wired and color coded:

- RED > LVDT
- BLUE > Load Cell
- GRAY > Light



WARNING: The cable for the lights should be connected to the load frame at all times while the BBR3 is in use. The electrical grounding for the load frame to the BBR3 chassis is done through the light cable.

1. Connect the air hose to the ports on the rear of the load frame assembly and to the ports at the rear of base unit. The air supply connections supply a minimum of 60psi of clean, dry air. Make sure the location of air hoses are such that they will not snag or catch on anything in the surrounding environment.

2. Connect the chiller RTD cable from the rear of the base unit to the refrigeration unit.

3. Connect the color-coded electrical cables from the rear of the base unit to the rear of the load frame assembly.

4. Connect the Chiller Communication Cable between the Chiller Communication Port on the rear of the BBR3 Chassis and the RS-485 Port on the rear of the Chiller.

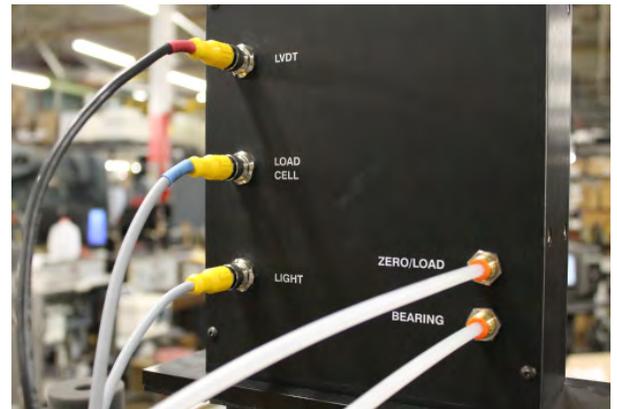


Figure D.11 - Load Frame Hook Ups



Figure D.12 - Chiller Communication Cable in RS-485 Port on the back of the Chiller.



Figure D.13 - Chiller Communication Cable in Chiller Communication Port on the back of the BBR3 unit.

5. Plug the power cables from the base unit and the refrigeration unit into a surge-protected power source of appropriate voltage. Refer to the data tag on the BBR3 base unit.
6. Connect printer if desired using the USB port located in the rear of the BBR3 base.



NOTE: If at any point power is lost, disconnect all power sources and place all controls in an OFF position. Reconnect power sources and restart the system.



CAUTION: Be aware of placement of all cables and hoses in relation to the surrounding area. Surrounding area should provide no hazards resulting in involuntary disconnection of cables and hoses. Disconnection will result in inaccurate test results.

E. Operation

E.1 Filling the Bath



WARNING: The protection of the device is impaired if used in a manner not specified in the manual.



WARNING: Possible Eye and/or skin irritant. Wear protective clothing and adequate eye protection during test procedures. Hazards can differ from fluid type to fluid type. Refer to fluid manufacturer's MSDS documentation for detailed information.



WARNING: During operation and testing never use bare hands to place objects in the fluid bath. Wear protective clothing and adequate eye protection during test procedures and use metal tongs for object placement and removal. Extremely cold fluid may cause frostbite.



NOTE: Depending on your temperature verification / calibration device, you may need to adjust the amount of fluid in the bath to reach proper submersion depths. Refer to individual specifications for more information.

1. Fill the BBR3 with 1.5 gallons (5.5 Liters), so the liquid is approximately 1 ½ to 2 inches from the top. Refer to individual test specifications for fluid type.

E.2 Power Up the BBR3

1. Press the power button on the rear of the BBR3 base unit. The power indicator light on the front of the unit will illuminate.
2. Turn on the refrigeration unit (chiller) by flipping the power switch in the rear of the unit.
3. Wait one to two minutes after powering up the BBR3 unit before opening the program. The computer requires this time to properly load the software and device drivers, and opening the program sooner will prevent it from operating as intended.
4. Once the BBR3 has loaded, a dialog window will appear on the screen. Press DISMISS.

5. Use the touchscreen to press the BBR3 software desktop icon to launch the program.

E.3 Overview of Touchscreen and Menu

Once the BBR3 program has launched, the MAIN SCREEN (shown in Figure E.1) will launch. This screen allows you to setup, run, and view tests, and machine components.

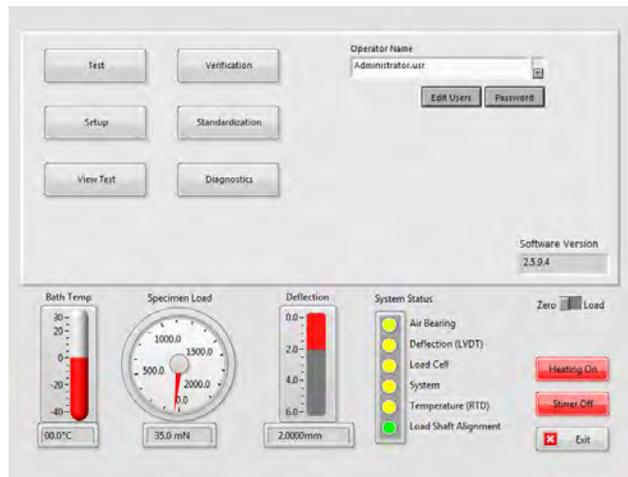


Figure E.1 - MAIN MENU screen

The lower part on the screen shows values for machine temperature, load, and deflection. It also has system status lights and controls for the machine. The chart in Figure E.2 (opposite page) outlines the BBR3's software screens.



NOTE: The EXIT button on the bottom right of the screen will exit the BBR3 program and return to Windows. To return to the MAIN MENU screen from any other BBR3 software screen, press the MAIN MENU button in the upper right corner.

E.4 Editing Users and Permissions

When you press the EDIT USERS button on the main screen the dialog shown in Figure E.3 (p. 31) is displayed.

The EDIT USERS button will not be shown on the main menu unless the currently logged in user has permission to edit users on the system.

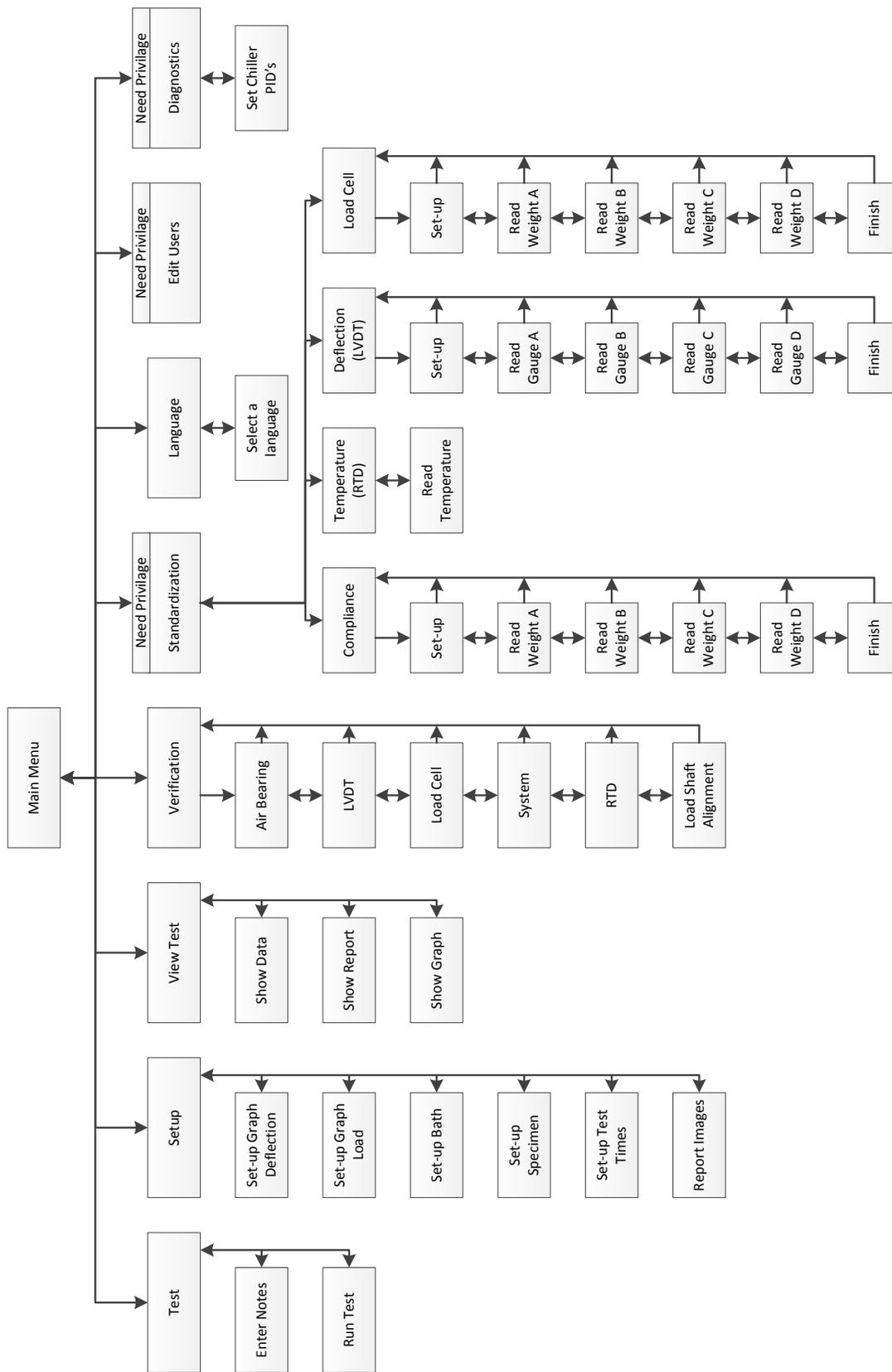


Figure E.2 - BBR3 Software Screen map



Figure E.3 - Edit Users dialog

The OPERATOR NAME combo will allow you to select a user to edit. Use the down arrow button to drop down a list of users saved on the system.

The PASSWORD field contains the current password for the selected user. If this field is left blank no password will be required to log in as this user, but this user will not be able to add a password in the future.

The first three user privilege switches set up privileges or permissions for the system:

- Edit Users – Allows this user to edit any of the users on the system.
- Diagnostics – Allows this user to enter a diagnostic or maintenance screen.



NOTE: Extreme caution should be used with this permission as there are no safety restrictions in this screen.

- Standardization - Allow this user to perform a standardization on the system.

Currently switches 3, 4, and 5 do not add or remove any additional permissions.

The SAVE button will save the current user. **This should be done any time you make any changes you want to keep. If you exit this screen without pressing SAVE you will lose any changes you have made.**

The COPY button will make a copy of a selected user under a new name. This is useful if you need to make a new user with similar permissions as a current user. Press SAVE when complete.

The NEW button will create a new user using default values. Press SAVE once you have created a new user.

The DELETE button will delete a saved user. Once pressed it will verify that you want to delete the selected user. If you answer YES the user will be permanently deleted from the system. To prevent software lockout, the system will not allow you delete the DEFAULT user.

E.5 Standardization Process

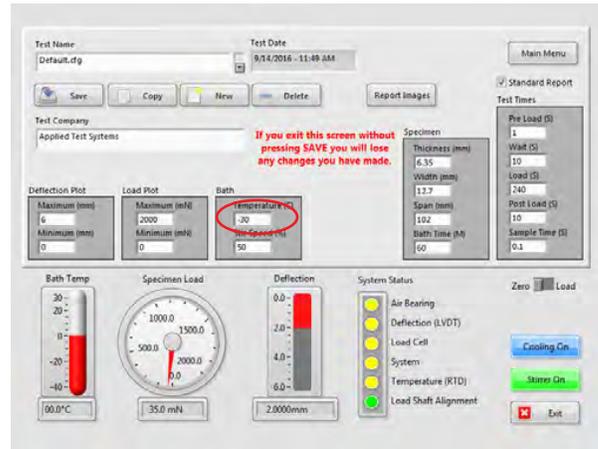


Figure E.4 - Bath Temperature Field on SETUP screen

Before standardization, verify that the bath is set at your desired testing temperature. To do this, press the SETUP button on the MAIN MENU touchscreen. Enter your desired testing temperature in the TEMPERATURE field in the BATH section of the SETUP screen (Figure E.4).

After you set your temperature, press MAIN MENU to return to the main BBR3 screen. From the main screen press the STANDARDIZATION button to enter the standardization screen (Figure E.5).



NOTE: The standardization button will not be shown on the main menu unless the currently logged in user has permission to perform standardization.



Figure E.5 - Standardization main screen

The BBR3's system status lights, located at the bottom right of the screen, indicate whether or not a component requires standardization.

- Red = the component requires standardization
- Yellow = the component requires verification
- Green = the component is ready for testing

Prior to standardization, verify that the information entered into the necessary fields matches the information provided on the CERTIFICATE OF CONFORMANCE that was shipped with the gauge kit being used for the standardization. Make adjustments as necessary. You will also need a BBR3 gaging kit.



WARNING: Be certain to perform ALL STEPS in the standardization menu for each of the sensors EXACTLY AS DESCRIBED. Failure to perform all steps of the standardization procedure may result in incorrect or erratic operation of the BBR3.

1. Standardizing the Temperature (RTD)



NOTE: Before standardization, verify that the bath is set at your desired testing temperature.

- a. From the Main Menu select the SETUP button.
- b. Verify the load frame is in the bath.
- c. Allow temperature to stabilize for one to two hours after set point is reached.
- d. After temperature has stabilized, select MAIN MENU and then press the STANDARDIZATION button.
- e. Select the TEMPERATURE button.
- f. You will need a calibrated partial immersion reference thermometer suitable to ASTM 133C. Submerge the thermometer into the liquid bath at the appropriate depth beside the RTD.
- g. Leave the thermometer in place for a minimum of two minutes and note the temperature reading to the nearest tenth of a degree (within 0.1°C).
- h. Record this temperature in the field and select the FINISH button.

2. Standardizing the Load (Load Cell)

- a. Select LOAD button from the Standardization Menu.
- b. With the load frame in the bath, load the non-compliant beam into test position.
- c. Using the zero regulator, adjust the load nose so it is slightly above the beam.
- d. Press the TARE button.
- e. Using the zero regulator, gently lower the load nose lightly onto the beam with minimal load ($20\text{mN} \pm 10\text{mN}$). Select the NEXT button.
- f. Select weight A from the gauge kit and place it on the weight pan. Wait five seconds and press the NEXT button.
- g. Select weight B from the gauge kit and place it on top of weight A. Wait five seconds and select the NEXT button.
- h. Select weight C from the gauge kit and place it on top of weight B. Wait five seconds and select the NEXT button.
- i. Select weight D from the gauge kit and place it on top of weight C. Wait five seconds and select the NEXT button.
- j. Select FINISH to record the calibration constant.

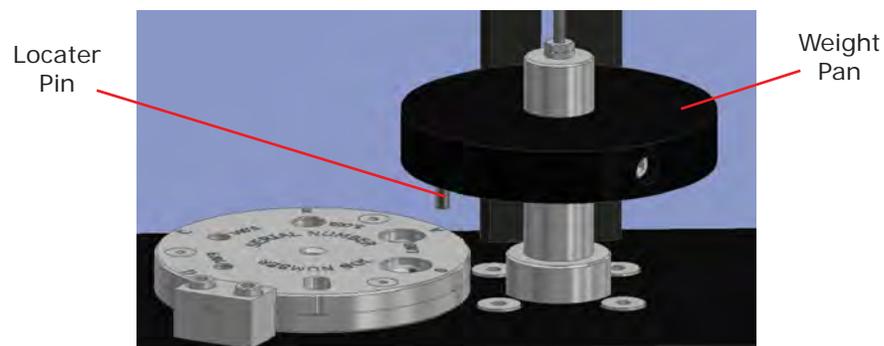


Figure E.6 - Step disk positioned under locater pin



NOTE: The calibration constant should be $\leq 2.5\text{mN}$ and repeatable within 10% from one standardization to another. If it is not, contact Applied Test Systems at +1-724-283-1212

3. Standardizing Deflection (LVDT)

- a. Press the DEFLECTION button from the Standardization Menu.
- b. With the load frame in the bath, remove any beams from the supports and any weights from the BBR3.
- c. Adjust the zero regulator to raise the load nose to its highest position.
- d. Remove the step disk from the gauge kit and place it on the load frame.
- e. Gently rotate the step disk so the locator pin is above the 0 step.
- f. Using the zero regulator, gently lower the load nose until the pin rests lightly on the 0 step.
- g. Place a 100g weight on the weight pan, wait five seconds and select NEXT.
- h. Manually raise the load nose by lifting the weight pan and gently rotate the step disk to the "A" position. Gently lower the load nose until the pin rests lightly on the "A" step. Wait five seconds and select NEXT.
- i. Manually raise the load nose again and gently rotate the step disk to the "B" position. Gently lower the load nose until the pin rests lightly on the "B" step. Wait five seconds and select NEXT.
- j. Manually raise the load nose again and gently rotate the step disk to the "C" position. Gently lower the load nose until the pin rests lightly on the "C" step. Wait five seconds and select NEXT.
- k. Manually raise the load nose again and gently rotate the step disk to the "D" position. Gently lower the load nose until the pin rests lightly on the "D" step. Wait five seconds and select NEXT.
- l. Select FINISH to record calibration.



NOTE: The calibration constant should be $\leq 2.5\mu\text{m}$ and repeatable within 10% from one standardization to another. If it is not, contact Applied Test Systems at +1-724-283-1212

4. Standardizing the Compliance

- a. Select the COMPLIANCE button from the Standardization Menu.

- b. With the load frame mounted in the bath load the non-compliant beam into test position.
- c. Slowly adjust the zero regulator to the lower loading nose until it gently makes contact with the beam (20mN \pm 10mN). Select the NEXT button.
- e. Select weight A from the gauge kit and place it on the weight pan. Wait five seconds and select the NEXT button.
- g. Select weight B from the gauge kit and place it on top of weight A. Wait five seconds and select the NEXT Button.
- i. Select weight C from the gauge kit and place it on top of weight B. Wait five seconds and select the NEXT button.
- k. Select weight D from the gauge kit and place it on top of weight C. Wait five seconds and select the NEXT button.
- m. Select FINISH to record the calibration contestant



NOTE: The calibration constant should be less than or equal to 5 μ m/N and repeatable within 10% from one standardization to another. If it is not, contact Applied Test Systems at +1-724-283-1212

E.6 Verification Process

Verification of most BBR3 components will need to occur every 24 hours - this is usually done at the beginning of a day of testing. You will need a BBR3 gaging kit and a calibrated thermometer (see RTD) to perform a verification.

The BBR3's system status lights, located at the bottom right of the screen, indicate whether or not a component requires verification.

- Red = the component requires standardization
- Yellow = the component requires



Figure E.7 - Verification main screen

verification

- Green = the component is ready for testing

1. To begin, select VERIFICATION from the main menu. The screen shown in Figure E.7 (p. 36) will display.
2. Verify the information entered in the Confidence Beam Serial # section matches the information on the certification of conformance form that was shipped with the BBR3. Make corrections if necessary.
3. Press the verification button to begin the verification sequence.
4. Verify the load bearing.

- a. Place the thin steel beam on the sample supports, and apply a 35mN load to the beam by turning the zero load regulator.
- b. Observe the reading of the LVDT. Gently grasp the shaft and lift it upwards approximately 5mm by observing the reading of the LVDT.
- c. When the shaft is released, it should immediately float downward and gently make contact with the beam.

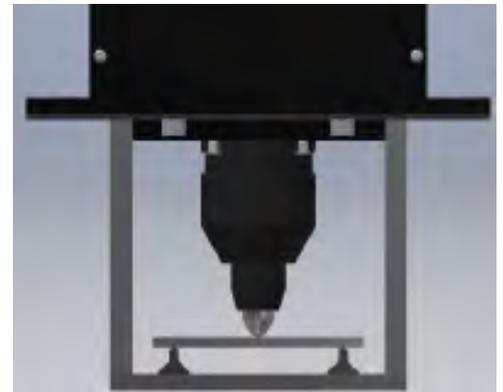


Figure E.8 - Confidence beam in place during verification.

- d. Remove any beams from the supports.
- e. Use the zero load regulator arrows to adjust the loading shaft so that it is free floating at the approximate midpoint of its vertical travel.
- f. Gently add a 2g mass to the loading shelf.
- g. The shaft will slowly drop down under the weight of the added mass. If everything works as the prompts require, select VERIFICATION COMPLETE and NEXT.
- i. If the results are not in acceptable range, select STANDARDIZATION REQUIRED and NEXT.

5. Verify the LVDT

- a. With the loading frame mounted in the bath at the test temperature, remove all beams from the supports.

- b. Place the step gauge disk in any position and apply the provided 100g mass to the weight pan.
- c. Compare the measured displacement to the known gauge disk location. This information can be found on the Certification of Conformance form, as well as on the main Verification screen.
- d. If the known dimensions differ from the measurements by more than $\pm 5\mu\text{m}$, standardization is required. Select the STANDARDIZATION REQUIRED button and then the NEXT button.
- e. If the measurements are within $\pm 5\mu\text{m}$ then press the VERIFICATION COMPLETE radio button and then the NEXT button to move to the next section.

6. Verify the Load Cell

a. Verify the Contact Load

- i. Place the Non-Compliant Beam on the sample supports and apply a 20mN load $\pm 10\text{mN}$ using the zero load regulator. Add a 2g mass to the weight pan.
- ii. Verify the increased measured load is 20mN $\pm 5\text{mN}$. Add the second 2g weight to the weight pan. Verify the increased measured load is 20mN $\pm 5\text{mN}$.
- iii. If the measurements do not fall within these ranges, standardization is required. Select the STANDARDIZATION REQUIRED radio button and select NEXT to move to the next section.

b. Verify the Test Load

- i. Place the non-compliant beam on the sample supports.
- ii. Apply 20mN $\pm 10\text{mN}$ load using the zero load regulator.
- iii. Add 100g mass to the weight pan.
- iv. If the increase in measured load falls within 981mN $\pm 5\text{mN}$ press the VERIFICATION COMPLETE radio button and then press the NEXT button to move to the next section.

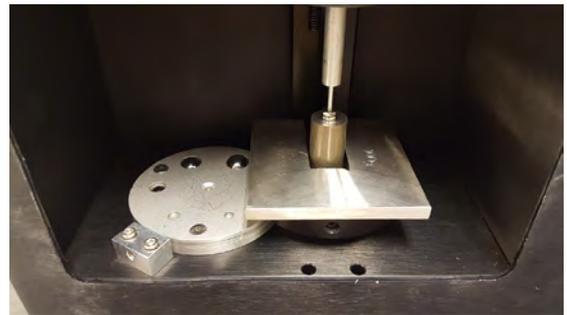


Figure E.9 - System Verification

v. If the increase in measure does not fall within $981\text{mN} \pm 5\text{mN}$ select STANDARDIZATION REQUIRED button and then NEXT.

7. Verify the System

- a. Ensure the load frame is in the bath.
- b. Place Confidence Beam on the sample supports.
- c. Apply 100g mass to the weight pan.
- d. Press RECORD.
- e. Apply the second 100g mass to the weight pan and press RECORD.
- f. The modulus reported should be within 10% of the modulus of the Confidence Beam, as listed on the verification conformance form.
- g. If the measurement is within 10% press OK then the VERIFICATION COMPLETE radio button.
- h. If the measurement is more than 10% press OK and then the STANDARDIZATION REQUIRED radio button.
- i. Press the NEXT button to move on to the next section.

8. Verifying the RTD

- a. You will need a partial submersion calibrated reference thermometer suitable to ASTM 133C.
- b. With the load frame in the bath, immerse the calibrated reference thermometer into the bath close to the RTD.
- c. Compare the measured system temperature to the reference thermometer
- d. If the temperatures differ more than $\pm 0.1^{\circ}\text{C}$ select the STANDARDIZATION REQUIRED radio button and NEXT.
- e. If the observed temperatures are within $\pm 0.1^{\circ}\text{C}$ select the VERIFICATION COMPLETE radio button and then NEXT.

9. Verifying the Load Shaft Alignment



NOTE: This only needs done every six months. To skip this step, press the FINISH button without pressing any of the radio buttons.

- a. For this process you will need a strip of white paper 12.7 mm x aprox. 25 mm long, and a strip of carbon paper of the same or similar dimensions.
- b. Place the white paper strip on the non-compliant beam and secure with tape.
- c. Remove the load frame from the liquid bath and set it in an upright position on a flat surface.



WARNING: Do not lay the load frame flat with the load nose attached. This will damage the load cell.

- d. Place the non-compliant beam on the sample supports, with the white paper facing up.
- e. Place a small section of carbon paper over the white paper with the dark side facing the white paper.
- f. With the air pressure applied to the air bearing, gently press the shaft downward causing the load nose to make an imprint through the carbon paper onto the white paper.
- g. Remove the carbon paper and measure the distance from the center of the carbon imprint to each sample support using vernier calipers.
- h. If the difference between the two measurements is 1.0mm or less, press the VERIFICATION button followed by the FINISH button.
- i. If the difference between the two measurements is more than 1.0mm, press STANDARDIZATION REQUIRED and contact the Applied Test Systems Service Department at +1-724-283-1212.

E.7 Test Setup

Test setup is used to define a BBR3 test specification as well as the type of report it will generate. When you press the SETUP button the screen shown in Figure E.10 will display.



Figure E.10 - Test Setup Main Screen

Test Name

The TEST NAME is the name of the currently selected test specification. The only limit to the number of tests that can be stored is the size of the disk drive in the BBR3. Since a test specification takes about 1K of storage space, it would be nearly impossible to run out of space on the drive. You can use the TEST NAME combo to select different test specifications already saved. Just press the down arrow button to get a list.

Test Date

TEST DATE will show the last time that the currently selected test was saved.

Saving Test Parameters

The SAVE button will save all the current screen data to the currently selected test specification.

This should be done any time you change anything that you want to keep. **If you exit this screen without pressing SAVE you will lose any changes you have made.**

Copying a Test

The COPY button is used to make a copy of a test specification under a new name. This is useful if you wish to make a new test with only a couple of changes from a currently save test.

Remember to press SAVE once you have the changes you want. **If you exit this screen without pressing SAVE you will lose any changes you have made.**

Creating a New Test

The NEW button will create a new test using default test specification values. Remember to press SAVE once you have created a new test, even if you have not changed anything so that it is saved.

Deleting a Test

The DELETE button will delete a saved test. Once pressed, a pop up will require you to verify that you want to delete the test. If you answer YES the test cannot be recovered.

Adding Report Images

The REPORT IMAGES button allows you to select images that are printed on the report that this test generates. When pressed it will display the dialog seen in Figure E.11, which will allow you to select each image.

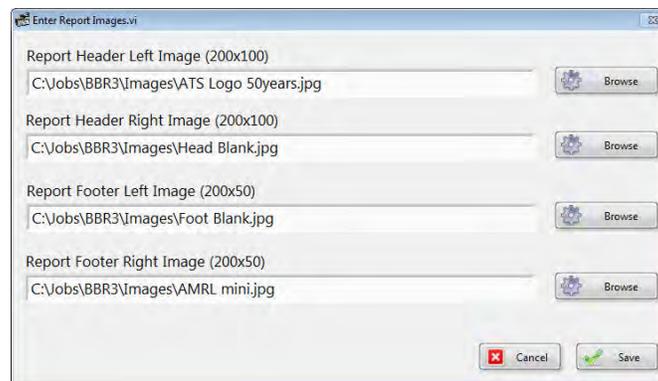


Figure E.11 - Add images to test dialog

The best image size is listed on screen for each position, and are as follows:

- Report Header Left Image (200x100)

- Report Header Right Image (200x100)
- Report Footer Left Image (200x50)
- Report Footer Right Image (200x50)

If the image entered is a different size it will be resized to fit, but may appear distorted.

Adding a Test Company

The TEST COMPANY is any text you wish to enter. It is stored with the test specification and printed on the report that this test will generate.

Standard or Data Report

The STANDARD REPORT check box lets you select a standard report or a data report. The data report is most often used to chart in Excel or another similar program to generate additional calculations or graphs.

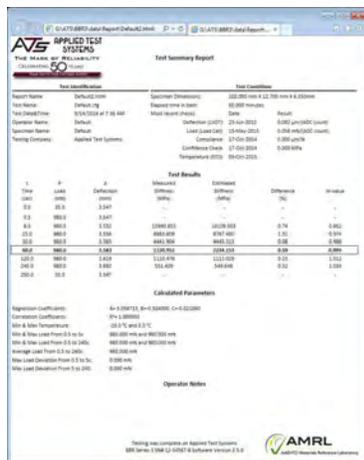


Figure E.12 - Standard Report

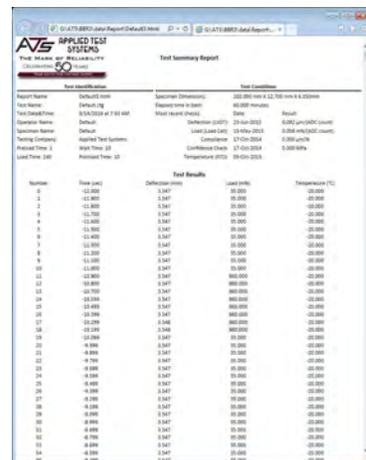


Figure E.13 - Data Report

Deflection Plot and Load Plot

DEFLECTION PLOT and LOAD PLOT set the graph limits when a test is running. They are stored with the test specification and are used each time that test spec is run.

Bath Values

The BATH values set the current Temperature and Stir Speed and are saved with the test specification to set the values when it is run.

Specimen Values

The SPECIMEN values are used in the calculations and printed on the report that this test specification generates.

Test Times

The TEST TIMES are what set the sequence and sample rate the system uses when running this test specification.



NOTE: Each stored data point is a running average of four data points.

Once you have entered your desired test parameters, press SAVE and then EXIT.

E.8 Run Test

Test setup will need to be done before you run a test. See Section E.7 for more details if you have not already set up your test. When you press the TEST button the run screen shown in Figure E.14 will display.

The BBR3's system status lights, located at the bottom right of the screen, indicate whether or not a component is ready for testing.

- Red = the component requires standardization
- Yellow = the component requires verification

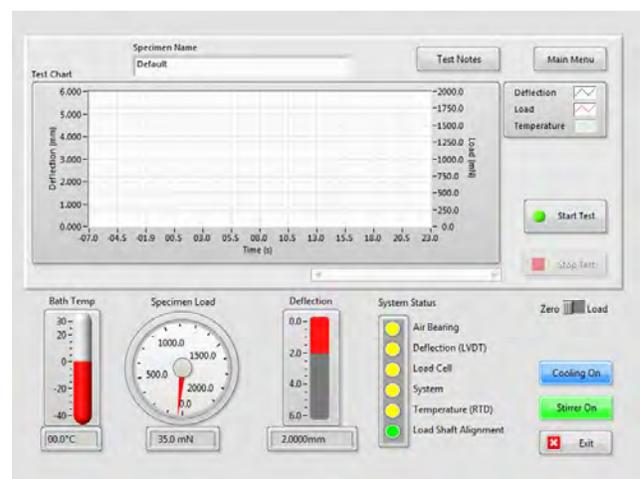


Figure E.14 - Run Test main screen

- Green = the component is ready for testing

The SPECIMEN NAME is any text you wish to make it. It is stored with the run data and printed on the report. This allows you to keep track of which test data or report you are looking at. Be sure you set this BEFORE you run a test for it to be included in the report.

The TEST NOTES button will bring up a dialog to allow you to enter any note you wish to keep with this test run. They are stored with the run data and printed with the report. Be sure you write these BEFORE you run a test for them to be included on the report.

If the BBR3 was sitting idle and the loading shaft was free hanging for more than one hour, place the non-compliant beam on the specimen support, then manually exercise the load cell. To do this, place 100 gram of weight on the weight pan and remove it, allowing three or four seconds between loading and unloading. Repeat this at least four times, allowing three or four seconds between each time.

Load Setup

1. Load the non-compliant beam on the specimen supports.
2. The load control switch is located on the Run Test main screen, to the right of the BBR3's system status lights. Using the touchscreen, move the switch to the zero position (Figure E.15).

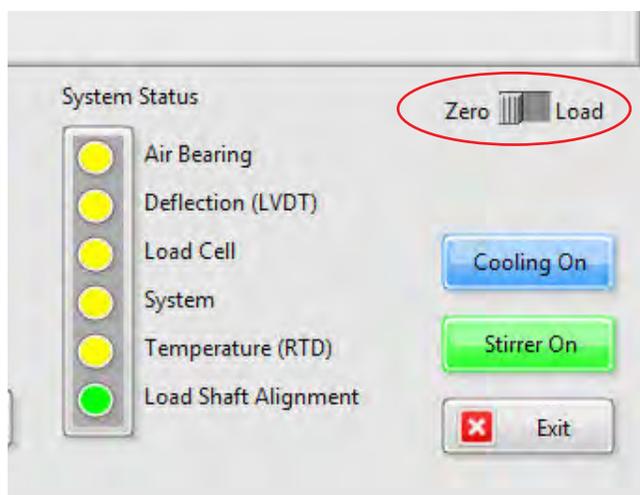


Figure E.15 - Load Control Switch in the Zero Position

3. Adjust the zero regulator (see Figure E.16) until the loading shaft contacts the non-compliant beam with a minimal force of 35 ± 10 mN.

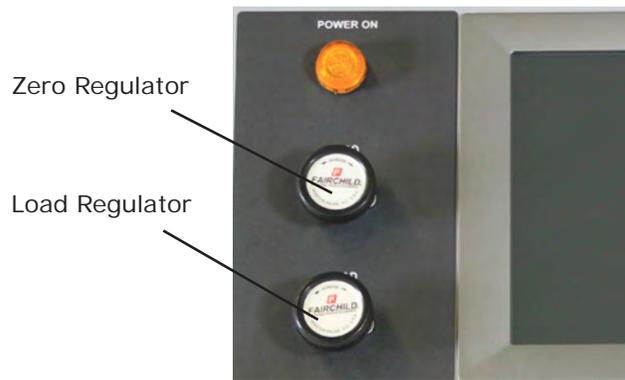


Figure E.16 - Zero Regulator & Load Regulator

4. Use the touchscreen to move the load control switch to the load position.
5. Adjust the load regulator until the load display reading is 980 ± 50 mN.
6. Use the touchscreen to move the load control switch between zero (contact load) and load (test load) several times to recheck the specimen load and verify that the values are stable.



NOTE: Allow the specimen to stabilize in the cooling fluid bath at the required test temperature according to the specifications.

Start Test

1. Raise the loading shaft. Remove the non-compliant beam and place the specimen in the test position.
2. Gently lower the loading shaft, so it contacts the specimen. Make sure the load display is 35 ± 10 mN. If it is not, adjust the zero regulator.
3. Press the START TEST button.
4. The horizontal graph allows the operator to monitor test progress. Current deflection and load values are displayed on the graph.

5. To abort the test, press the STOP TEST button.
6. When the test is complete the system will automatically generate a report and display it.
7. If you have connected a printer to your BBR3, you can print the test summary report from this screen. To do so, select file and then print.

Run Crack Sealant Test

1. Before running this test you will need to remove the (2) anvil adapters from the Anvil. This is performed by lifting STRAIGHT UP on each adapter off the guide pins. See Figure E.17.



WARNING: Load frame should be removed from the bath and allowed to warm to room temperature before removing the anvil adapters.

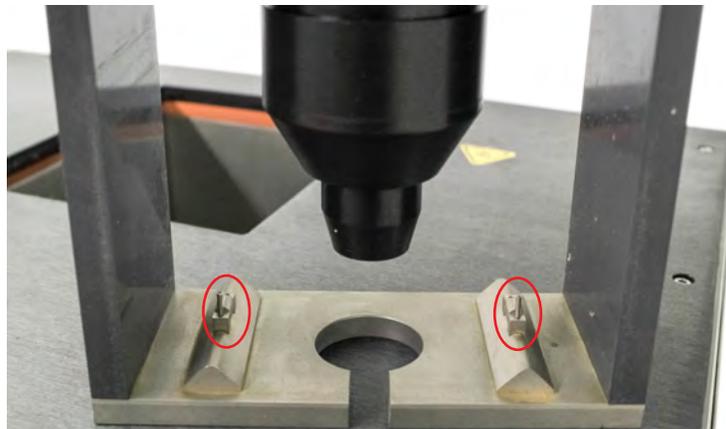


Figure E.17 - BBR3 anvil adapters

2. Raise the loading shaft. Remove the non-compliant beam and place the specimen in the test position. Gently lower the loading shaft, so it contacts the specimen. Make sure the load display is 35 ± 10 mN. If it is not, adjust the zero regulator.
3. Press the START TEST button.
4. The horizontal graph allows the operator to monitor test progress. Current deflection and load values are displayed on the graph.
5. To abort the test, press the STOP TEST button.

6. When the test is complete the system will automatically generate a report and display it.

View Test

View Test is used to look at test data for tests that have already been run and saved. When you press the VIEW TEST button the screen shown in Figure E.18 will display.



Figure E.18 - View Test main software screen

The TEST DATA sections allows users to select different test runs already saved. Press the down arrow button to show a list. Once a data set has been selected, the data is displayed in the graph.

Press the SHOW DATA button to open a dialog that shows a table of the data values for the selected run. It can also be printed from this dialog.

The SHOW REPORT button will open the report that was generated for the selected test run.

Use the TIME switch to change between FULL GRAPH and ZOOM. ZOOM will let you zoom in on the time scale and put a scroll bar under the graph to allow you to move the display back and forth.

You can also click on either end of any of the scales to change that value to zoom in on just part of the graph. Keep in mind that pressing the TIME switch will reset this.

E.9 Diagnostics

When you press the DIAGNOSTICS button the screen in Figure E.19 will be shown.

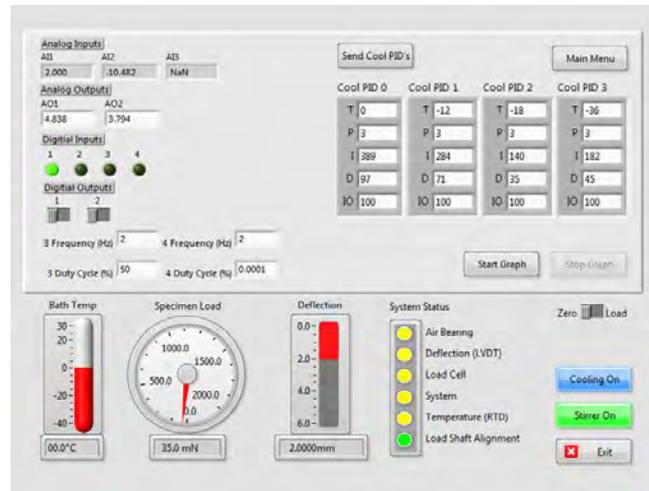


Figure E.19 - Diagnostics main software screen

You should not have permission for this screen unless you are experienced with the machine and what it does.

There are no safety features in this screen. It should mostly be use for maintenance to trouble shoot I/O problems.

The diagnostics button will not be shown on the main menu unless the currently logged in user has permission for this screen.

Analog Inputs AI1, AI2, and AI3

Raw voltages into the system. You should be able to use a voltmeter to test the voltage at the input pin and it should match what is shown here. AI1 is deflection, AI2 is load, and AI3 is not used on a mechanical chiller system.

Analog Outputs AO1 and AO2

Raw voltages out of the system. Use a voltmeter to test the voltage at the output pin and verify

that it matches the value shown on the diagnostics screen.

Digital Inputs 1, 2, 3, and 4

Raw values into the system. Use a voltmeter to test the state at the input pin and verify that it matches the value shown on the diagnostics screen. The BBR3 does not currently use any of the digital inputs.

Digital Outputs 1 and 2

Raw values out of the system. Use a voltmeter to test the state at the output pin and verify that it matches the value shown on the diagnostics screen. DO1 is the valve to switch between contact and test loads. DO2 is pulsed by the program to control the bath stirrer.

Digital Outputs 3 and 4

High speed pulse outputs. Use a scope to test the output pin and verify that it matches the frequency and duty cycle entered in the diagnostics screen. DO3 is not used in the current BBR3, DO4 is used to control the bath heater.

Cool PID Values

If you have mechanical cooling you will see the “Cool PID” values, which set the PID information for each range of the mechanical chiller.



WARNING: These values have been set at the factory by Applied Test Systems and **SHOULD NOT BE CHANGED** without consulting with the Applied Test Systems Service Department.

The Cool PID values are as follows:

- T sets the temperature for that set of values.
- P is the proportional gain of this set of values.
- I is the integral time of this set of parameters.

- D is the derivative time of this set of parameters.
- IO is the integral offset of this set of parameters.

For more information and further understanding concerning the temperature controller in the BBR3's chiller, refer to the separate chiller manual that accompanies it.

F. Troubleshooting

F.1 Preface

Listed within this section are the most common troubleshooting errors that operators may encounter when using the BBR3. Users may follow the steps provided to work through these basic errors.

Any additional issues or system errors should be brought to the attention of the Applied Test Systems Service Department immediately by calling +1-724-283-1212 or emailing service@atspa.com.

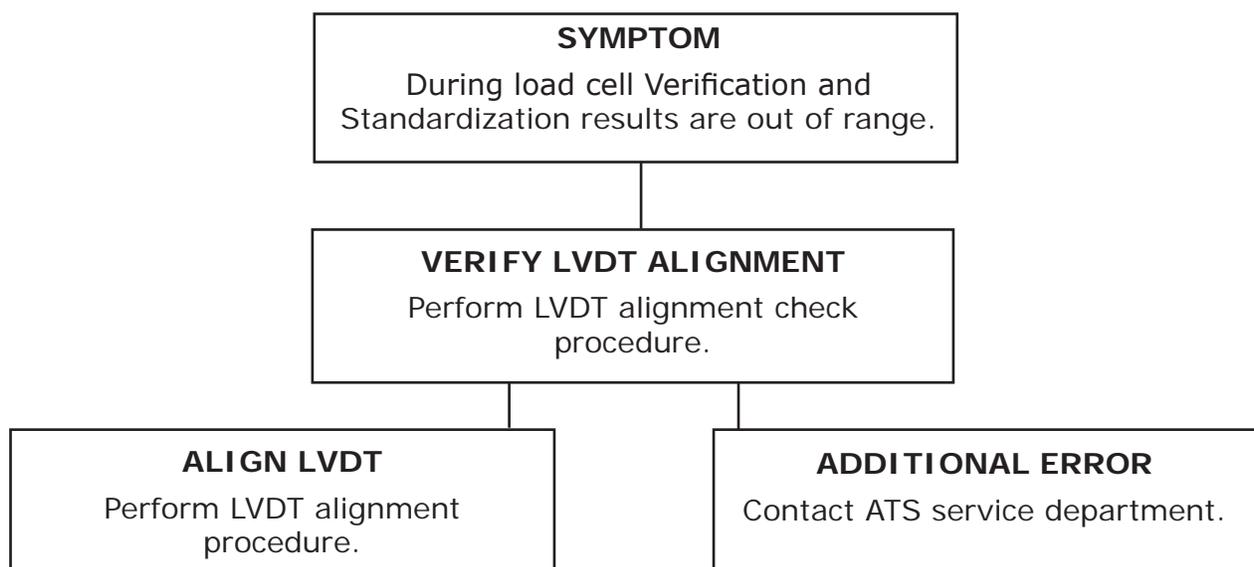
DO NOT attempt to independently fix any other system errors. Any additional errors fixed independent of technical support at Applied Test Systems could result in damage to the equipment, or injury on the part of the operator.



WARNING: To prevent electrical shock, use extreme caution when removing covers or panels. Follow your company's electrical safety procedures thoroughly.

F.2 Load Shaft Stuck or Stalled During Verification or Standardization

When the load shaft seems to be stuck or stalled during verification and standardization procedures, the most likely cause is a misaligned LVDT. To fix this issue, perform the following steps:



1. In order to determine if the LVDT is misaligned, the LVDT must be viewed from above.

- Remove the front cover on the load frame assembly.
- Shine a flashlight at the lower end of the LVDT shaft. This light reflects up the shaft, so the LVDT can be viewed from above. See Figure F.1.



Figure F.1 - LVDT Shaft

2. If the LVDT shaft appears to be centered in the LVDT, re-secure the cover and contact ATS for assistance.

3. If you determine that the shaft is misaligned, attempt to center it by performing the steps below.

- Loosen the four retainer screws using a 3/32-inch Allen wrench.
- Continue to shine the flashlight on the lower end of the LVDT shaft, while carefully adjusting the housing with the other hand. Position the LVDT housing so the shaft is in the center of the LVDT housing.



CAUTION: Never attempt to adjust the LVDT shaft. If the shaft becomes damaged, the load frame will not produce accurate results.



CAUTION: The load cell can be easily damaged, especially from side loading and excessive torque. **DO NOT** place Load Frame on its side when the Load Cell is in

place. Doing so will result in damage to the Load Cell.

G. Maintenance

G.1 Cleaning the BBR3

1. When cleaning the surface of the BBR3, first disconnect all power sources and place all controls in an OFF position.
2. Use a very mild cleaning agent to wipe down the outside of the unit.



NOTE: When cleaning be careful not to allow cleaning agent to enter and contaminate the fluid bath.

G.2 Changing the BBR3 Fluid Bath

1. Verify that the BBR3 has reached room temperature before attempting to change the bath fluid.
2. Connect the provided hose to the drain in the underside of the bath. Place the other end of the hose in a bucket large enough to hold the amount of fluid within the unit.
3. Carefully remove the load frame. Do not place the load frame on its side when the load cell is in place, as it can be easily damaged.
4. Use personal protective gear (PPG) to reach into the room temperature bath and pull up on the lever attached to the BBR3 plug. Once the plug is loose enough, pull it out.
5. Once the plug has been removed, the fluid will drain through the hose into the bucket. After the bath has completely drained, remove the house and discard the bath fluid per fluid manufacturer's instructions.



Figure G.1 - BBR3 plug

APPENDIX A: Warranty

Your Applied Test Systems product has been manufactured and inspected by experienced craftsmen. Applied Test Systems warrants, for the original purchaser, each product to be free from defects in material and workmanship for a period of thirteen (13) months from date of shipment or twelve (12) months from date of installation - whichever comes first. This warranty does not apply to failures caused by normal usage, misuse, or repair or service by unauthorized personnel, nor does it cover limited life electrical components which deteriorate with age such as tubes, lamps, fuses, and heaters. Load cells are covered for manufactured defects only - incidents of over load or other customer misuse are not covered under warranty. The warranty does not extend to products not manufactured or assembled by Applied Test Systems.

This warranty is expressly limited to the repair, replacement, or adjustment of the product at Applied Test Systems' option. The product must be returned to the Applied Test Systems factory or an authorized repair center. Applied Test Systems shall not be liable for any labor, transportation, or installation costs that may arise in connection with the product or return.

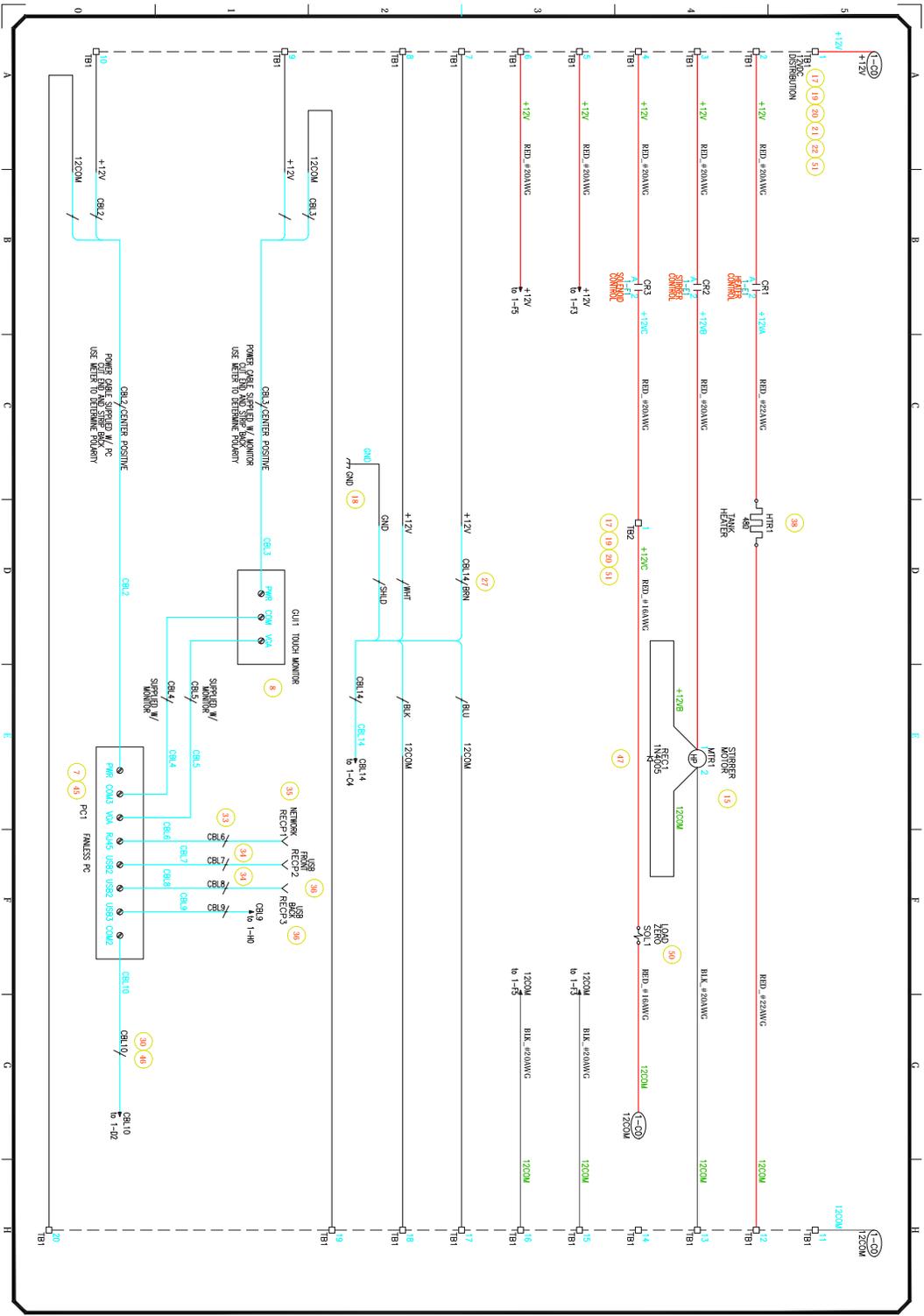
To obtain warranty service:

1. Applied Test Systems must be promptly notified in writing of the defect.
2. Upon receipt of written authorization, said defective equipment is returned as directed, with transportation charges prepaid by the buyer and –
3. Applied Test Systems examination of such equipment discloses to its satisfaction that the defect exists and was not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of merchantability or fitness for particular purpose. In no event shall Applied Test Systems be liable for direct, indirect, special, incidental, collateral, or consequential damages.

The aforementioned provisions do not extend the original warranty period of any article that has been either repaired or replaced by Applied Test Systems.

Applied Test Systems reserves the right to change published specifications.



APPENDIX C: Image Glossary

Figure A.1 - ATS Sample Data Tag	2
Figure C.1 - Front of BBR3 Unit	6
Figure C.2 - Back of BBR3 Unit	7
Figure C.3 - Load Frame	8
Figure C.4 - Tank Interior	9
Figure C.5 - Gauge Kit.....	10
Figure C.6 - Load Frame without Anvil Adapters.....	14
Figure C.7 - Load Frame with Anvil Adapters	14
Figure C.8 - BBR3 Step Disk.....	17
Figure C.9 - Internal Controls.....	18
Figure C.10 - Data Instruments	19
Figure C.11 - Basic Unit Controls	20
Figure D.1 - Load Frame Screw Location	22
Figure D.2 - Foam Inside Load Shroud.....	23
Figure D.4 - Set Screw Location on Load Nose	23
Figure D.3 - Unscrew the Lower Portion of the Load Shroud.....	23
Figure D.5 - Tightening the Set Screw	23
Figure D.7 - Attaching Lower Portion of Load Shroud	24
Figure D.6 - Load Nose with Upper Portion of Shroud Attached to Load Cell	24
Figure D.8 - Attaching Lower Portion of Load Shroud	24
Figure D.9 - Attached Load Nose with Shroud.....	24
Figure D.10 - Connecting the BBR3	25
Figure D.12 - Chiller Communication Cable in RS-485 Port on the Back of the Chiller.....	26
Figure D.13 - Chiller Communication Cable in Chiller Communication Port on the Back of the BBR3 Unit.....	26
Figure D.11 - Load Frame Hook Ups	26
Figure E.1 - Main Menu Screen	29

Figure E.2 - BBR3 Software Screen Map.....	30
Figure E.3 - Edit Users Dialog.....	31
Figure E.4 - Bath Temperature Field on Setup Screen	32
Figure E.5 - Standardization Main Screen.....	32
Figure E.6 - Step Disk Positioned Under Locator Pin.....	34
Figure E.7 - Verification Main Screen	36
Figure E.8 - Confidence Beam in Place During Verification.	37
Figure E.9 - System Verification.....	38
Figure E.10 - Test Setup Main Screen	41
Figure E.11 - Add Images to Test Dialog	42
Figure E.12 - Standard Report.....	43
Figure E.13 - Data Report	43
Figure E.14 - Run Test Main Screen.....	44
Figure E.15 - Load Control Switch in the Zero Position	45
Figure E.16 - Zero Regulator & Load Regulator	46
Figure E.17 - BBR3 Anvil Adapters	47
Figure E.18 - View Test Main Software Screen	48
Figure E.19 - Diagnostics Main Software Screen.....	49
Figure F.1 - LVDT Shaft.....	53
Figure G.1 - BBR3 plug.....	55



154 East Brook Lane - Butler, PA 16002 USA | +1-724-283-1212

sales@atspa.com | www.atspa.com