The Bisco Shear Bond Tester (SBT) is designed to test samples of composite bonded to tooth using the Ultradent test mold or to perform other tests with other test adapter blades. The maximum force limit for testing is 100 lbs., 50 kg or 500 newtons.

**WARNING:** Safety glasses should be worn when using the SBT or preparing samples for testing.

**CAUTION:** Do not exceed the maximum force limit or irreversible damage to the force gauge will occur!

**CAUTION:** Do not use the force gauge assembly designated for the Micro Tensile Tester (40 lb., 20 KG capacity limit) with the SBT or the capacity of the force gauge will be exceeded and the gauge damaged.

**CAUTION:** Make sure the proper test blade and sample holder are being used as determined by the test being performed.

**SYSTEM CONTENTS**

The shipment should contain the following items. Please do not discard the shipping carton until all items have been accounted for.

1. Test bed—silver anodized square channel 4” x 4” x 20.5” long with electronics control panel attached.

2. Box containing 50 Kg force gauge assembly—the contents listed on the box as it comes from the manufacturer has been modified by BISCO to assemble the force gauge to be used on the SBT. There will only be one item in the box, but is the complete assembly as needed for use with the SBT.

3. Sample holding clamp assembly

4. AC adapter

5. Test cradle assembly

6. Blue tinted core material (2 syringes, 5g ea.)

7. Fixture for setting sample block flush in sample clamp.

**SETUP**

1. Place the SBT on the bench with the control panel facing the user.

2. Place the force gauge assembly on the test bed by positioning the 4 notches in the slide plate over the 4 slide shoulders. See Figure 1. Rest the bottom of the slide plate on the test bed, then slide to the left so the plate is held under the shoulders. See Figure 2.
3. Slide the gauge assembly further to the left and place the nylon strap over the motor CAM. See Figure 3.

4. Make sure the gauge and slide plate move freely back and forth.

5. Plug the cord on the back of the test bed into the power jack on the force gauge located on the right side of the gauge. See Figure 4.

6. Plug the cord from the AC adapter into the jack on the left side of the control panel. See Figure 5.

7. Plug the AC adapter into the wall socket. The tester is now powered. The AC Adapter has a universal 100-240 VAC input, but a country adapter may be required for mechanical compatibility with various wall outlets.

8. Turn on the force gauge by pressing and holding the On/Zero button. Allow the force gauge to perform its power-on self-test sequence. For best results, continue to hold the On/Zero button until the display reads no AO (“No Auto Off”). This disables the automatic shutoff feature in the force gauge display. See Figure 6.
9. The force gauge is factory set to store and display the maximum tensile force in kilogram units. This is indicated by two vertical arrows in opposite directions and “MAX” on the left side of the display and “kg” in the middle of the display. To change the desired measurement units and gauge mode, refer to the force gauge instructions included in the operators manual. See Figure 7.

10. The unit is ready to use.

11. The unit has a variable speed control. In the nominal position the force is applied such that a typical sample will break in about 20 seconds. The speed can be adjusted faster (+) or slower (-) than nominal. The speed is determined by the voltage applied to the cam motor. Although the unit is not calibrated for speed, the same speed can be set and repeated by measuring the voltage to the motor with the two test jacks on the right side of the control box. To determine the motor voltage, plug the pin probes typically used with a digital voltmeter (meter not supplied) into the jacks on the right side of the control panel. See Figures 8 and 9. Set the meter for 20 volts DC. Before mounting a sample to the tester, run the unit by pressing the start button. When the motor is running, measure and record the voltage reading. The voltage can be adjusted while the motor is running during the voltage setting process, (but it is not recommended to vary the speed during actual testing.) Once the voltage is set, the testing may be performed.

NOTE: The speed that the unit resets at (clockwise rotation) is not the same speed that the unit performs the tests at (counterclockwise). DO NOT apply any voltage to the speed monitoring jacks, these are for monitoring the motor speed only.

DESCRIPTION OF TEST APPARATUS - SAMPLE HOLDING CLAMP

1. The test sample holding clamp assembly is a precision machined assembly that clamps a 1” diameter prepared sample cylinder for testing. The sample cylinder should be ½” high to allow the sample to be at the correct height for proper shear test action. When the sample is placed in the clamp, the top of the sample cylinder must be flush with the top of the clamp surface. See Figure 10. The top is marked “TOP”. One side of the clamp has an angle and a force plate on it, the other side has the clamp tightening screws. Since the sample cylinder is plastic, the screws do not need to be over tightened, but should be tight enough to keep the sample from moving or turning in the clamp. There are gripping knurls on the inside surface of the clamp to increase the holding forces.
2. Included is a fixture for helping to position the test sample flush with the top of the sample clamp. See Figure 10a.

3. Place the fixture on the top of the sample clamp such that the slot in the fixture is over the tab of the sample clamp and the hole is over the sample block. See Figure 10b.

4. Hold the fixture tight against the top. Take care to not touch the sample area. See Figure 10c.

5. Place fingers on the bottom of the sample block and press on the bottom of the sample block, pushing it against the fixture such that the other side of the sample block will be flush to the top of the sample clamp. See Figure 10d.
2. The tightening screws are mounted with a minimum of hole clearance to keep the jaws of the clamp properly aligned. Each side should only be loosened one or two turns. If the screws become hard to rotate, it is because one side has been loosened more than the other and the sides of the clamps are binding because they are not parallel. Loosen one side or the other to get the sides parallel and to free up the movement. DO NOT adjust with pliers or wrench. See Figure 11.

3. Care should be taken when storing and handling to keep the clamp clean and to avoid any possible damage from mishandling. The clamp should not have to be disassembled during use, only loosened or tightened to fit the sample cylinder.

4. The clamps are made of nickel plated steel. Do not subject to acid, alkali, corrosive salts or high magnetic fields. Do not soak in liquids.

5. Do not clean the clamps with abrasive powders, acidic or alkaline cleaning agents.

6. Some users find it convenient to have two clamp assemblies to allow one to be prepared while the other is being used on the test bed.

**DESCRIPTION OF TEST APPARATUS - TEST CRADLE**

1. The test cradle holds the test blade (crosshead contact) that is specifically designed to match the sample as prepared by the Ultradent shear test mold. Use of the test blade for other samples may damage the precision test blade and give erroneous results. Contact BISCO for information on other types of test blades and tests that are compatible with this equipment.

2. The test cradle is mounted such that the side with the swivel linkage goes over the pin and block on the end of the force gauge and the side with the slot in it goes over the alignment pin on the other end of the test bed. See Figure 12.
SUGGESTED PREPARATION OF SAMPLE AND SAMPLE CYLINDER

1. Prepare a flat dentin surface perpendicular to the occlusal direction using a slow speed diamond cutting wheel or a grinding wheel and water cooling.

2. Create a smear layer by abrading the surface with wet silicon carbide paper. 320 grit is suggested for self-etched adhesives and 600 grit is suggested for total-etch adhesives.

3. Apply and cure a layer of adhesive per manufacturer’s directions.

4. Apply and cure 1 or 2 layers of composite per manufacturer’s directions, up to a maximum of about 4mm thickness. A special blue tinted composite is available from BISCO allowing the interface between the dentin and composite to be easily seen (see ACCESSORIES). After a sample is broken, it should be inspected to verify that the break occurred at the composite/adhesive/dentin interface rather than the composite or dentin. If a break occurred other than at the interface, the user should decide how to include the results in the data. If there is white and blue material on a section of broken test sample, the break did not occur at the interface.

5. Soak the sample for 24 hours at 37°C to optimize the cure and bond.

6. Let the samples soak in room temperature DI water until ready for test.

DESCRIPTION OF TEST APPARATUS - TEST CRADLE CONTINUED

1. There is an adjustable stop screw on the slotted end of the test cradle that can be used for optional test sample preparations using more than 1 sample on a test cylinder. See Figure 13.

PREPARATION FOR TEST

1. The unit should be in the start position; the CAM should be touching the larger limit switch. If not, press the yellow RESET/REVERSE button and allow the CAM to rotate to the start position. See Figure 14.

2. Place the test sample clamp and sample into position against the stop block. The angled side of the clamp should fit against the angled side of the stop block. Move the sample clamp sideways until the test sample is in the approximate center of the test bed. See Figure 15.
3. Rotate the jog nut so the swivel linkage moves away from the test cradle. See Figure 16 & 17.

4. Place the test cradle over the stop block and test sample clamp. See Figure 17. Align the front linkage over the pull block pin. See Figure 18. Lower the back of the test cradle down towards the test bed.

5. As the cradle comes down, the slot at the back of the cradle should slip over the rear alignment pin. See Figure 19. The half-round notch of the test blade should be able to be placed against the back of the test sample. See Figure 20. The test clamp can be moved from side to side to finalize this alignment. See Figure 22.
6. The test blade should be resting on the top of the test cylinder and should be making contact at the base of the test sample. If it is making contact higher, the test results will not be accurate. Readjust as necessary. The linkage on the pull block should also be all the way down on the pin and the block holding the jog nut should be resting on the test bed.

7. Zero the force gauge.

8. With the left hand, push the force gauge towards the right side of the test bed to take slack out of the pull strap, while making final positioning of the half-round notch in the test blade against the test sample. See Figure 21. The sample clamp can be moved from side to side to align to the center and the test cradle can be moved left or right for proper positioning. See Figure 22.

9. While placing slight tension on the strap of the force gauge, rotate the jog nut to take out any additional play in the test cradle mechanism. See Figures 21 and 23. Slowly release tension on the gauge and strap.

10. It is OK if there is 1–2 kg of ambient force indicated on the force gauge after this adjustment is made. DO NOT RE-ZERO the force gauge at this point.

11. Optional instructions for multiple samples on a cylinder. If more than one test sample have been mounted on a test cylinder, an additional adjustment is recommended. When a sample fails, the test cradle may lurch forward and shear the other sample(s). To avoid this, adjust the nylon screw on the back of the alignment slide so it is about 4–5mm away from the alignment pin, after the test cradle has been positioned and the jog nut adjusted. See Figure 24. This will allow the test to be performed, but will stop the test cradle from moving forward and damaging other sample placements. For best results with multiple placements, they should be spaced as far apart as possible from each other, using the full area of the sample tooth.
1. Press and hold the green START/TEST button for two seconds. The green light will come on and stay on after the button is released. The CAM will rotate counterclockwise. See Figure 25.

**NOTE:** If the motor stops after a few seconds, the START button was probably pressed and released too quickly, the START button can be repressed to continue the test. See Figure 25.

2. Allow the test to run until the sample is broken.

3. If the CAM is allowed to continue to run, it will trip the small limit switch (CAM stop switch) and automatically reverse direction until it returns to the start position. The yellow light will go on when the CAM is reversing. See Figure 26.

4. The operator can reset and reverse the CAM manually anytime after about 4 seconds (at nominal speed) from starting the test by pressing the yellow RESET/REVERSE button. The 4 second delay is to allow the CAM enough rotation to overcome the hysteresis of the large limit switch.

5. The unit will automatically stop when it returns to the start position and wait for the next test.

6. **CAUTION:** Do not allow the unit to exceed the maximum force limit of the gauge as printed on the front label or the gauge will be damaged and be considered out of warranty. The force gauge has an internal memory that stores force overloads and can only be cleared by the force gauge manufacturer. If the reading exceeds the maximum force limit, press reset to stop the test.

7. Inspect the broken sample to verify that the break occurred at the composite/adhesive/dentin interface rather than in the composite or dentin. If a break occurred other than at the interface, the user should decide how to include the results in the data.

**MAINTENANCE**

1. The unit does not require normal maintenance, other than keeping the test bed and slide surfaces clean.

**REMOVING THE FORCE GAUGE ASSEMBLY FROM THE UNIT FOR TRANSPORT OR STORAGE**

1. Remove the test cradle from the test bed.

2. Slip the nylon strap over and off of the CAM, then slide the slide plate to the right until the notches in the slide plate line up with the shoulder screws.

3. Lift the slide plate off of the test bed.
PREPARING THE FORCE GAUGE FOR RETURN

1. Remove the 4 screws on the bottom of the slide plate and save the plate and screws.

2. Remove the pull block and threaded spacer from the gauge and save. It is not necessary to remove the pull block from the threaded spacer.

3. Return only the Compact Gauge to MECMESIM (manufacturer) or BISCO for repair or replacement.

REPLACING THE FORCE GAUGE ON THE ASSEMBLY

1. Attach the open end of the threaded spacer to the rod on the force gauge, leaving slightly loose.

2. Mount the slide plate to the bottom of the force gauge, allowing the pull block to be located in the opening in the plate. Do not over tighten the screws.

SPECIFICATIONS

20.25” (413mm) L x 8.0” (203mm) W x 4.5” (114mm) H

Shipping weight = 10 lbs (4.5 Kg)

Shipping dimensions = 24” (514mm) x 10.25” (260mm) x 10.25” (260mm)

100-240 VAC 0.5 AMP a 50-60 Hz universal power adapter with U.S. plug blades

ACCESSORIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-6311P</td>
<td>Additional test clamp</td>
</tr>
<tr>
<td>T-6312P</td>
<td>Replacement test blade</td>
</tr>
<tr>
<td>T-6313P</td>
<td>Replacement test cradle (with blade)</td>
</tr>
<tr>
<td>T-6315P</td>
<td>Carrying Case for Shear Bond Tester (T-63010K)</td>
</tr>
<tr>
<td>A-1728P</td>
<td>Blue Tinted Core Material (2 syringes, 5g ea.)</td>
</tr>
</tbody>
</table>

BISCO, Inc.
1100 W. Irving Park Rd.
Schaumburg, IL 60193 USA
1-800-247-3368
1-847-534-6000
Fax: 1-847-891-5049