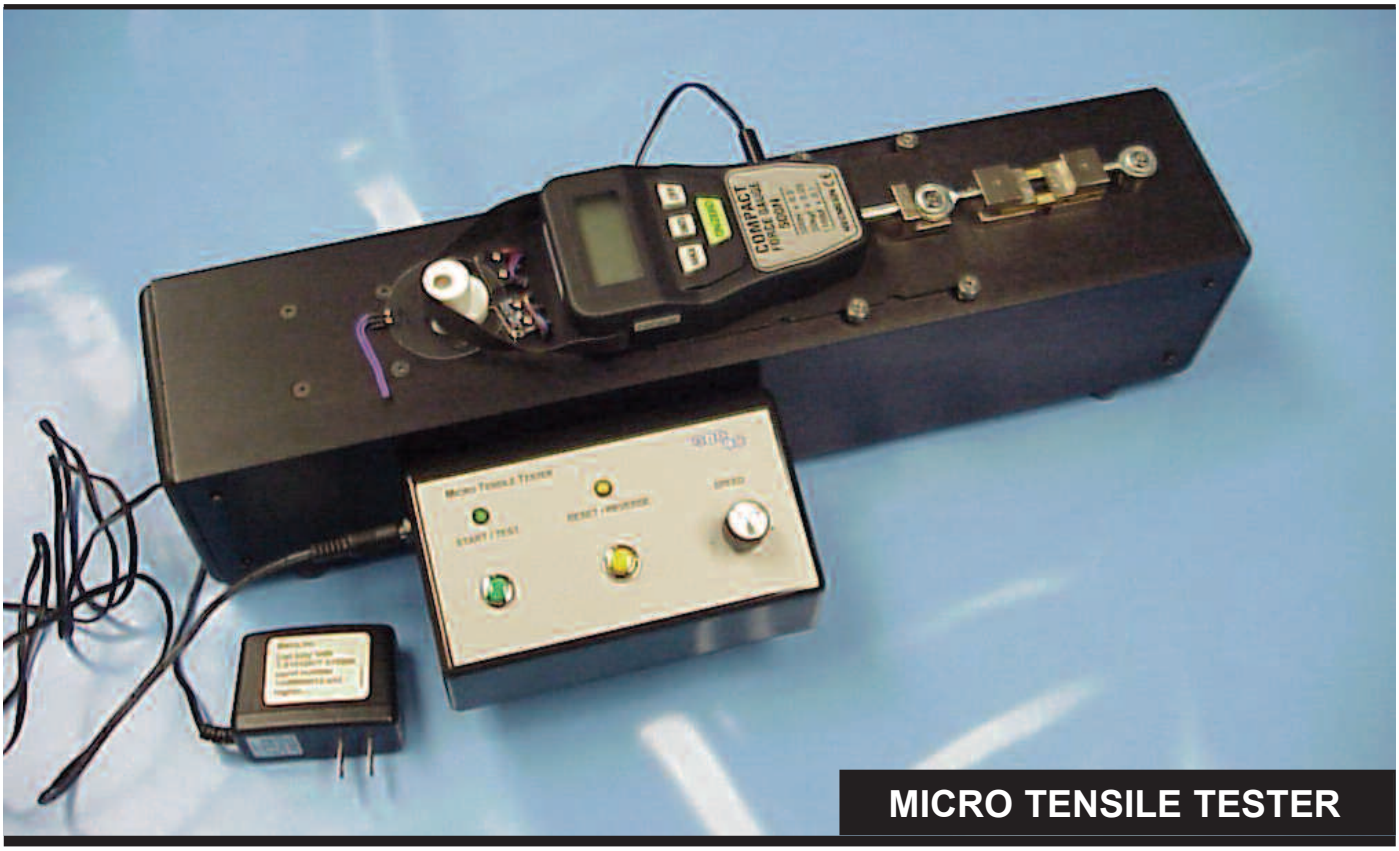
Micro Tensile Tester
User Manual

(Ref. T-61010K)
110/220 Volts



MICRO TENSILE TESTER

Bringing Science to the *Art* of Dentistry™

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Made in the U.S.A.

IN-161
Rev. 10/08

MICRO TENSILE TESTER USER INSTRUCTIONS

The Bisco Micro Tensile Tester (MTT) is designed to test 1mm x 1mm (approx.) cross sectional samples of composite bonded to tooth. The typical force required for testing is less than 45 lbs., 20 kg or 200 newtons.

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

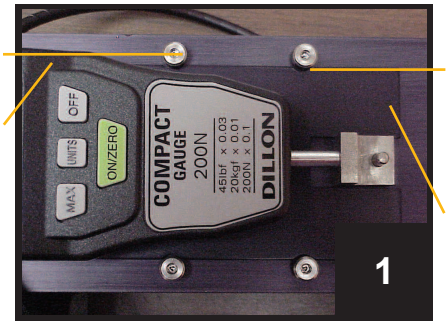
CAUTION: Do not exceed the maximum force limit of the force gauge supplied or irreversible damage to the force gauge will occur.

SYSTEM CONTENTS

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

1. 1 Test bed – black anodized square channel 4″ x 4″ x 18.6 ″ long with electronics control panel attached
2. Box contains 1 force gauge assembly – the contents listed on the box as it comes from the manufacturer have been modified by BISCO to assemble the force gauge to be used on the MTT. There will only be one item in the box, but it is the complete assembly as needed for use with the MTT
3. 1 AC to DC power adapter
4. Test block assemblies in clear plastic protective tube
5. 10 Polycarbonate introductory kit blocks for holding and cutting sample bars
6. 1 Zapit* introductory kit
7. Blue tinted core material (2 Syringes, 2.5g ea.)

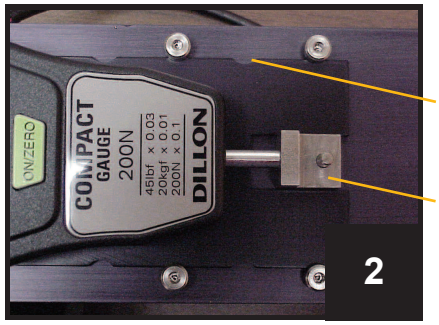
SETUP



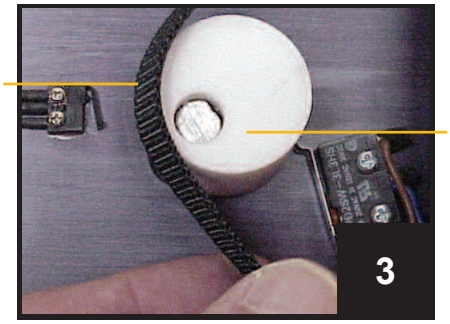
1. Place the MTT on the bench with the control panel facing the user.

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.**

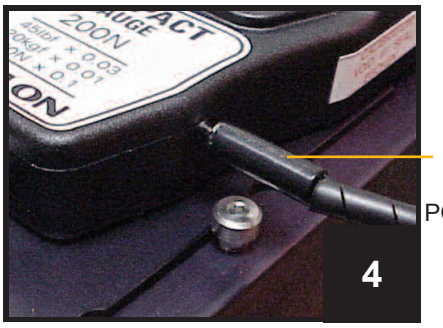


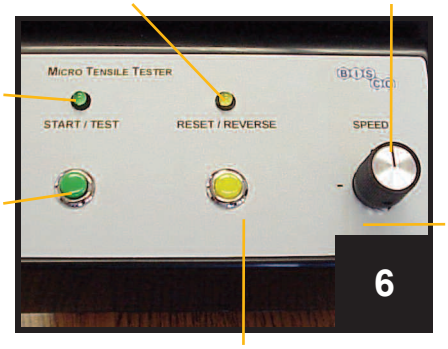
3. The pull block should be slightly loose. **See Figure 2.**



4. Slide the gauge assembly further to the left and place the nylon strap over the motor CAM. **See Figure 3.**

*Zapit Base, Zapit Accelerator, and Zapit Solvent are available from Dental Ventures of America, 800-2280-6696, www.dentalventures.com as well as BISCO (see **ACCESSORIES**).





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.

8. Turn on the force gauge by pressing the On/Zero button. Allow the force gauge to perform its power-on self-test sequence. For best results, hold the On/Zero button until the display reads no AO ("No Auto Off").

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 this operators manual.

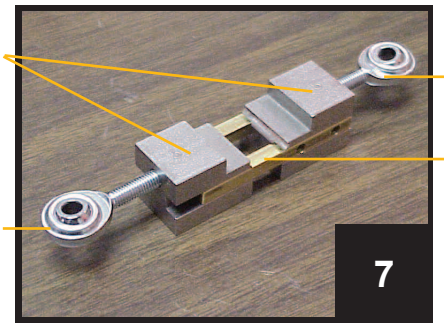
10. The unit is ready for use.

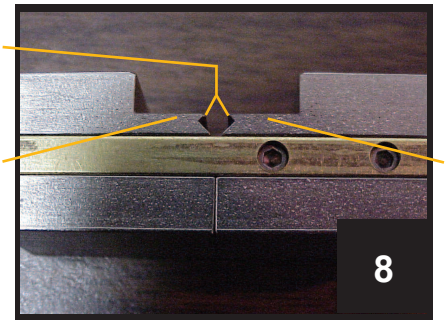
11. The unit has a variable speed control. In the nominal position the force is applied such that a typical sample will break in about 60 seconds. The speed can be adjusted faster (+) or slower (-) than nominal. The speed is determined by the voltage applied to the CAM motor. Although the unit is not 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 into the jacks on the right side of the control panel. **See Figure 6**. 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).

DESCRIPTION OF TEST BLOCK





1. The test block is a precision machined assembly providing a minimum of play between the test jaws while also minimizing the friction between the jaws. **See Figure 7**.

2. Care should be taken when storing and handling to keep the block clean as to avoid any possible damage. Do not twist or bend the brass slide keys, as this will cause the test block to bind and give erroneous results.

3. The jaws of the test block have a 2mm gap between them to allow the test sample to be glued to the block without glue migrating between the jaws and giving erroneous readings. The edges of the jaws are also cut back at an angle to further allow the sample to be glued in place without glue dripping between the jaws. **See Figure 8**.

4. The test block is made from steel for durability. Broken samples and adhesive can be removed by scraping with the edge of a sharp razor blade.

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

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

SUGGESTED PREPARATION OF SAMPLE AND TEST BLOCK

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.

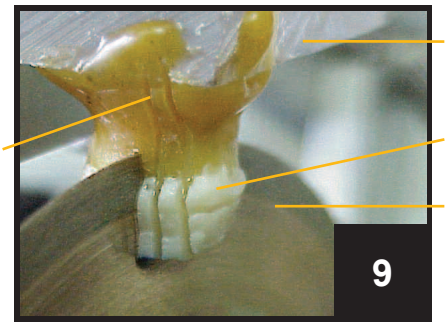
2. Create a smear layer by abrading the surface with wet silicon carbide paper. 320 grit is suggested for self-etched adhesives and 600 grit is suggested for total-etch adhesives.

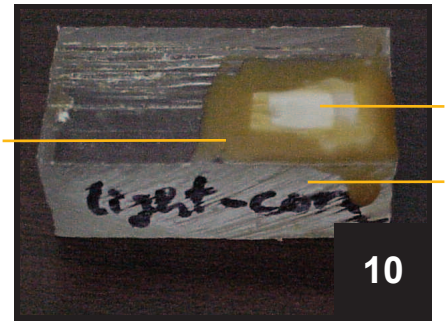
3. Flatten the gingival side of the sample on a grinding wheel and attach to a mounting block (acrylic or polycarbonate) with KERR Sticky Wax. Recommended block size is 1.5″ x .75″ x .4″. Mounting blocks are available from BISCO (see **ACCESSORIES**).

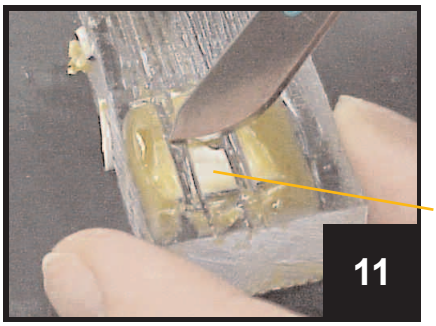
4. Apply and cure a layer of adhesive per manufacturer's instructions.

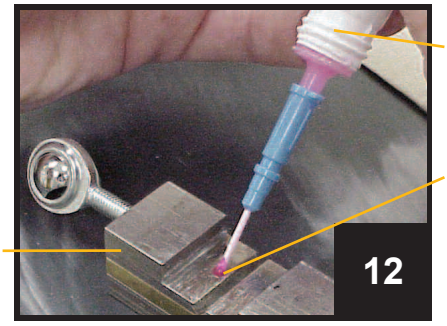
5. Apply and cure 1 or 2 layers of composite per manufacturer's instructions, up to a maximum of about 4mm thickness. A special blue tinted core material is available from BISCO allowing the interface between the dentin and composite to be easily seen (see **ACCESSORIES**). After a sample is broken, 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.

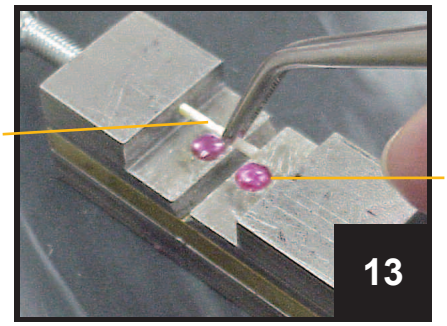
6. Soak the sample for 24 hours at 37° C to optimize the cure and bond.











7. Section into 0.9mm thick slabs from the occlusal to the gingival using a water cooled diamond saw at 100rpm with 75 grams of force.

   Tip: Move the saw index 0.9mm plus the width of the blade each time. **See Figure 9.** Make sure the cuts are perpendicular to the bond interface.

8. Mount the slab sections flat on their side onto another plastic block with KERR Sticky Wax and section into 0.9mm x 0.9mm bars. **See Figure 10.** It is important to make sure that the bars are cut such that the bond interface is perpendicular to the sides. If not, the cross section area will be slightly larger as it will be a diagonal across the measured bar dimensions and the force applied will not be perpendicular to the bond, resulting in an invalid computation of MP as well as some shear force vectors instead of pure tensile force acting on the bond interface.

9. Let the bars soak in room temperature DI water until ready for mounting to the test block.

10. Break away the wax at each end of the array of bars and carefully pick one bar off the block with the end of a scalpel. **See Figure 11.**

11. Scrape any excess wax from the samples and measure the actual cross sectional dimensions of the sample and record.

    Tip: Scrape towards the interface rather than away so as not to put any stress on the interface and break the sample.

12. Place the sample on a paper towel to absorb any excess moisture.

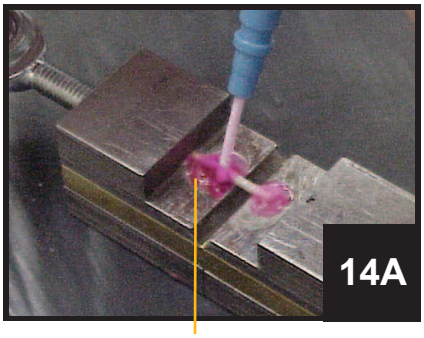
13. Make sure the surface of the test block is clean and free of material from the previous test. The jaws should be off of the test bed on the bench, on a paper towel or sheet of rubber.

14. Close the jaws tightly together. Place a drop of glue (Zapit Base*) on each jaw in the middle of the test sample mount area. **See Figure 12.**

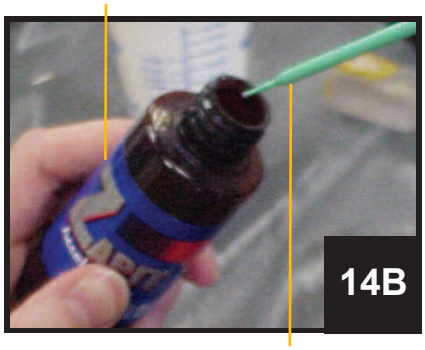
15. Pick up the sample with tweezers at the interface and place on the jaws. It is important that the sample be parallel to the direction of the test block keys so the tension does not have a sideways vector. Position the sample so the interface is over the gap between the jaws. Make sure that no excess adhesive has dripped into the gap or on the keys. **See Figure 13.**

*Zapit Base, Zapit Accelerator, and Zapit Solvent are available from Dental Ventures of America, 800-2280-6696, www.dentalventures.com as well as BISCO (see **ACCESSORIES**).

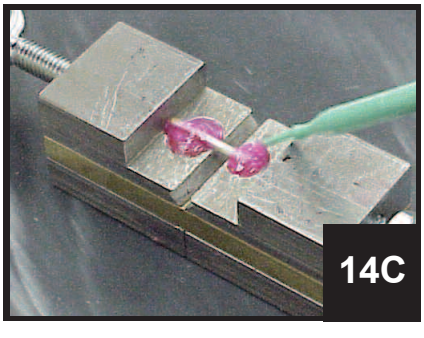
SUGGESTED PREPARATION OF SAMPLE AND TEST BLOCK CONTINUED



SECOND DROP OF ZAPIT BASE



BRUSH TIP WITH DROP OF ACCELERATOR

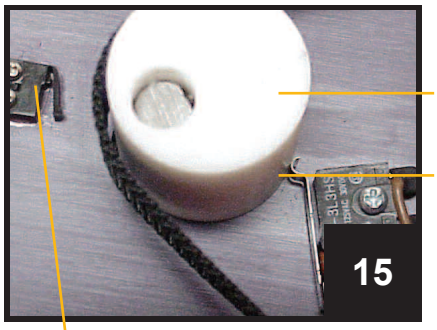


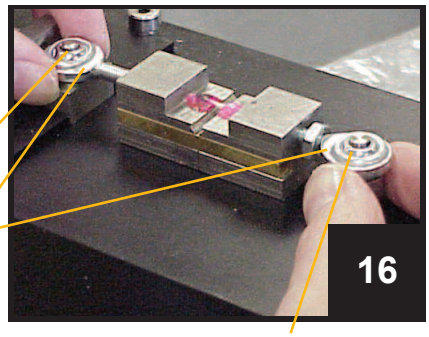
PLACING ACCELERATOR - ON DROP OF ZAPIT BASE

16. Apply another drop of Zapit Base on both sides to cover the ends of the sample (**See Figures 14A and 14B**), then apply a small amount of Zapit Accelerator* with a small pin or probe to cure. Repeat once more if necessary to assure the sample is well attached to the test block. **See Figure 14C.**

    Tip: If not using the special tinted composite, identify the composite side of the sample for future analysis.

PREPARATION FOR TEST

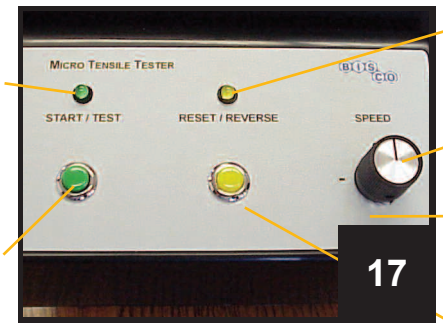




1. The unit should be in the start position; the CAM should be touching the larger limit switch. If not, press the yellow RESET/REVERSE button and allow the CAM to rotate to the start position. **See Figure 15.**

2. Place the test block into position by sliding the linkages over the fixed and pull block pins. There should be a slight bit of slack in the nylon strap, so no tension is placed on the test sample. The linkages can be adjusted by screwing them in or out to increase or decrease the starting tension as needed. **See Figure 16.** It is necessary to remove the test block from the test bed to adjust the linkages.

TEST



1. Press the ON/ZERO button on the force gauge to clear the last saved reading and reset the force gauge to zero.

2. 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 counter clockwise. **See Figure 17.**

*Zapit Base, Zapit Accelerator, and Zapit Solvent are available from Dental Ventures of America, 800-2280-6696, www.dentalventures.com as well as BISCO (see **ACCESSORIES**).

TEST CONTINUED

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.

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

4. If the CAM is allowed to continue to run, it will trip the small limit switch and reverse direction until it returns to the start position. The yellow light will go on when the CAM is reversing. **See Figure 17.**

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

6. The unit will automatically stop at the start position and wait for the next test.

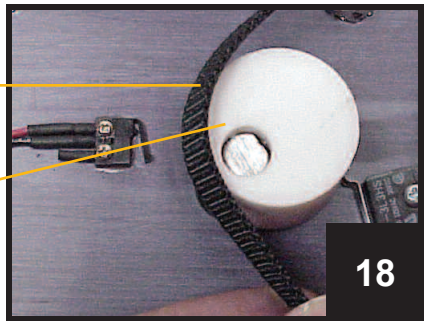
   CAUTION: Do not allow the unit to exceed the maximum force limit of the gauge as printed on the front label or the gauge will be damaged and be considered out of warranty. The force gauge has an internal memory that stores force overloads and can only be cleared by the force gauge manufacturer. If the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

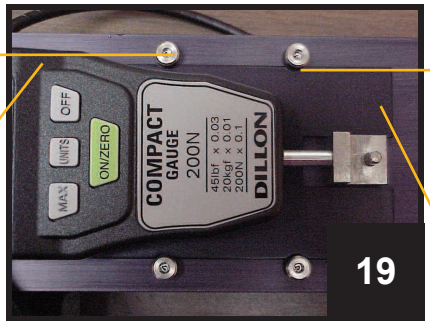
7. Inspect the broken sample to verify that the break occurred at the composite/adhesive/dentin interface rather that in the composite or dentin. If a break occurred other than at the interface, the user should decide how to include the results in the data. If there is white and blue material on a section of broken test sample, the break *did not* occur at the interface. Breakage can occur at the point of a bubble in composite or naturally occurring weak point in dentin.

MAINTENANCE

1. The unit does not require normal maintenance, other than keeping the test bed and slide surfaces clean. It is recommended to remove all components from the gauge before returning it to the manufacturer for any reason.

REMOVING THE FORCE GAUGE ASSEMBLY FROM THE UNIT



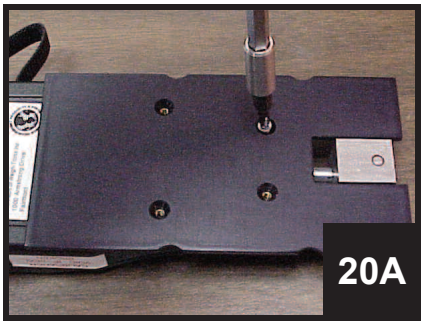


1. Remove the test block from the test bed.

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. **See Figure 18.**

3. Lift the slide plate off of the test bed. **See Figure 19.**

PREPARING THE FORCE GAUGE FOR RETURN FOR CALIBRATION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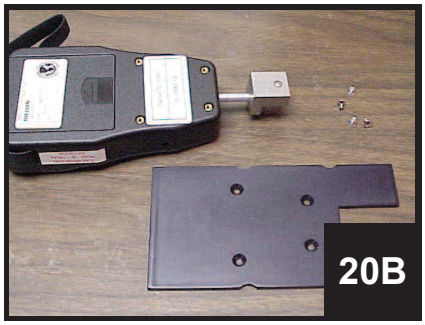
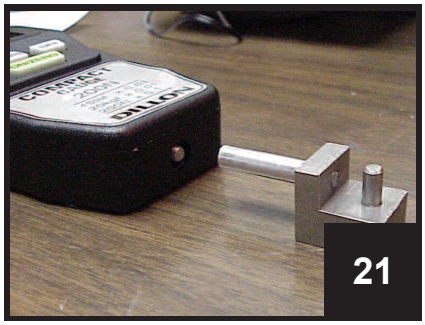

20B



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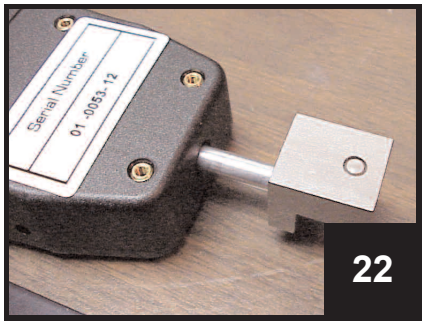
1. Remove the 4 screws on the bottom of the slide plate and save the plate and screws. **See Figures 20A and20B.**

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. **See Figure 21.**

3. Only return the Compact Gauge to MECMESIM (manufacturer) for calibration.

REPLACING THE FORCE GAUGE ON THE ASSEMBLY



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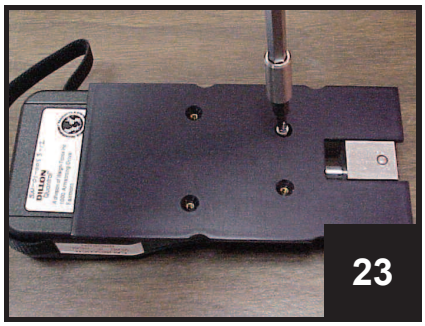
1. Attach the open end of the threaded spacer to the rod on the force gauge, leaving slightly loose. **See Figure 22.**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2. Mount the slide plate to the bottom of the force gauge, allowing the pull block to be located in the opening in the plate. **See Figure 23.** Do not over tighten the screws.

SPECIFICATIONS

19″ (482mm) L x 8.0″ (203mm) W x 4.5″ (114mm) H

Shipping weight = 10 lbs (4.5 Kg)

Shipping dimensions = 24″ (610mm) x 10.25″ (260mm) x 8.5″ (216mm)

ACCESSORIES

T-6111P	Additional test
T-6112P	ZAZAI ZAPIT introductory kit (1/3oz. base, 2oz solvent, 2oz accelerator, 2 tips)
T-6113P	ZAZAB-20 ZAPIT base refill (20g)
T-6114P	10 polycarbonate blocks
T-6115P	Carrying case for Micro Tensile Tester
T-6116P	Blue tinted Core Material (2 syringes, 2.5g ea.)

Bringing Science to the Art of Dentistry™

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