BROOKFIELD CT3

TEXTURE ANALYZER

Operating Instructions

Manual No. **M/08-371**

BROOKFIELD

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I. INTRODUCTION

The CT3 Texture Analyzer is the most recent development of the original Boucher Jelly Tester. The original product was created as the Stevens Texturemeter and evolved into the CNS Farnell LFRA TA (Leatherhead Food Research Association Texture Analyzer). Brookfield Engineering first enhanced the design of the LFRA, maintaining the characteristics of the original equipment, while expanding its measurement capabilities and ease of use by incorporating modern digital technology.

The new Brookfield CT3 Texture Analyzer is the third generation of this venerable product, adding tension testing capability, increased load cell options, space for large samples, two options for base tables and a wider range of accessories for more flexibility.

The principle of operation of the CT3 Texture Analyzer is to subject a sample to controlled forces in compression using a probe, or in tension using grips. The resistance of the material to these forces is measured by a calibrated load cell and shown in either grams or Newtons. These forces are a function of the properties of the sample and the parameters of the test method.

There are five load cell ranges available for the CT3 Texture Analyzer offered by Brookfield:

Model	Load Cell Range
CT3-100	100g
CT3-1000	1kg
CT3-1500	1.5kg
CT3-4500	4.5kg
CT3-10k	10kg

I.1 Components

Please check to be sure that you have received all components, and that there is no damage. If you are missing any parts, please notify Brookfield Engineering or your local Brookfield agent immediately. Any shipping damage must be reported to the carrier.

Component	Part Number	Quantity
CT3 Texture Analyzer	varies	1
Probe	varies	per order
Operating Manual	M08-371	1
USB Cable	Part # DVD-202	1
Power Cord		1
115 Volt *or*	DVP-65	1
230 Volt	DVP-66	
TextureLoader CD	Part # TIA-0106Y	1
Probe Adapter M6 to M3 Threads	TA51	1
Optional		
Temperature Probe	DVP-94Y	1
Bloom Strip	CT3-CS-100 *or* CT3-CS-1000	1
Calibration Weight Set (1)	TA-CW-100C, -1000C, -1500C, -4500C, -10kgC	1
Standard Probe Kit	TA-P-KIT2	1
TexturePro CT Software	TA-CT-PRO	1

Note: Optional components may include probes or fixtures. See Appendix A for details.

I.2 Utilities

Input Voltage:	90-265 VAC
Input Frequency:	50/60 Hz
Power Consumption:	150 VA
Fuse:	Two 4 amp, 5 x 20mm, Time-lag

Power Cord Color Code:

	United States	Outside United States
Hot (live)	Black	Brown
Neutral	White	Blue
Ground (earth)	Green	Green/Yellow

Main supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage.

I.3 Units

The CT3 Texture Analyzer uses the SI system of units for all parameters.

Parameter	**Unit**	**Abbreviation**
Load	Grams or Newtons	g or N
Deformation	Millimeter	mm
Time	Seconds	s
Speed	Millimeter per second	mm/s
Work	MilliJoules	mJ

I.4 Specifications

Load:

Model	Range Grams	Resolution Grams	Accuracy*
CT3-100	0-100	0.01	±0.5%FSR
CT3-1000	0-1000	0.10	±0.5%FSR
CT3-1500	0-1500	0.20	±0.5%FSR
CT3-4500	0-4500	0.50	±0.5%FSR
CT3-10kg	1-10000	1.0	±0.5%FSR

FSR = Full Scale Range

*This value applies to the full range of operating temperatures as defined in Section I.4 Environmental Conditions. Accuracy will be greatly improved if the instrument is operated at or close to ambient temperature.

Trigger Point:

Model	Range Grams	Resolution Grams
CT3-100	0.1-10	0.01
CT3-1000	0.2-100	0.10
CT3-1500	0.2-150	0.2
CT3-4500	0.5-500	0.5
CT3-10k	1-1000	1.0

Speed: 0.01 to 0.1 mm/s in increments of 0.01 mm/s
0.1 to 10 mm/s in increments of 0.1 mm/s
Accuracy: ±0.1% of set speed

Position: Range: 0-101.6 mm
Resolution: 0.1mm
Accuracy: 0.1mm

Temperature Measuring Range: -20°C to 120°C

Output: RS232 Compatible Serial Port, USB Port

Environmental Conditions: 0°C to 40°C temperature range (41°F to 104°F)
20% - 80% relative humidity, non-condensing atmosphere

Use: Intended for indoor use only
Altitude: up to 2000m

I.5 Installation

1) Prepare a clean, level surface.

NOTE: This instrument is a sensitive load measuring device. It should be installed on a clean, solid, level bench surface which is free from external vibrations.

2) Unpack and remove the CT3 Texture Analyzer from the shipping container.

> ⚠ The CT3 Texture Analyzer weighs 17 kg (37 pounds). Use caution when lifting the unit out of the packaging.

3) Place the CT3 Texture Analyzer on a sturdy, level surface. Adjust the four feet to ensure that the instrument is stable.

4) Remove any additional components from the shipping package. Save the shipping container and packaging for future use.

5) Make sure that the AC power switch at the rear of the CT3 Texture Analyzer is in the OFF position. Connect the power cord to the socket on the back panel of the instrument and plug it into the appropriate AC line. Position instrument so that the power cord can be removed easily.

> ⚠ The AC input voltage and frequency must be within the appropriate range as shown on the model and serial tag of the instrument (located on the back of the CT3).

> ⚠ The CT3 Texture Analyzer must be earth grounded to ensure against electronic failure!

6) If appropriate, connect communication cable which is supplied with Texture Loader software to the appropriate port for connection to a computer.

7) Turn the power switch to the ON position. The startup screen will indicate the firmware version and load range of the CT3 (Figure II.1).

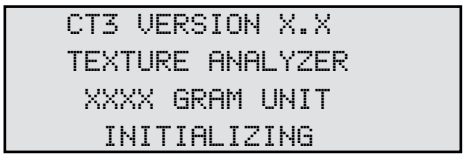


Figure I.1

8) Allow the instrument to warm up for 10 minutes. If desired, check calibration according to Section III.8.

I.6 Safety Symbols and Precautions

Safety Symbols

The following explains safety symbols which may be found in this operating manual, or on the instrument itself.

 Indicates hazardous voltages may be present.

 Refer to the manual in all cases where this symbol is evident. Used for specific warning or caution information to avoid personal injury or damage to the instrument.

 Keep hands, fingers and other body parts clear of moving parts when operating instrument.

 Functional Earth Terminal - Main power entry module must have an earth conductor.

Precautions

 If this instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

 This instrument is not intended for use in a potentially hazardous environment.

 In case of emergency, turn off the instrument and then disconnect the electrical cord from the wall outlet.

 The user should ensure that the substances placed under test do not release poisonous, toxic or flammable gases or liquids at the temperatures which they are subjected to during the testing.

I.7 Key Functions

The CT3 Texture Analyzer is operated through two keys and a knob located on the keypad. Additionally, there is an emergency stop button located above the base and to the right of the probe rod.

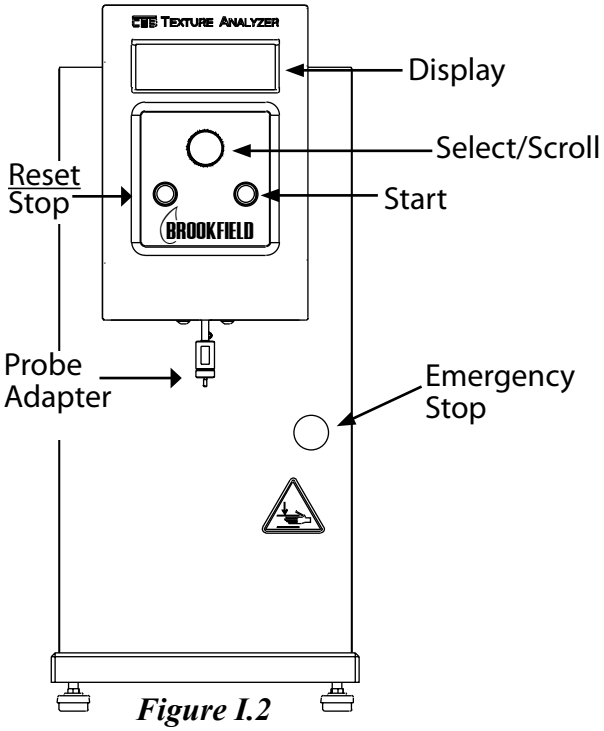


Figure I.2

RESET / STOP
This key is used to stop a test in progress and return to starting position.

START
This key is used to start the test. During the descent of the probe, prior to the trigger point, this key can be used to accelerate the rate of descent.

SELECT / SCROLL (see section III.6)
This knob has multiple functions:

1. The knob is pressed to select the option currently highlighted.
2. The knob is rotated to change the value of the parameter being selected.
3. During a test, pressing this knob will display test parameters.
4. Holding knob depressed while turning on power will switch the load display units between grams and Newtons.

EMERGENCY STOP
This button is used to abort a test in case of an emergency condition.

BACK PANEL

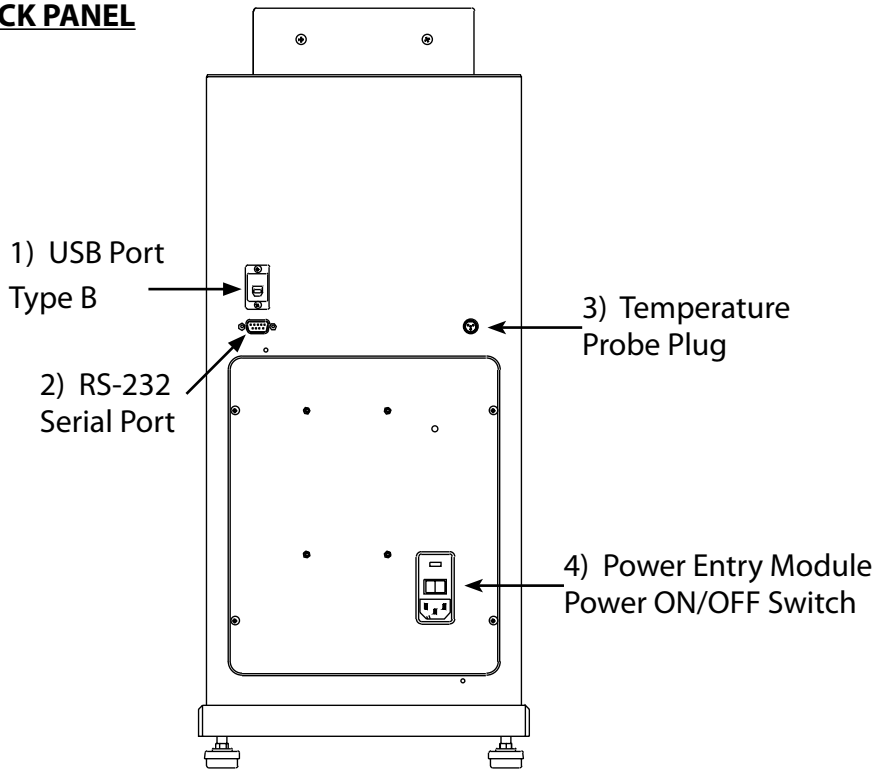


Figure I.3

1) USB TYPE B PORT (Female) - PIN 1: POWER PIN 3: + Data
PIN 2: - Data PIN 4: Cable Gnd
Use with - USB Cable P/N DVP-202 to connect instrument to a computer. Cable USB 2.0 A Male to B Male
2) RS-232 Serial Port
See Appendix D, CT3 to Computer Command Set
3) Temperature Probe Plug - 4 pin plug. Use with BEL P/N DVP-94Y, 4 wire probe assembly.
4) Power Entry Module: ON/OFF switch-fused (see I.2 Utilities). Voltage: 90-265 VAC

I.8 Cleaning

Instrument and Keypad:	Clean with a dry, nonabrasive cloth. Do not use solvents or cleaners.
Probes and Fixtures:	Probes and fixtures are made from a variety of materials from metals (stainless steel, aluminum) to plastics (acrylic, Black Delrin, Nylon). Clean with a nonabrasive cloth using solvents that are appropriate for both the sample material and the material of the probe and/or fixture.

⚠ Do not apply excessive upward, downward or sideways force to probe while fixed to CT3. Damage may occur to the load cell.

II. QUICK START

1. Unpack the instrument according to Section I.5.

2. Install base table in accordance with the instruction sheet that is enclosed with the base table. Place the sample on the base table. Adjust the table height so that the surface of the sample is within 5 mm of the probe.

3. Attach the selected probe. See Section IV.2 for more information.

4. Set the test mode to Normal. Please review section III.6 for detailed explanation of operation of Select/Scroll knob.

5. Set the trigger value as recommended below.

Load Cell	Recommended Minimum Trigger Value
100g	0.5g
1000g	2g
1500g	3g
4500g	4.5g
10kg	10g

Table II.1

6. Set the test speed and distance. See Section IV.3 for more information.

7. Press the START button. The weight of the probe will autozero and then the test will start.

8. Record all test results.

9. Remove sample and clean the probe.

III. OPERATION

III.1 Principle

The Brookfield CT3 Texture Analyzer can be operated in either compression or tension modes.

In compression mode a probe moves slowly at pretest speed until a threshold value (the trigger) is reached. The probe then moves a set distance at a set speed into the sample material that is placed (or fixed) on the base table. The load is continuously monitored as a function of both time and distance until the probe again returns to its starting position.

In tension mode the sample is typically held between a pair of grips. The test starts when the trigger load is reached as the grips move apart. The load resistance as the sample is stretched or pulled apart is recorded as a function of both time and distance.

III.2 Emergency Stop

The CT3 Texture Analyzer can operate with up to 10,000g (10 kg) of force dependent on load cell. Be sure to place only the sample for test under the probe.

Keep body parts and clothing away from the probe during the test.

The CT3 Texture Analyzer uses applied forces to evaluate a material. The user must take care not to place any body part or clothing in the testing zone while the machine is moving. The CT3 Texture Analyzer is provided with an Emergency Stop Button (see Figure I.2) for use in case of an operational problem.

Pressing the Emergency Stop Button will cause different immediate actions depending upon the type of test in use.

Compression: Pressing Emergency Stop Button during a compression test will:

1) Stop the test in progress and display emergency stop screen.

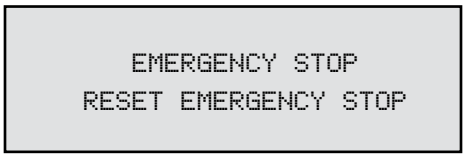


Figure III.1

2) The probe immediately returns to the home position.

3) The Emergency Stop condition can be canceled by rotating the Emergency Stop Button clockwise. This will reset the CT3 firmware to the power up condition.

Tension: Pressing Emergency Stop Button during a tension test will:

1) Immediately stop probe movement and display the emergency stop screen.

2) Probe returns to test start position, after resetting the emergency stop.

3) A sequence of menus then leads user back to the home position.

III.3 Base Table

Both base tables are designed to provide height adjustment allowing the sample to be placed close to the probe starting position, see Figure III.2.

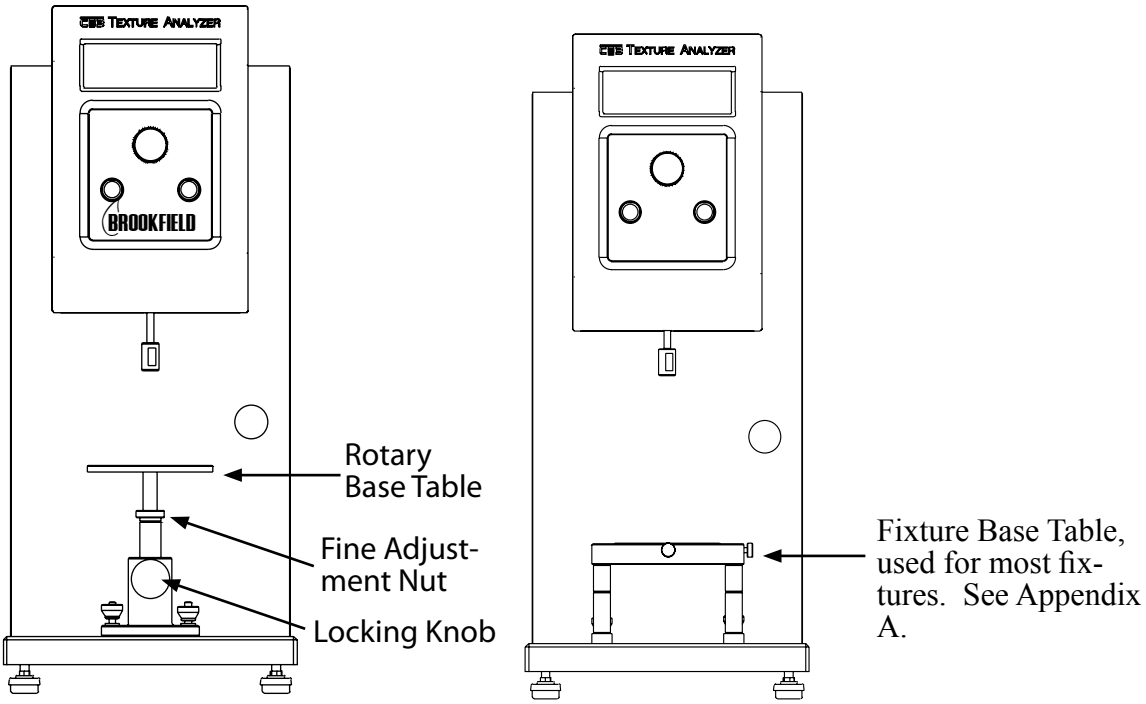


Figure III.2

Rotary base table

The locking knob is used to allow quick, large height adjustments, then lock the table into position. The fine adjustment nut under the table allows securing the table after making fine height adjustments by rotating the table to the left or right.

Always hold the Rotary Base Table with one hand while loosening the Locking Knob. This will prevent the Rotary Base Table from falling abruptly to the CT3 housing.

Keep fingers away from the Fine Adjust Nut when lowering the Rotary Base Table to prevent a pinch injury.

Fixture base table

This table allows the use of a wide variety of test fixtures and is shown with 2 1/2 inch leg extensions. Additional extension pieces of 2 inches and 4 inches in length are supplied. These allow setting the height of the test surface the desired distance from the probe starting position. Some disassembly of the base table is necessary to add or remove leg extensions.

III.4 Probes

There are a range of probes available for use with the CT3 Texture Analyzer (see Appendix A). All probes are configured with a right hand thread to attach to the CT3. Attach the probe with care to prevent damage to the threads. **Do not overtighten!**

The probes may be cleaned while attached to the CT3. Follow recommendations in Section I.8.

> ⚠ Do not apply excessive upward, downward or sideways force. Damage may occur to the load cell.

III.5 Fixtures / Jigs

There are a range of fixtures / jigs available for use with the CT3 Texture Analyzer (see Appendix A). These devices are designed to hold a sample in place during measurement. Each fixture / jig is designed to attach to the Base Table. Refer to the instructions provided with the fixture / jig for proper installation.

Note: Brookfield can design custom fixtures/jigs to meet your application. Contact Brookfield or our authorized dealer for details.

III.6 Operating Menu

The CT3 Texture Analyzer offers six test modes and one calibration mode.

Normal Test – single compression cycle.
Hold Time Test – compress and hold.
Cycle Count Test – compress sample several times.
Bloom Test – compression test measures gelatin bloom strength.
TPA Test – two cycle Texture Profile Analysis compression test.
Tension Test – pulls apart a sample using tension force.
Static Load Test – monitors load while hanging calibration weights.

Each test mode requires parameters to be set. All test mode selection and parameter setting is done using the Select/Scroll knob (see figure 1.2). This knob is both rotated and depressed during operation.

NOTE: When setting the test speed, pressing the RESET button will toggle the increments from 0.1mm/s to 1mm/s.

The specific parameters required will depend upon the type of test chosen:

Normal Test requires:	trigger, deformation, speed
Hold Time Test requires:	hold time, trigger, deformation, speed
Cycle Count Test requires:	cycle count, trigger, deformation, speed
Bloom Test requires:	All parameters are fixed according to industry standard
TPA Test requires:	trigger, deformation, speed

Tension Test requires:	trigger, deformation, speed
Static Load Test requires:	none

These parameters, once set, will be maintained by the CT3 during power down to facilitate repetitive testing. The test mode used prior to powering down will be presented on the screen at the next power up. A test is started by depressing the start button.

The test parameters are defined as follows:

Trigger: The load, in grams, measured by the CT3 to indicate that the probe is in contact with the sample. Once the trigger value is reached, the test will begin at the defined speed. Brookfield recommends trigger values as specified in Table III.1

Deformation: The total downward distance the probe will travel once the trigger value is reached.

Speed: The speed at which the probe will travel the specified distance.

Time: The number of seconds that the probe will be held at the defined distance during a Hold Time test.

Count: The number of cycles (Speed and Distance) that will be applied to the sample during a Cycle Count test.

All parameters can be set within the ranges shown in Table III.1.

Parameter	100g	1000g	1500g	4500g	10k
Trigger*	0.1 – 10g	0.1 – 100g	0.2 – 150g	0.5 – 500g	1.0-1000g
Deformation	0.1 – 101.6mm	0.1 – 101.6mm	0.1 – 101.6mm	0.1 – 101.6mm	0.1 – 101.6mm
Speed	0.01 – 10 mm/s	0.01 – 10 mm/s	0.01 – 10 mm/s	0.01 – 10 mm/s	0.01 – 10 mm/s
Hold Time	0 – 9999 s	0 – 9999 s	0 – 9999 s	0 – 9999 s	0 – 9999 s
Cycle Count	0 – 99	0 – 99	0 – 99	0 – 99	0 – 99

* Minimum recommended values for trigger are shown in table II.1.

Table III.1

Define a test by first selecting a test mode. Rotate the Select / Scroll knob until the required test mode is displayed, then press the Select / Scroll knob to confirm your choice. As the test modes are displayed, the parameters specific to that mode will be shown with the previously selected parameters.

Once a test mode is selected, the cursor will move to the first parameter. You may either select that parameter to enter new values by pressing the Select / Scroll knob or you may scroll to the next parameter by rotating the Select / Scroll knob.

Data entry is accomplished by setting each digit individually. For example: to set a value of 57.0 as the target distance, rotate the Select / Scroll Knob until the "D" in "Distance" is blinking. Depress the Select / Scroll knob to get to the tens digit, then rotate the knob to the value 5. Depress the Select / Scroll knob again to get to the ones digit, then rotate the knob to the value 7. Depress the Select / Scroll knob to get to the tenths digit, and depress it again to leave the value at 0.

A data entry of zero in all columns for any parameter will result in that parameter being reset to the previous value. Pressing the Select / Scroll knob without first rotating it during the data entry process will result in a zero being placed in that column. This can expedite the entry of Trigger values since in most cases the first one or two columns will be zero (004.0 grams).

Display Conventions

The CT3 display contains four lines, but some result screens contain additional lines of information. In order to show more than four lines of information, screens are allowed to scroll using the Scroll knob. Scrollable screens are identified by the ↑↓ symbols in the upper right corner of the display. Whenever these symbols appear, the display can be scrolled up or down as indicated to show the lines above or below those presently displayed. In the following section describing test modes, all possible displays are shown. For those having more than four lines, the additional lines are shown in grey text as seen in figure III.3.

Load shown in grams Load show in Newtons

Figure III.3

III.7 Running A Test

A test is initiated by depressing the start button. The operator is reminded to attach a probe, then press start again to zero the weight of the probe and begin the test.

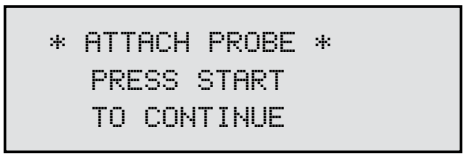


Figure III.4

Depressing the Select/Scroll knob at any time during the test, or even while test results are displayed, will show the current test parameters. At the completion of the test, the final results will be displayed until the start button or rest button is pressed. The reset button will return the instrument to the default display where the test mode may be selected. The start button will begin the same test again.

A test may be repeated simply by depressing the start button while viewing test results.

The test may be stopped at any time by using the stop/reset button or by pressing the emergency stop button. We recommend that the stop/reset button be used for normal operation. The emergency top is intended for emergency use only.

NORMAL TEST – performs a single compression of the sample then immediately returns to HOME starting position.

The operator sets the trigger value, target deformation (travel distance into the sample) and the test speed using the Normal menu screen:

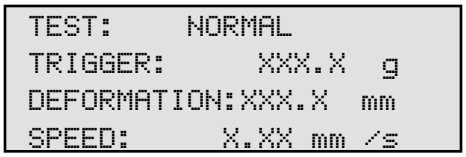


Figure III.5

A normal test performs a single compression cycle when the operator depresses the start button. Beginning at the position where the trigger load is measured, the probe descends at the programmed test speed to the target deformation, then returns immediately to home/starting position. Return travel speed is 4.5mm/s. During the test the running screen is seen as shown below:

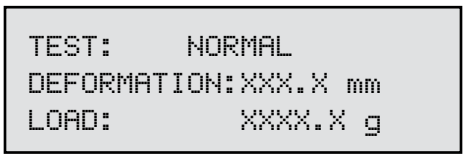


Figure III.6

Deformation and Load will remain live displays during the test.

Test results are shown on the reporting screen:

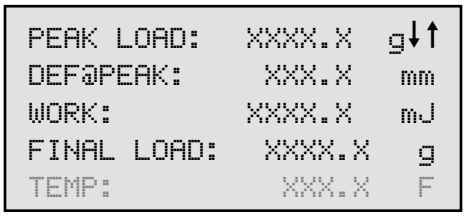


Figure III.7

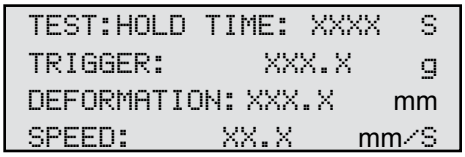
Peak load is reported as the maximum measured load during the test.

Deformation at peak is the distance to which the sample was compressed when the peak load occurred.

Work is defined as the area under the compression stroke and is reported in milli-Joules.
Final load is the load at maximum deformation. Often the peak load and final load will be the same value.

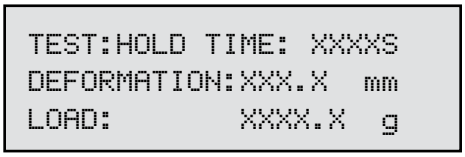
HOLD TIME TEST - performs a single compression of the sample. The sample remains compressed for programmed hold time before the probe returns to starting position.

The operator sets the hold time, trigger value, target deformation and test speed using the Hold Time menu screen:



III.8

A hold time test performs a single compression cycle when the operator depresses the start button. The test runs at the programmed test speed to the target deformation, then holds at this position while monitoring sample load for the programmed hold time. The countdown clock shows remaining hold time. During the test, the running screen is seen as shown below:



III.9

Deformation and Load will remain live displays during the test. When the countdown clock reaches zero, the probe returns to home/starting position at 4.5mm/s.

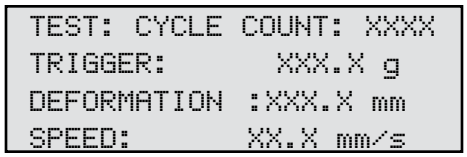
Test results are shown on the reporting screen:

III.10

Peak load usually occurs at the target deformation, but may occur before the target is reached. Final load is the load recorded at the end of the hold time and is usually lower than the peak due to sample relaxation.

CYCLE COUNT TEST – performs a programmed number of compression cycles upon a sample.

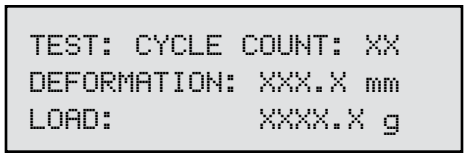
The operator sets the number of cycles, trigger value, target deformation and test speed using the Cycle Count menu screen:



III.11

When the operator depresses the start button, the cycle count test performs multiple compressions on a sample at the programmed test speed to the target deformation, then returns immediately to home/starting position. Return travel speed for each cycle is the same as compression speed.

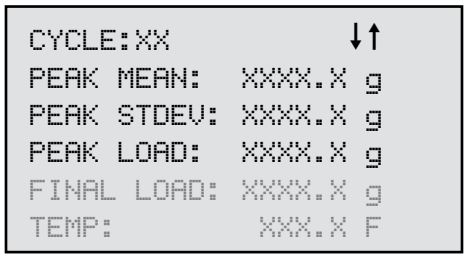
During the test the running screen is seen as shown below:



III.12

Cycle count will show a count down of the number of cycles remaining. Deformation and Load will remain live displays during the test.

Test results are shown on the reporting screen:

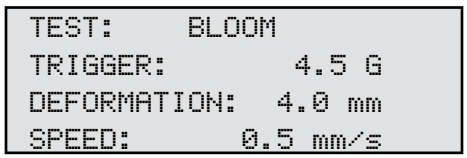


III.13

Mean and standard deviation of all peaks is reported.
Peak load is the highest peak and final load is the peak load of the last cycle.
Temp shows temperature at time of last cycle peak, only if probe is connected.

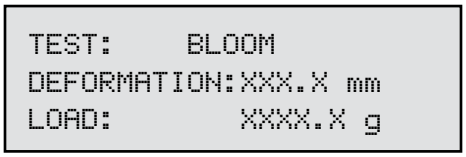
BLOOM TEST – performs a single compression cycle using industry established test parameters and reports gelatin bloom strength.

Deformation and test speed are fixed in the Bloom Test specification.



III.14

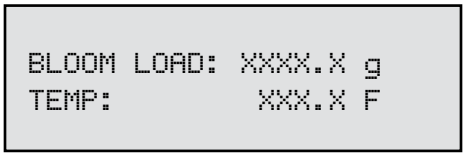
When the operator depresses the start button the Bloom test performs a single compression cycle at 0.5mm/s to the target deformation of 4mm. During the test the running screen is seen as shown below:



III.15

Both Deformation and Load displays are live during the test. The probe then returns immediately to home/starting position at 4.5mm/s.

Test results are shown on the reporting screen:



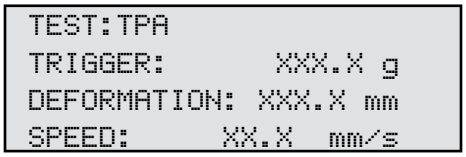
III.16

Bloom load in grams is generally reported as "grams bloom"

NOTE: It is not recommended to conduct bloom testing with load cells greater than 1500g.

TPA TEST – performs two compression cycles on the sample and reports five established Texture Profile Analysis results.

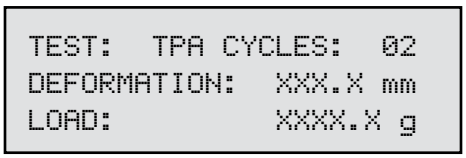
The operator sets the trigger value, target deformation (travel distance into the sample) and the test speed using the TPA menu screen:



III.17

The operator depresses the start button to begin the test. In a TPA test the compression and return strokes of both cycles occur at the programmed test speed. Target deformation for both cycles begins at the trigger position of the first cycle.

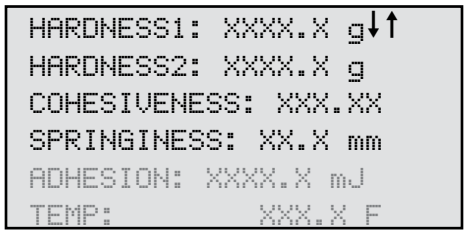
During the test the running screen is seen as shown below:



III.18

TPA cycles will count down to show the number of cycles remaining. Deformation and Load will remain live displays during the test.

Test results are shown on the reporting screen:



III.19

Hardness1 is the peak load of the first compression cycle.
Hardness2 is the peak load of the second compression cycle.

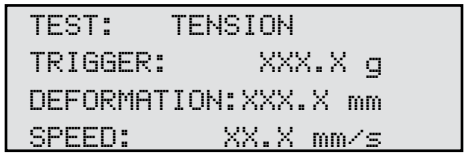
Cohesiveness is the ratio of A2/A1. A2 is the area under the compression stoke of the second cycle and A1 is the area under the compression stoke of the first cycle. If the structure of the sample is completely destroyed on the first compression, this ratio is zero. If the sample is perfectly elastic and not damaged at all by the first compression this ratio is 1.0 Most food products will fall somewhere in between 0 and 1.

Springiness is a measure of how far the sample returns after being compressed to the target deformation.

Adhesiveness is a measure of stickiness and is calculated as the area under the negative peak as probe withdraws after the first compression.

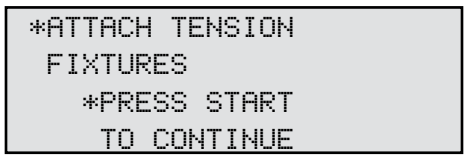
TENSION TEST – this test can be used to pull apart a sample, usually using grip fixtures to apply tension load on the sample.

The operator sets the trigger value, target deformation and the test speed using the Tension menu screen:



III.20

After pressing Start the operator is presented with this reminder screen:



III.21

Be sure grips or other sample fixtures are secure and aligned then press START. The Scroll/Select knob now becomes a tool for adjusting the position of the grips so that the sample can be clamped. Rotate knob to move 1mm/click or hold knob down to descend at 4.5mm/s:

```
*ADJUST POSITION
 USING SCROLL/SELECT
   *PRESS START
DEFORMATION:XXX.X mm
```

III.22

The deformation value shown in this screen is the current distance from the top Home position and as such shows how much travel is possible once the test begins. Be sure this value is greater than the sum of the distance necessary to reach the trigger plus the programmed target deformation.

When clamping the sample try to exert only minimal lateral loads on the probe shaft. Pressing Start as shown below will start the test:

```
*CLAMP SAMPLE
   *PRESS START
    TO CONTINUE
```

III.23

During the test the running screen is seen as shown below:

```
TEST:   TENSION
DEFORMATION:XXXX.X mm
LOAD:       XXXX.X  g
```

III.24

Deformation and Load will remain live displays during the test. When deformation reaches the target value, the test stops.

Test results are shown on the reporting screen:

```
PEAK LOAD: XXX.X  g↓↑
DEF@PEAK:   XXX.X mm
WORK:       XXXX.X  mJ
FINAL LOAD: XXXX.X  g
TEMP:        XXX.X  F
```

III.25

Peak load is the maximum load measured during the test. Temperature at peak load is only shown if temperature probe is used.

Def@Peak is the sample deformation at the peak load. The trigger position is the zero deformation reference point.

Work is the area under the load curve and is measured in milli joules.

Final load is the load at the target deformation.

NOTE: It is not possible to perform tension tests with the 100g load cell.

III.8 TEXTURE LOADER SOFTWARE (See Appendix C for details)

Texture Loader software was supplied with your CT3 on the bundled software CD. After installing this software into a computer you can add up to 10 additional test programs to the CT3 menu based upon any one of the test methods described above. For example, suppose you routinely test rye bread using a TPA test with a trigger value of 5g, deformation of 18mm and a test speed of 3mm/s. You can create a test called RYE with these test parameters. After downloading this test to the CT3, you will see the RYE test appear in the display as you scroll through the test methods. The Texture Loader program is supplied as a convenience for our customers who routinely run tests with established parameters.

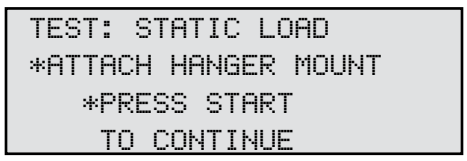
III.9 Checking Calibration

The load calibration of the CT3 Texture Analyzer can be verified using the Static Load mode. We recommend that you use the Brookfield weight set appropriate for your CT3 load range:

BEL Part No.	Load Range
•TA-CW-100C	100 gram
•TA-CW-1000C	1000 gram
•TA-CW-1500C	1500 gram
•TA-CW-4500C	4500 gram
•TA-CW-10KGC	10kg

The frequency of the calibration verification should be set in accordance to your company procedures.

Start the calibration verification process using the select/scroll knob to set the test mode to Static Load and press the start button. The display will request that you attach the hanger mount to the probe shaft.



III.26

The weight of the hanger mount itself will be zeroed by pressing the start button.

```
TEST: STATIC LOAD
*PRESS START TO ZERO
LOAD      XXXX.X   g
```

III.27

The display will change to show static load active parameters once the autozero process is complete.

```
TEST:   STATIC LOAD
ADD HANGER AND MASS
LOAD        XXXX.X g
```

III.28

The Hanger is the first weight to be fixed to the Hanger Mount.

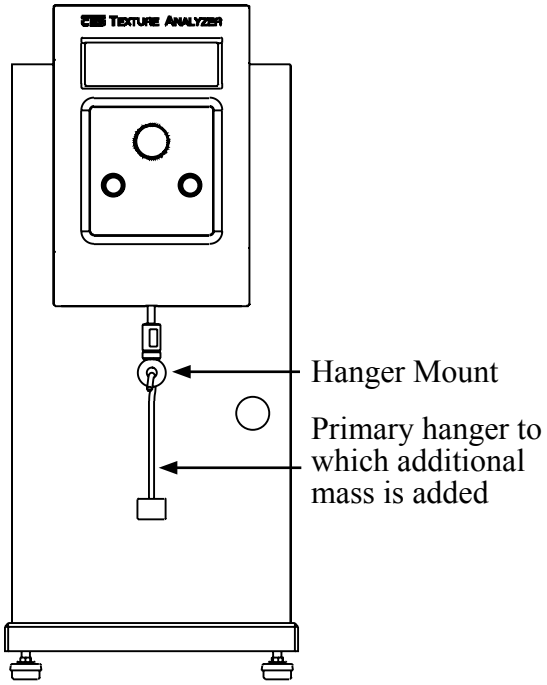


Figure III.29

Note: The Hanger is part of the calibrated weight set, and it has a calibrated weight value. This weight must be included as part of the total weight applied to the load cell.

Attach the desired weight to the Hanger and record the load value from the display. Multiple weights may be attached to the Hanger to achieve a range of test points.

⚠ Do not apply excessive upward, downward or sideways force to the Hanger Mount or Hanger while adding or removing weight. This may damage the sensing mechanism of the CT3.

As successive weights are added, the CT3 will show the total weight, which should be within the specified instrument tolerance shown in table III.2. The accuracy of the CT3 is defined by the rating of the load cell as detailed in Table III.2. If the CT3 Texture Analyzer produces data outside of the acceptable range, contact Brookfield or our authorized representative for information on repair/calibration services (see Appendix D for Brookfield locations).

	Load Range	**Load Accuracy**
Model		**Grams**
CT3-100g	0 – 100g	0.5
CT3-1000g	0 – 1,000g	5.0
CT3-1500g	0 – 1,500g	7.5
CT3-4500g	0 – 4,500g	22.5
CT310kg	0-10kg	50

Table III.2

Example of Calibration Verification

A 4500 gram CT3 Texture Analyzer, according to Table III.2, has an accuracy of ±22.5 grams. The spreadsheet shown below can be used to easily evaluate a calibration check using the appropriate Brookfield calibration weight set.

Calibration Spreadsheet

CT3 TEXTURE ANALYZER serial # 6514047

Load Cell Capacity 4500					
#	1	2	3	4	5
Mass	999.84	994.04	993.96	994.05	497.12
Serial #	59	87	92	106	153

Load Cell Accuracy
22.5g

	Weight
1	999.84
1 & 2	1993.88
1, 2 & 3	2987.84
1, 2, 3 & 4	3981.89
1 - 5	4479.00

Low Limit	**Reading**	High Limit	**Difference**
977.34	**999.5**	1022.34	**-0.3**
1971.38	**1993.5**	2016.38	**-0.4**
2965.34	**2987.5**	3010.34	**-0.3**
3959.39	**3981.5**	4004.39	**-0.4**
4456.51	**4479.5**	4501.51	**0.5**

INSTRUCTIONS FOR USE

The Calibration workbook can be downloaded from our website,
www.brookfieldengineering.com

IV. TEST METHOD DEVELOPMENT

The measurement results provided by the CT3 Texture Analyzer will be dependent on several factors relating to the sample, the test probe, and the test parameters. A variation on any of these elements may result in a change in measurement results. For good test repeatability it is suggested that a clear and complete test method be developed. The following sections describe these elements. Brookfield suggests that your method development include some trial and error testing to determine the best test method for your sample material.

IV.1 Sample Preparation

The measurement of texture using the CT3 Texture Analyzer requires contact between the test probe and the sample. The shape and surface of the sample may affect the measurement results. Consider for example an orange: the test of a peeled orange will likely give a different result from the test of a single wedge from the same fruit. This is likely the same for any bulk material when compared to a neatly prepared cube of material. Consideration should be given to the preparation of the sample to facilitate repeatability of the test. For example a material that has a flat surface offers a consistent interface with the probe even if the material is not centered in the test fixture. If your test sample is uneven, part of the test method could be to cut / shape / modify the sample such that the sample is flat; consider, for example, the difference between a loaf of bread versus a slice of bread.

IV.2 Test Probe / Fixture

The CT3 Texture Analyzer may be used with a wide variety of probes and fixtures. Brookfield offers a set of standard items while also providing special design services. Each type of probe offers benefits for certain sample types. The following table provides some basic guidelines. Although this table represents our general experience, it is important to note that there are few established standard tests for physical measurements of texture. The main objective is to characterize your material in a way that best represents its perception by human senses. This is the essence of texture analysis.

Probe Type	Typical Application
Cylinder	well defined samples with uniform surfaces, general purpose, TPA (texture profile analysis)
Sphere	samples with small scale variations on surface, general purpose
Cone	samples with rigid outer layer. Also used for penetrometry and spreadability
Wire	used for cutting or slicing samples such as cheese
Magness Taylor	used for puncturing, often used for determining ripeness of fruit/vegetables
Extrusion Cell	samples that can be made to flow, general purpose
Shear blades	meat tenderness

Table IV.1

Within a probe category, variations of geometry can be significant. It may require a larger force to drive a cone of shallow angle as compared to a cone of steep angle. Similarly, a cylinder of large diameter may require a larger force than a cylinder of small diameter. The selection of the probe (type and size) will affect the test result.

Keep hands, fingers and other body parts clear of moving test probes when operating instrument.

IV.3 Test Parameters

The CT3 Texture Analyzer will require the setting of several parameters depending upon the test method selected (see Table III.1). In general, the following relationships will hold true for Speed and Distance.

1) The measured load tends to increase as the test speed increases.

2) The measured load tends to increase as the compression distance increases. An exception to this could be a material with an outer layer such as an apple, or one that fractures.

The Trigger Point establishes the minimum load required to begin the test. This is how the CT3 knows when the probe is touching the sample. This parameter should be set to a low value for a material with a very delicate outer layer. Trigger value depends upon you load cell. Minimum recommendations are shown in Table II.2.

The Hold Time allows for monitoring the response of a material as it is held compressed. Normally, an increase in the Hold Time will result in a lower measured value, as the sample relaxes.

The Cycle Count provides a way of working a sample by compressing it repeatedly and monitoring its response.

IV.4 Recommendations

The test results of a texture measurement are very dependent on both sample preparation and the test method. When developing a method, Brookfield recommends that each parameter be varied in turn to determine its effect on the results. (Note: vary only one parameter at a time.) Once this information is considered and a method established, the method should be documented in significant detail. This will ensure good repeatability of results and good comparison with others who attempt to duplicate your method.

V. APPLICATIONS

This applications section should be used as a guide to the development of techniques specific to your own application and requirements. These notes are empirical in nature. Deviation from the described test configurations (parameter settings, sample size, shape, formulation, etc.) will result in deviations from the observations discussed in each application.

V.1 Comparison of Low Fat and Virtually Fat Free Yogurt Consistencies

PRODUCT: Low-fat (1%) and virtually fat-free (0.05%) natural yogurt

OBJECTIVE: Comparison of textural properties in order to identify differences between protein networks formed as an indication of product creaminess.

BACKGROUND: The textural properties of yogurts are critical in determining consumer preference where variation in fat content of formulation has a direct influence on the sensory characteristics of the product. The elevated Solids Not Fat (SNF) content of low-fat yogurts forms strong casein-casein bonds uncharacteristic in a full-fat yogurt, where homogenized fat globules are partly covered with casein, facilitating protein-protein interactions. Fat becomes trapped within this protein network where it imparts a smooth creamy mouthfeel and spoonable glossy consistency characteristic of full-fat yogurts.

Back Extrusion is an ideal method for the assessment of yogurts and other gelled, semi-solid foods. This compression extrusion test consists of applying a force to the product until it flows through the space between the probe perimeter and the container. A wide range of complex forces are generated. However, the test gives good measures of peak force and area of work during compression indicative of the strength of the gel and product consistency. These forces may also be recorded in reverse on the negative portion of the force-time curve where they are indicative of sample viscosity.

CT3 SETTINGS:

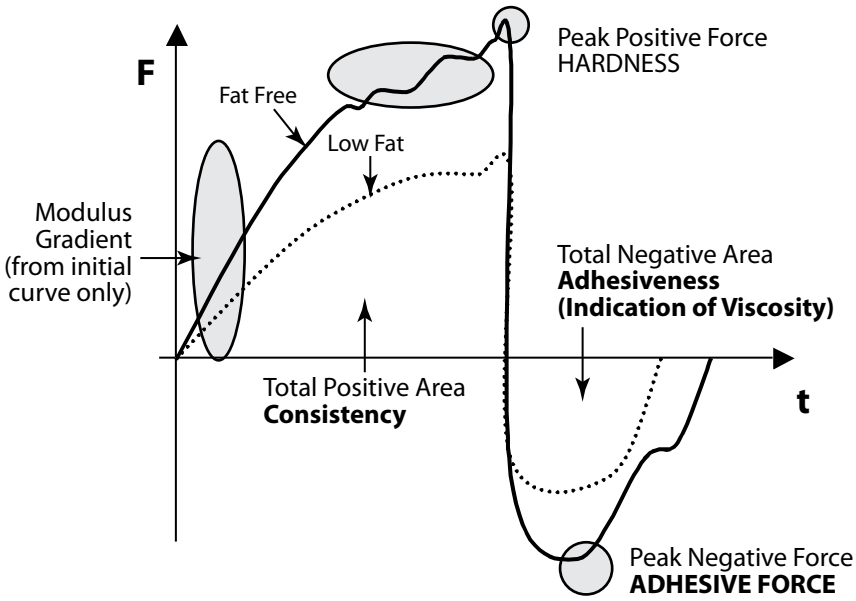
MODE:	Normal
TRIGGER:	see table II.2
DISTANCE:	30mm, or appropriate for your container
SPEED:	1mm/s

PROBE REF: TA4 38.1mm Ø Perspex Cylinder, or larger if your container allows.

METHOD: Samples were removed from refrigerated conditions of 5°C and centrally positioned beneath the probe within the container in which they were packed. Tests were conducted at ambient conditions of 18.2°C while the test temperature of the low-fat yogurt was 8.7°C and the virtually fat- free was 7.9°C. It was essential that a sufficient distance (circa 20mm) was left between the sample surface and the base of the probe. This was left to ensure that a complete break between probe/sample interface was made during probe retraction so that adhesiveness characteristics could be evaluated.

NOTE: Samples were tested with original containers as supplied. Use of different dimension holding vessels will change results obtained, therefore, operators must be consistent with the test setup used.

READING:



DISCUSSION:

Once the trigger is attained, the force continues to increase until a surface fracture occurs. The modulus changes at this point to a less steep gradient, and the force nearly reaches a plateau.

The low-fat sample appears much softer than the fat-free, having increased flow over the plunger with a visually less grainy and more glossy fluid appearance. The softer set is characterized by the lower forces and areas of work measured, as well as the shallower slope. The softer set is also characterized by the failure to form sample fracture and the absence of peaks within the curve.

The fat-free sample has a much steeper initial gradient and subsequently higher values for all measured parameters. Its grainy set structure is characterized by the large number of peaks attained within the curve, while the increased viscosity or spoonability is shown within the negative portion of the curve.

PARAMETER COLLECTION:

Peak force and work (area under load curve) will show on CT3 display when used as stand alone. With an attached computer and TexturePro CT software modulus and many other parameters are available.

PARAMETERS:

HARDNESS	Force necessary to attain a given deformation
WORK (Total Positive Area)	Internal strength of bonds within a product
ADHESIVENESS (Total Negative Area)	Work necessary to overcome attractive forces between surface of the food and the materials with which it comes into contact.
ADHESIVE FORCE	Force required to "pull" probe from sample (suction).
MODULUS	Ratio of stress divided by strain during the first compression cycle (e.g., the slope of the force: deformation curve). It is representative of sample rigidity.

RESULTS:

	LOW-FAT	FAT-FREE
MODULUS (g/mm)	7.0	15.7
HARDNESS (g)	122	227
WORK (mJ)	1592.7	3199.9
ADHESION (mJ)	-246.4	-522.6
ADHESIVE FORCE (g)	-58	-112
BREAK LOAD (g)	122	223

CONCLUSIONS:

Creaminess of samples was evaluated as a comparison between low-fat and fat-free samples. This is a comparative measure between two samples, but does give good indication of the effect of formulation on the protein:protein network and resulting gel set. Such a test would be excellent both within the Quality and Development environments, where product matching as well as process control could be facilitated.

The modulus values are also considerably different where the higher values for the fat-free fat product denote the firmer, more bound consistency of the product.

EMPIRICAL FACTORS:

Test conditions which will affect results generated:

1. Sample size
2. Sample age
3. Sample temperature
4. Base and edge effects
5. Sample container and/or test probe employed

Sample conditions which will effect results generated:

1. Fat content
2. Protein content
3. pH
4. Set/Stirred product
5. Syneresis and surface characteristics
6. Presence of inclusions e.g. fruit
7. Temperature and uniformity

RELATED TESTS: 45° cone penetrometer test utilizing hold until time function to determine relaxation.

BIBLIOGRAPHY AND REFERENCES:

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Varnam. A. and Sutherland, J. 1994. Milk and Milk Products - Technology, Chemistry and Microbioogy. Chapman and Hall, Great Britain.

V.2 A Comparison of the Textural Characteristics of Biscuits (Cookies)

PRODUCT: Biscuits

OBJECTIVE: To compare the textural characteristics of the two different types of biscuit while utilizing parameters generated using penetration test.

BACKGROUND: The textural characteristics of hygroscopic foods (those which take up water from the atmosphere) such as biscuits is of critical importance in the assessment of their quality. The hardness of a sample is indicative of its freshness, while the crispiness parameter evaluated within this investigation, characterizes its inner crumb structure and bake characteristics.

The test may be employed as part of any quality control procedure, whether that is to evaluate staling of product life, bake characteristics through quantification of hardness at different points within the biscuits circumference or any other application specific to your organization.

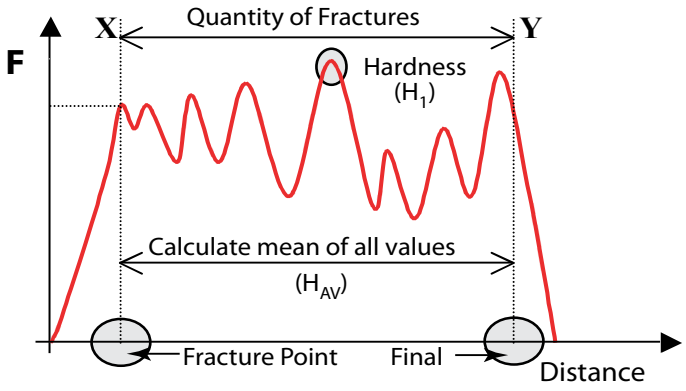
CT3 SETTINGS:

MODE:	Normal
TRIGGER:	See table II.1
DISTANCE:	3mm
SPEED:	0.5mm/s

PROBE REF: 2 mm stainless steel cylinder probe (REF: TA39)

METHOD: Biscuits approximately 6 mm thick were located beneath the probe and clamped to the analyzer bed using low pressure clips. The probe then penetrated sample to target distance and the profile of characteristics was recorded through the interface package.

READING:



H_1/H_{AV} = Indication of Crispiness
(Crispiness becomes a function of hardness)

Relate the mean value of peaks obtained to the original hardness value. Empirically our investigations highlighted that higher values of the ratio were indicative of increased crispiness.

DISCUSSION: As the probe travels through the sample an initial fracture of the surface is recorded. This fracture is greater in relation to other peaks within the chocolate coated sample due to surface characteristics. A range of internal fractures are then recorded as the probe progresses to the target deformation of 3 mm. The level of peaks within the sample are indicative of crispiness e.g. harder samples showed greater fracture force and were thus considered as being more crispy. The overall force:deformation curve highlights various peaks and troughs as the aerated structure of the sample is penetrated, peaks may be caused through the presence of sugar crystals or where the probe makes contact with air pockets within the dough structure. The overall positive area of the curve is indicative of sample hardness (as is peak force) and may be taken as a direct indication of bake conditions imposed e.g. hotter oven or longer residence time produces a harder biscuit within a sample batch. As two different varieties of biscuit were evaluated, the overall hardness characteristics were considered to be the result of variations in formulation, composition and process conditions imposed. Please note that if inclusions such as chocolate chips or oats are in the biscuit, they will contribute directly to result fluctuations.

PARAMETER COLLECTION:

Use with TexturePro CT software is necessary to obtain fracture calculations.

PARAMETERS:

HARDNESS — Load detected at highest peak during compression

WORK — Integrated area under the compression cycle. Total energy required to penetrate the sample

QUANTITY AND NUMBER OF FRACTURES — Internal ruptures and fracture of sample as structure is broken. Indicative of sample brittleness and internal bond strength

CONCLUSIONS:

Crispiness is an extremely complex parameter to quantify being a function of many artifact attributes. This investigation has excluded the inclusion of number of peaks in order to simplify the equation employed, however, it should be noted that the number of internal factors is an important consideration when evaluating the force:deformation profiles formed. More comprehensive equations should include the calculation of peaks per mm penetration as well as the internal strength or bake characteristics of the product.

EMPIRICAL FACTORS:

Results will be affected by a large number of factors including:

1. Biscuit composition
2. Sample age
3. Atmospheric exposure
4. Positioning beneath probe (closeness to sample edges)
5. Surface characteristics

V.3 Review of Solid Chocolate at Ambient Temperature

PRODUCT:

Milk Chocolate (single chunk 27.25mm x 7.92mm)

OBJECTIVE:

To determine the optimum penetration distance to detect hardness of solid chocolate tablet through the employment of penetration forces.

BACKGROUND:

The CT3 is restricted to maximum force generation in the region of 1kg thus the relatively solid consistency of chocolate determined that a very small Ø probe was utilized at minimal test speed. This permitted a flow of molecules within the sample and minimized the forces generated while maximizing the force:deformation profile of the product.

LFRA SETTINGS:

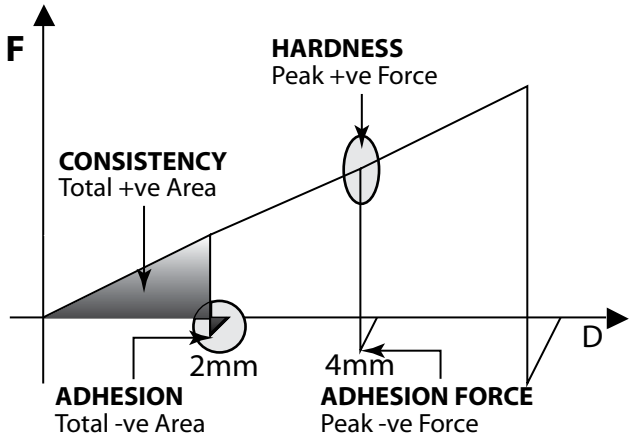
MODE:	NORMAL
TRIGGER:	See table II.1
SPEED:	0.1 mm/s
DISTANCE:	2, 4, or 6 mm

PROBE REF:

Stainless steel needle probe, 10° Taper (Ref: TA9)
Confectionery holding rig TA-CJ

METHOD: Samples were removed from wrappers and broken into individual chunks. The individual chocolate piece was then held within jaws of confectionery holder clamped to adjustable bed of CT3 approximately 2mm below surface probe.

READING:



Note: Graph shows continuation of penetration at 2mm, 4mm and 6mm parameter values recorded at set points for each penetration depth.

DISCUSSION: Force: deformation curves generated indicate a linear relationship between forces generated and depth of penetration. It was therefore recommended that the 4mm mid penetration value is utilized to permit evaluation of a range of chocolate types thus enabling comparison of a range of results.

PARAMETER COLLECTION All parameters are automatically calculated within the a test report once they are selected on the test results tab. Thus calculate parameters for each curve individually and record results.

PARAMETERS:

HARDNESS	Force necessary to attain a given deformation
WORK	Internal strength of bonds within a product
ADHESIVENESS	Work necessary to overcome attractive forces between surface of the food and materials as the probe retracts.
ADHESION	Maximum negative load (stickiness)

RESULTS:

PARAMETER	UNIT	2mm	4mm	6mm
HARDNESS	(g)	334	722	1159
WORK	(g.mm)	3192.3	1278.6	23878.9
ADHESIVENESS	(g.mm)	-0.4	-4.1	-180
ADHESION	(g)	-18	-60	-15.1

where: gs = work
NOTE: Adhesion forces give greatest differentiation.

CONCLUSIONS: This empirical procedure generates key information related to chocolate hardness and consistency, while additional information relating to adhesion is also acquired. Adhesion forces were not considered paramount to the investigation due to difficulties in imitating oral mastication properties. A penetration depth of 4mm (approx. 50% deformation or strain) was considered optimum in generating key profile data and is recommended for future investigation using the 1500g CT3 where prevention of upload forces is critical.

EMPIRICAL FACTORS: Test conditions will be affected by:

1. Sample temperature
2. Proximity of test holes within sample
3. Ambient temperatures
4. Base effects where probe compresses against analyzer test bed

Rheology of chocolate is influenced by:

1. Cocoa solids content
2. Cocoa butter content
3. Solid fat content
4. Crystal modification (acting as an indication of temperature abuse).

Appendix A - Probes and Fixtures

CT3 systems are configured by components. Every system must include at least one of each required item. Additional optional items should be selected to match application requirements.

Required items

1) CT3 Texture Analyzer - select load cell
2) Base Table - Rotary Base Table or Fixture Base Table
3) Probe Kit, Individual Probe and/or Accessory Fixture

Optional items

Probe Kit
Cylindrical Probes
Conical Probes
Spherical Probes
Special Purpose Probes
Calibration Weight Set to match load cell
Texture Pro CT Software

Gelatin Bloom Testing

Bloom Bottles
Water Bath system for gelatin sample conditioning

ACCESSORIES FOR ROTARY BASE TABLE

TA-RT-KIT ROTARY BASE TABLE
Round base table provides quick and easy height adjustment to accommodate various samples. Accessories listed below are mounted onto this table to facilitate special sample holding requirements. Includes pair of T-bolts for securing table.

ALL ACCESSORY FIXTURES BELOW MOUNT ONTO ROTARY BASE TABLE

TA-ATT ADHESIVE TACK TESTER
Small scale assembly for testing adhesive strength

TA-AVJ ADJUSTABLE VICE JIG
Small scale assembly for sample positioning

TA-BEC BACK EXTRUSION CELL
Small scale back extrusion testing consisting of 3 containers with internal dimensions of 38.1mm diameter, 24mm deep; includes one 25.4mm diameter probe

TA-JTPB **JUNIOR THREE POINT BEND ASSEMBLY**
Small scale three point bend assembly for fracture test of brittle materials. Probe used with this accy, TA7 Knife Edge Blade, is included in General Probe Kit TA-P-KIT2. Otherwise, please order TA7 separately.

TA-JPA **JUNIOR PUNCH ASSEMBLY**
Small scale accessory for controlled puncture testing of solid materials. Probe used with this accy, TA10, is included in General Probe Kit TA-P-KIT2. Otherwise, order TA10 separately.

TA-RT-5 **T-BOLTS (2)**

TA-RT-3 **THUMBNUT (2)**

T-bolts - used for securing base tables and grips to instrument base.

ACCESSORIES FOR FIXTURE BASE TABLE

TA-BT-KIT **FIXTURE BASE TABLE**
Rectangular base table with removable insert which is used as a test surface. With insert removed, all below accessories mount onto this table. Pair of T-bolts for securing table are included.

ALL ACCESSORY FIXTURES BELOW MOUNT ONTO FIXTURE BASE TABLE

TA-CJ **CONFECTIONERY JIG**
Simple support jig used to permit the accurate positioning of irregular shaped samples beneath the travelling beam. Requires Fixture Base Table TA-BT-KIT

TA-DE **DOUGH EXTENSIBILITY JIG**
Comprising of 2 aluminium plates - 1 with 25.4mm hole and 1 with 38.1mm hole complete with upper fixing plates to hold del of sample. For use with TA18* and TA43* probes respectively. Requires Fixture Base Table TA-BT-KIT

TA-DEC **DUAL EXTRUSION CELL FOR BOTH BACK AND FORWARD EXTRUSION**
Allows back extrusion and forward extrusion. Cylindrical cell 40mm diameter and 50mm in depth. Forces a semi-solid sample through an outlet of known geometry. Complete with 4 plungers of 34mm, 36mm, 38mm and 39.9mm in diameter and interchangeable base plates with apertures of 8mm, 6mm, 4mm, 2mm and one blank. Requires Fixture Base Table TA-BT-KIT

TA-DGA **DUAL GRIP ASSEMBLY**

These are multipurpose general jigs for tensile type testing. The fixtures utilize a universal fitting enabling 360º rotation for comprehensive test configuration. The 25mm wide grips are fitted with rubber inserts to maximise contact adhesion with sample and are capable of holding rectangular samples up to 5mm thick. Each grip clamps from both sides of sample with two opposing thumbscrews.

TA-DSJ **DOUGH STICKINESS JIG**

Special sample fixture for assessing the stickiness of uncooked bakery dough. Requires Std Base Table TA-BT-KIT and TA3/1000 or TA11/1000* Probe.

TA-FMBRA **FMBRA DOUGH POT SET**

Standard accessory used in the preparation of dough samples prior to textural assessment. The set comprises of two test cells and two plungers: An aeration plunger and a compacting plunger. A known weight of sample is placed in the pot and the aeration plunger is used to remove air pockets through gentle rotation. The dough is then assessed for firmness using a 6mm in diameter stainless steel probe. Includes Dough Aerator, Dough Compactor & 2 Containers.

TA-JMPA **JUNIOR MULTIPLE PROBE ASSEMBLY**

Small scale multiple probe assembly consisting of nine 2mm probes and corresponding base plate specifically designed to hold small samples of irregular geometry. Requires Fixture Base Table TA-BT-KIT

TA-OC **OTTAWA CELL**

The Ottawa cell follows principles of the Ottawa Test Measurement System (OTMS). An acrylic fronted test cell and corresponding plunger are used to compress and extrude samples. Test samples are extruded by the travelling plunger. Complete With 3 Plates and 2 Plungers for forward and back extrusion. Requires Fixture Base Table TA-BT-KIT

TA-VBJ **VOLODKEVITCH BITE JAWS**

Compression test used to simulate the shearing action of the front incisors as they bite through a food item, generating an indication of sample toughness or fibrousness. Consisting of both upper and lower jaws, the compressive movement of the travelling beam imitates the human “biting action”. Requires Fixture Base Table TA-BT-KIT

TA-WSP **WIRE SHEAR PLATE**

Aluminium plate with aperture to pass wire cutting blade through for shear type testing. Used with TA 53 cutting wire. Requires Fixture Base Table TA-BT-KIT

TA-SB **SET OF 4 SHEAR BLADES**
Including Warner Bratzler test jig complete with slotted base. The blade set includes four shear blades, firmly held within a specially designed blade holder. The jig is utilized in the measurement of shearing and cutting forces, as the blades pass through a sample. Requires Fixture Base Table TA-BT-KIT

TA-CTP **COMPRESSION TOP PLATE**
Rectangular plate 150mm X 100mm, used for compressing large samples. Fixture Base Table TA-BT-KIT is normally used to support sample while testing with this large compression plate.

T-BOLTS

TA-RT-5 **T-BOLT (2)**

TA-RT-3 **THUMBNUT (2)**

SELECTED PROBE KITS

TA-P-KIT2 **RECOMMENDED GENERAL PROBE KIT**
Includes the following probes: 60 degree cone TA2/1000; 12.7mm cylindrical (BS std) TA5; 60mm wide knife edge TA7; 1.0mm dia needle TA9; 12.7mm cylindrical (AACC std) TA10; 25.4mm cylindrical (AOAC std) TA11/1000; 45 degree cone TA15/1000; 30 degree cone TA17; 12.7mm ball TA18; 50.8mm cylinder TA25/1000; 0.33mm cutting wire TA26; 2mm rod TA39; 38.1mm cylinder TA4/1000; 6mm cylindrical TA41; 25.4mm ball TA43; 4mm cylinder TA44 and TA-PCC

TA-P-KIT3 **CURD PROBE KIT**
Includes the following probes: 5mm disc TA46; 8mm disc TA-47; 10mm disc TA48 and storage case.

CYLINDER / ROD PROBES

**** included in TA-P-KIT2***

TA3/100 **25.4mm DIAMETER CYLINDER PROBE**
Clear Acrylic. 35mm Long. Rad .35 - .43mm (Low mass for CT3100)

TA3/1000 **25.4mm DIAMETER CYLINDER PROBE**
Clear Acrylic. 35mm Long. Rad .35 - .43mm.

TA4/100 **38.1mm DIAMETER CYLINDER PROBE**
Clear Acrylic. 20mm Long. Rad .35 - .43mm. (Low mass for CT3100)

TA4/1000 *** 38.1mm DIAMETER CYLINDER PROBE**
Clear Acrylic 26g. 20mm Long. Rad .35 - .43mm.

TA5 *** 12.7mm DIAMETER CYLINDER PROBE**
Black Delrin 5g. 35mm Long. Rad .35 - .43mm.

TA6 **6.35mm DIAMETER CYLINDER PROBE**
Black Delrin. 20mm Long. Rad .35 - .43mm. . (Low mass for CT3100)

TA10 *** 12.7mm CYLINDER PROBE**
Clear Acrylic 5g. 35mm length with sharp edge. Gelatin Bloom Probe

TA11/100 **25.4mm AOAC STANDARD CYLINDER PROBE**
Clear Acrylic. 35mm Long. (Low mass for CT3100)

TA11/1000 *** 25.4mm AOAC STANDARD CYLINDER PROBE**
Clear Acrylic 21g. 35mm Long.

TA19 **1cm² KOBE TEST PROBE**
Stainless Steel. 11.3mm Diameter. 25mm Long.

TA24 **4mm DIAMETER ROD PROBE**
Black Delrin. 20mm Long, Flat End

TA25/1000 *** 50.8mm DIAMETER CYLINDER PROBE**
Clear Acrylic 23g. 20mm Long. Rad .35 - .43mm.

TA35 **5mm DIAMETER CYLINDER PROBE**
Black Delrin. 20mm Long.

TA36 **7mm DIAMETER CYLINDER PROBE**
Stainless Steel. 35mm Long.

TA39 *** 2mm DIAMETER ROD PROBE**
Stainless Steel 5g. 20mm Long. Flat End (Margarine).

TA40 **4.5mm DIAMETER ROD PROBE**
Stainless Steel. 20.5mm Long. Flat End (Margarine).

TA41 *** 6mm DIAMETER CYLINDER PROBE**
Stainless Steel 7g. 35mm Long.

TA42 **3mm DIAMETER CYLINDER PROBE**
Stainless Steel. 35.8mm Long.

TA44 *** 4mm DIAMETER CYLINDER PROBE**
Stainless Steel 10g.

TA45 **1mm DIAMETER CYLINDER PROBE**
Stainless Steel.

CONICAL PROBES

* *included in TA-P-KIT2*

TA2/100 **60º CONE PROBE**
Clear Acrylic. 30mm Diameter. (Low mass for CT3100)

TA2/1000 *** 60º CONE PROBE**
Clear Acrylic 15g. 30mm Diameter, 36mm L

TA15/100 **45º CONE PROBE**
Clear Acrylic. 30mm Diameter. (Low mass for CT3100)

TA15/1000 *** 45º CONE PROBE**
Clear Acrylic 13g. 30mm Diameter, 40mm L

TA16 **40º CONE PROBE**
Clear Acrylic. 29mm Diameter 41mm L

TA17 *** 30º CONE PROBE**
Clear Acrylic 8g. 24mm Diameter, 46mm L

TA27 **20º CONE PROBE**
Clear Acrylic. 12.4mm Diameter.

TA29 **15º CONE PROBE**
Stainless Steel. 8mm Diameter.

TA32/100 **90º CONE PROBE**
Clear Acrylic. 30mm Diameter. (Low mass for CT3100)

TA32/1000 **90º CONE PROBE**
Clear Acrylic. 30mm Diameter.

TA-PCC **PROBE CARRYING CASE**
For Texture Analyzer Probes And/Or Calibration Weights. (Foam Insert Cut To Order). Black Polypropylene - 225mm(L)X 200mm(W) X 70mm(H).

SPHERICAL PROBES

* *included in TA-P-KIT2*

TA8 **6.35mm DIAMETER BALL PROBE**
Stainless Steel.

TA18 *** 12.7mm BALL PROBE**
Stainless Steel 30g

TA28 **2mm DIAMETER BALL PROBE**
Stainless Steel.

TA31 **1mm DIAMETER BALL PROBE**
Stainless Steel.

TA33 **3mm DIAMETER BALL PROBE**
Stainless Steel.

TA38 **10mm DIAMETER BALL PROBE**
Stainless Steel.

TA43 *** 25.4mm DIAMETER BALL PROBE**
Nylon 14g

TA50 **5mm DIAMETER BALL PROBE**
Surimi application

MISCELLANEOUS PROBES

**** included in TA-P-KIT2***
***** included in TA-P-KIT3***

TA-DGA **DUAL GRIP ASSEMBLY**
These are multipurpose general grips for tensile type testing. The 25mm wide grips are fitted with rubber inserts to maximise contact adhesion with sample and are capable of holding rectangular samples up to 5mm thick. Each grip clamps from both sides of sample with two opposing thumbscrews for precise alignment. Includes one pair of T-Bolts for mounting to base. Base table kits are NOT USED with this fixture.

TA7 *** KNIFE EDGE**
Clear Acrylic 8g. 60mm Wide.

TA9 *** NEEDLE PROBE**
Stainless Steel. 1.0mm Diameter. 43mm Long.
10º Maximum Taper.

TA22 **18SWG BAR FRAME PROBE**
Aluminium Frame. 39mm Wide.1.2mm Dia

TA23 **12.7mm DIAMETER ROUND END PROBE**
Black Delrin. 35mm Long.

TA26 *** 0.33mm DIAMETER CUTTING WIRE PROBE**
Aluminium Frame 67g, 40mm Wide, Connects to M3 Male Thread

TA46 **** TA CURD PROBE 5mm**
Stainless Steel, 5mm dia disc (0.2 sq cm)

TA47 **** TA CURD PROBE 8mm**
Stainless Steel, 8mm dia disc (0.5 sq cm)

TA48 **** TA CURD PROBE 10mm**
Stainless Steel, 10mm dia disc (0.8 sq cm)

TA37 **2.36mm DIAMETER CUTTING WIRE PROBE**
Aluminium Frame. 40mm Wide.

TA49 **25.4mm DIAMETER ROUND END**
Clear Acrylic.

LFRA Train **LFRA On-Site Installation and Training**
one day on-site time

CT3 Train **CT3 On-Site Installation and Training**
one day on-site time

TA52 **Small Scale MOHRS Shear Blade**
Includes one blade holder and five blades. Blades are 9mm Wide x 35mm Length x .5mm Thick

TA53 .33mm Dia Cutting Wire Probe Aluminum Frame, 40 mm Wide, Connects to M6 Female Thread

CALIBRATION ACCESSORIES

TA-CW-100C **CALIBRATION WEIGHT SET, 100g WITH CASE & CERTIFICATE**
Set of weights (total mass 100g) to be used to check calibration of the 100g LFRA Texture Analyzer. Includes verification certificate traceable to NIST standards.

TA-CW-1000C **CALIBRATION WEIGHT SET, 1000g WITH CASE & CERTIFICATE**
Set of weights (total mass 1000g) to be used to check calibration of the 1000g LFRA Texture Analyzer. Includes verification certificate traceable to NIST standards.

TA-CW-1500C **CALIBRATION WEIGHT SET, 1500g WITH CASE & CERTIFICATE**
Set of weights (total mass 1500g) to be used to check calibration of the 1500g CT3 Texture Analyzer. Includes verification certificate traceable to NIST standards.

TA-CW-4500C **CALIBRATION WEIGHT SET, 4500g WITH CASE & CERTIFICATE**
Set of weights (total mass 4500g) to be used to check calibration of the 4500g CT3 Texture Analyzer. Includes verification certificate traceable to NIST standards.

TA-CW-10KGC **CALIBRATION WEIGHT SET, 10kg WITH CASE & CERTIFICATE**

Set of weights (total mass 10kg) to be used to check calibration of the 10kg CT3 Texture Analyzer. Includes verification certificate traceable to NIST standards.

TIA-8013 **HANGER MOUNTING RING**
Used to hang calibration weights. Included with each weight set. Replacements may be ordered with this number.

CCSCT3 **Calibration & Certification Service for CT3**

GELATIN ACCESSORIES

TA-GBB-2 **BROOKFIELD GELATIN BLOOM BOTTLE KIT (12 pcs)**
One dozen Brookfield gelatin bloom sample bottles w/BEL logo bottle holds 120ml volume and includes TA-SBS stoppers

GELATIN BATH PREPARATION SYSTEM
Gelatin Preparation Bath System

TC-402D (qty2)
TC-351D (qty1)
System is used by attaching TC-351 to one TC-402D bath set to 10C. Second TC-402D bath is set to 60C providing rapid transfer between the thermal environments necessary for conditioning gelatin for Bloom testing. Each bath has 29L reservoir and capacity for twelve (12) gelatin jars and a removable rack for easy handling. 21L of water is required for proper fluid level with rack and 12 bloom jars.

TA-SB **BROOKFIELD SAMPLE BOTTLES (6 pcs)**
Alternative sample bottle similar to TA-BSB. Order stoppers TA-SBS separately

TA-SBS **BROOKFIELD RUBBER STOPPERS (12 pcs)**
Rubber stoppers for TA-SB (Brookfield Sample Bottles)

CT3-CS-100 **BLOOM TEST STRIP**
For use with 100g CT3 Texture Analyzer to check load calibration.

CT3-CS-1000 **BLOOM TEST STRIP**
For use with 1000g & 1500g CT3 Texture Analyzer to check load calibration.

Appendix B - Troubleshooting

If no power to the instrument:

Check:

- User replaceable fuses: two (2) fuses, 4 amp, 5 x 20mm, time-lag located behind removable red color panel just above switch.
- Fuses located within power entry module on the rear of the instrument.
- If fuses blow continually, serious damage to the instrument could result. Contact repair services immediately.

Probe won't attach:

- Check thread on probe and probe shaft - remove any dirt

Rotary Base table won't move:

- Ensure locking knob is loose
- Ensure fine adjust nut is loose

Rotary Base table will not travel to the lowest position:

- Loosen fine adjust nut and rotate base table

Instrument is unsteady:

- Ensure that bench top is stable
- Adjust the CT3 feet

Probe doesn't move when start is pressed:

- Ensure emergency stop button is not pressed in (rotate clockwise)
- Ensure test mode is not Static Load
- Ensure probe is not in contact with sample (or base table)

Display shows "REMOTE OPERATION"

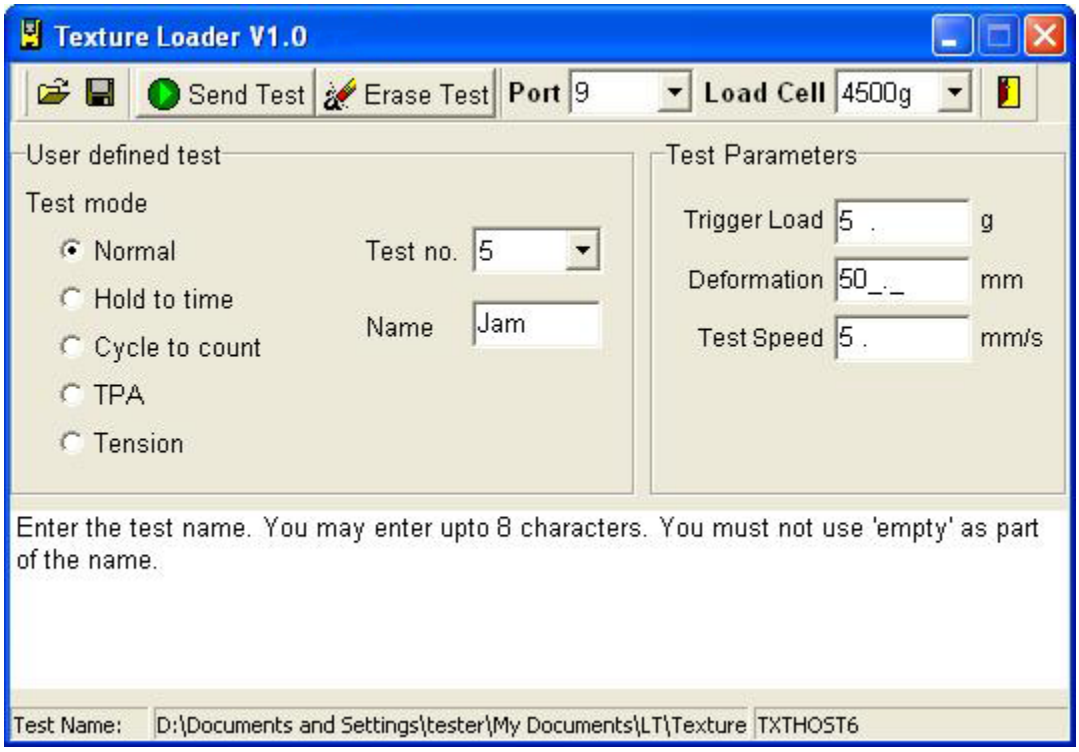
- This will always show when the computer interface cable is connected to the CT3. To use the CT3 without the computer program, the serial cable must be disconnected.

Appendix C - Texture Loader Programming

OVERVIEW

Texture Loader software is provided to allow you to create and load, into the CT3, up to ten additional test methods specific to your product. You may set up any CT3 test type of Normal, Hold Time, Cycle, TPA or Tension. Test methods created with Texture Loader may contain test parameters specific to your product. Your product name may even appear as the test name, subject to an eight character limit.

There are ten memory slots for such programs available in the CT3, labeled 0-9. You may create up to ten tests. All memory slots containing tests will appear in sequence as the SELECT/SCROLL knob is rotated. Memory slots can later be hidden by erasing a test using the Erase Test button when its Test no. is selected.



OPERATION OF TEXTURE LOADER

The supplied USB cable must be connected to both CT3 and any valid USB port on your computer. Turn on CT3, select StandAlone mode and rotate SELECT/SCROLL knob to *DOWNLOAD TEST FROM PC

Start TextureLoader software. Be sure to select the correct load cell of your CT3 and choose the correct USB port of your computer. You are now ready to create and load custom programs into your CT3 Texture Analyzer

User defined test window

1) Test mode: Choose the type of test you wish to create.

2) Test Number.: Select from the list the number of the memory slot in the CT3 where you wish to load the test.

3) Name: Enter the name of test as you wish it to appear on the screen of the CT3.

Test Parameters window

Enter the desired test parameters. The specific test parameters available will vary depending upon the test mode chosen.

Now that you have created the test, you may:

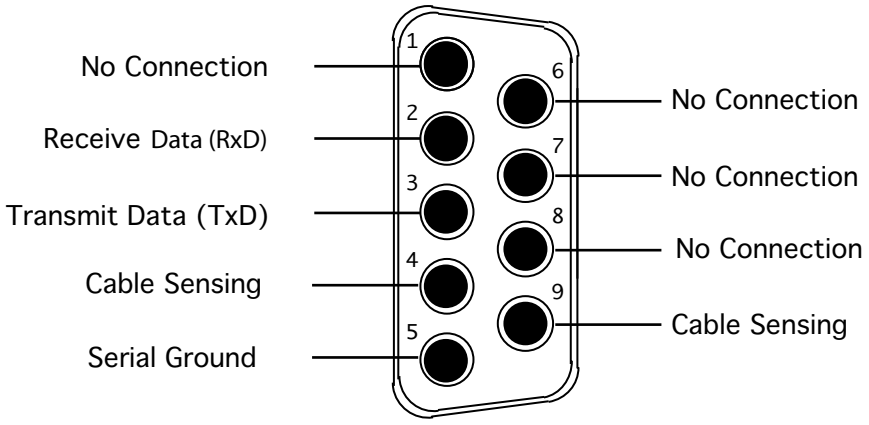
1) Save test if desired by clinking on diskette icon button.

2) Click Send Test button to download the test to the CT3.

3) If you decide to change a parameter in a test that has been downloaded to the CT3, you can make the change and download the test to the same memory slot in the CT3. This will overwrite the initial program.

Serial (RS-232) Communications Parameters

Baud Rate	115200
Data Bits	8
Stop Bits	1
Parity	None
Handshake	None



Pins 4 and 5 are used to sense presence of serial cable.

Appendix E- Warranty and Repair Service

Brookfield Texture Analyzers are guaranteed for one year from date of purchase against defects in materials and workmanship. The Texture Analyzer must be returned to **Brookfield Engineering Laboratories, Inc.** or the Brookfield dealer from whom it was purchased for no charge warranty service. Transportation is at the purchaser's expense.

For repair or service in the **United States** return to:

Brookfield Engineering Laboratories, Inc.
11 Commerce Boulevard
Middleboro, MA 02346 U.S.A.

Telephone: (508) 946-6200 FAX: (508) 923-5009
www.brookfieldengineering.com

For repair or service outside the United States consult Brookfield Engineering Laboratories, Inc. or the dealer from whom you purchased the instrument.

For repair or service in the **United Kingdom** return to:

Brookfield Viscometers Limited
1 Whitehall Estate
Flex Meadow, Pinnacles West
Harlow, Essex CM19 5TJ, United Kingdom

Telephone: (44) 27/945 1774 FAX: (44) 27/945 1775
www.brookfield.co.uk

For repair or service in **Germany** return to:

Brookfield Engineering Laboratories Vertriebs GmbH
Hauptstrasse 18
D-73547 Lorch, Germany

Telephone: (49) 7172/927100 FAX: (49) 7172/927105
www.brookfield-gmbh.de

For repair or service in **China** return to:

Guangzhou Brookfield Viscometers and Texture Instruments Service Company Ltd.
Room C1, 5/F, Tianxing Building East Tower, No. 21, Zhongshan Yi Road, Yuexiu District
Guangzhou, 510600, P. R. China

Telephone: (86) 20/3760-0548 FAX: (86) 20/3760-0548
www.brookfield.com.cn

On-site service at your facility is also available from Brookfield. Please contact our Service Department in the United States, United Kingdom, Germany or China for details.